

Walking in Tropical Climate? A Review of Issues and Challenges

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Abstract

Walking represents a sustainable mode of transportation, backed by a body of research that underscores its manifold benefits. These include improvements in personal health, mitigation of environmental harm, alleviation of road congestion, and reduction of air pollution. Nonetheless, walking in tropical climates remains underexplored and fraught with numerous challenges. This paper comprehensively reviews of twenty studies conducted in tropical university campuses and cities, shedding light on the issues and obstacles associated with promoting walking in tropical environment. We seek to address a fundamental question: is the sweltering and humid tropical climate the primary deterrent to pedestrian activity, or do the physical environments themselves fail to encourage walking? This comprehensive analysis underscores the pivotal role played by the built environment in shaping the comfort of walking. Our investigation identifies barriers to pedestrian activity while elucidating both general and specific characteristics of key physical features within the built environment that can overcome these obstacles, fostering increased levels of walking. Ultimately, an amplified emphasis on promoting non-motorized transportation options, such as cycling and walking, holds the potential to elevate pedestrian activity within tropical cities and campuses.

Keywords: Sustainable transportation, Walking, Active community, Pedestrian environment, Sustainable development

INTRODUCTION

Numerous studies have focused on the topic of walking and walkability (Labdaoui et al., 2021). And Labdaoui et al. (2021) have both highlighted the increasing importance of research in this domain, particularly regarding pedestrian comfort and the physical environment's impact on walking. Walking stands out as a sustainable mode of transportation, effectively catering to society's mobility needs (Kasim & Shahidan, 2022) while minimizing environmental harm and preserving future generations' mobility (Tsunoda et al., 2023). Tsunoda et al. (2023) have underscored walking's simplicity and effectiveness, especially in developed countries. This form of transportation, although labour-intensive and slower than driving, aligns with sustainability principles due to its beneficial effects on human health and the environment (Caspi et al., 2013; Tennøy et al., 2022; Tsunoda et al., 2023).

However, navigating tropical climates presents unique challenges, including persistently high temperatures (averaging 27°C), elevated humidity (70–90%), intense solar radiation (14 to 16 MJ/m²d), and substantial annual precipitation (minimum 2600mm) (Ghaffarianhoseini et al., 2019). These weather conditions are compounded by infrastructural deficiencies, heightened accident risks, and societal attitudes that may not fully appreciate the importance of walking (Marzuki et al., 2022). This review will delve into additional issues and challenges related to practicing walking in tropical climates by drawing insights from existing research on the subject.

LITERATURE REVIEW

Walking, an important element of sustainable campus life, serves multifaceted purposes within academic communities. Its significance extends to mitigating air pollution, alleviating traffic congestion, addressing parking dilemmas, and fostering overall health (Keat et al., 2016). One crucial factor that bolsters walking is the establishment of efficient pedestrian networks. However, walking in tropical climates poses unique challenges due to the region's high humidity levels and inadequately developed pedestrian infrastructure.

The intricate interplay between walking and the built environment has captivated the attention of researchers worldwide. For instance, Zhang et al., (2023) conducted a study exploring the intricate connections between the built environment and walking in residential areas, investigating into variations in these relationships across different neighbourhoods in Shanghai, China. Yet, conducting similar research in a tropical climate is notably difficult, primarily because walking is not as deeply ingrained in the culture of these regions. Given these complexities, this study takes on the formidable task of examining the myriad issues and challenges associated with walking in tropical climates. The insights gleaned from the studies outlined in Table 1 shed light on the formidable hurdles that must be overcome to promote walking within these unique environmental conditions.

Table 1: Examination of Challenges and Issues in Implementing Walking within Tropical Climates

No.	Authors	Study Environment	Findings/Study Matter
1	(Keat et al., 2016)	Malaysian public universities: Universiti Malaya, Malaysia.	Most students perceived the overall walkability environment at UM did not give them a positive walking experience on campus.
2	(Mansouri & Ujang, 2016)	Kuala Lumpur, Malaysia	Tourist' expectation and satisfaction towards pedestrian networks in the historical district of Kuala Lumpur.
3	(Nasrudin et al., 2018)	Jalan Tuanku Abdul Rahman, Kuala Lumpur, Malaysia.	Assessing a walkable environment
4	(Kasim et al., 2018)	Four campuses in Malaysia.	The results of the study revealed that different types of LESP have potential in providing a better campus environment and lifestyles.

5	(Asadi-Shekari et al., 2019)	Urban streets in Johor Bahru, Malaysia.	Exploring effective micro-level items for evaluating inclusive walking facilities on urban streets.
6	(Kasim et al., 2019)	University campus, Kuala Lumpur, Malaysia.	A suitable microclimate can increase pedestrian comfort and encourage walkability and support sustainability.
7	(Kurniawati, 2019)	Jalan Jenderal Sudirman dan Jalan Salemba Kramat Raya, Jakarta, Indonesia.	The purpose of this study was to examine a person's walking intention in terms of socio-economic demographic factors and walking feasibility.
8	(Abdullah et al., 2019)	Setia Tropika, Kempas Johor Bharu.	User's perspective on the provision of pedestrian pathways in Setia Tropika towards creating a green neighbourhood.
9	(Arif & Yola, 2020)	Conceptual study on high-density tropical cities.	Review the development of literature relating to the urban microclimate, thermal comfort to walkability, especially in high-density tropical cities.
10	(Ramakreshnan et al., 2020)	Malaysian public universities: Universiti Malaya, Malaysia.	Motivations and built environment factors associated with campus walkability in the tropical settings in Kuala Lumpur, Malaysia.
11	(Kasim et al., 2020)	University campus, Kuala Lumpur, Malaysia.	Evaluates the relationship between pedestrians' thermal comfort and comfortable walking distance in various landscape settings.
12	(Saraswati, 2020)	Gajah Park Area, Bandar Lampung City Indonesia.	Pedestrian Path Layout Concept in Gajah Park Area, Bandar Lampung City Indonesia.
13	(Irmawandari & Handayeni, 2020)	Surabaya City, Indonesia.	Study of Station Accessibility by Walking in Surabaya City.
14	(Lestari & Pramita, 2020)	Bandar Lampung, Indonesia.	Identification of pedestrian facilities of Bandar Lampung. Pedestrian facilities that are currently available are still very minimal, not comfort and no safety to pedestrian.
15	(Alfanadi Agung Setiyawan et al., 2020)	Pandanaran Semarang, Indonesia.	Street vendor's attribute perception towards utilization of Pandanaran sidewalk.

16	(Mohamad Surani et al., 2020)	Kuala Lumpur Monorail Station. Facilities at Monorail Stations: Challenges for People with Disabilities.	Facilities at Monorail Stations: Challenges for People with Disabilities.
17	(Kurmanbekova, 2020)	Putrajaya Malaysia	Thermal perception and willingness to walk among office workers in tropical low carbon city of Putrajaya Malaysia
18	(Noor et al., 2022)	A Scoping Review in Malaysia.	Understanding Travel Behavior and Sustainability of Current Transportation System for Older Adults in Malaysia.
19	(Pueboobpaphan et al., 2022)	Bangkok Thailand.	Acceptable walking distance (AWD) to transit station in Bangkok Thailand: Application of stated preference technique.
20	(Marzuki et al., 2022)	Review in Malaysia campus.	Importance and challenges of walking practice in Malaysia campus.

This review encompass primary objective. The objective of this study is to identify the issues and challenges of walking within tropical climate in various cities.

METHODOLOGY

In this analysis, comprehensive review of twenty (20) scholarly papers that delve into the intricate aspects of implementing walking within tropical climates. As explained in the introductory section, walking is recognized as a sustainable mode of transportation, given its positive impacts on both human health and the environment.

This paper presents findings resulting from an extensive investigation aimed at identifying the challenges and issues associated with integrating walking as a sustainable component within tropical campus settings. Additionally, it explores the motivations driving individuals to walk, scrutinizes the built environment factors that influence campus walkability, and delves into various studies addressing the concept of walkable environments within cities situated in tropical climates. Furthermore, the study examine research concerning walking facilities, walkable distances, and travel behaviour within these unique tropical contexts.

RESULT AND DISCUSSION

The discussion in this section is organized into three distinct segments. Initially, the study delve into an in-depth analysis of the challenges and issues surrounding the integration of walking as an essential component of sustainable campus life within tropical climates. Subsequently, the study shift our focus to the examination of hurdles faced in establishing walkable environments within several cities located in tropical regions. Lastly, the study engage in a comprehensive discussion concerning the issues and challenges related with walking facilities, walkable distances, and travel behaviour in the context of tropical climates.

Challenges and Obstacles in Implementing Walking as a Component of Sustainable Campus in Tropical Climates

The effort to create a sustainable campus plays a pivotal role in advancing the cause of sustainable development. Universities, being hubs of education and innovation, are well-positioned to catalyse sustainable development efforts. To comprehensively address this aspect, a study was undertaken to evaluate various facets of campus walkability. This assessment included an examination of student preparedness, an evaluation of the physical infrastructure's readiness, and an exploration of the challenges associated with implementing campus walkability. Insights from this study were drawn from research conducted by (Keat et al., 2016; Marzuki et al., 2022; Ramakreshnan et al., 2020).

Walkability encompasses the evaluation of a built environment's compatibility with walking behaviours, spanning physical activity, active mobility, recreation, and access to essential services (Battista & Manaugh, 2019). It constitutes a fundamental element of a healthy, sustainable, and vibrant community, characterized by the ease and comfort with which individuals can navigate urban areas and neighbourhoods. In essence, walkability reflects the quality of a community that not only accommodates but actively encourages people to reach their destinations on foot.

This discussion centres on three relevant studies focused on campus walkability in public Malaysian universities carried out by Keat et al. (2016), Ramakreshnan et al. (2020), and an exploration of the significance and challenges of cultivating sustainable walking habits within Malaysian campuses by Marzuki et al. (2022). Additionally, we supplement this discourse with insights gleaned from studies pertaining to the walking environment within tropical campuses, as detailed in works by Kasim et al., 2018, 2019, 2020.

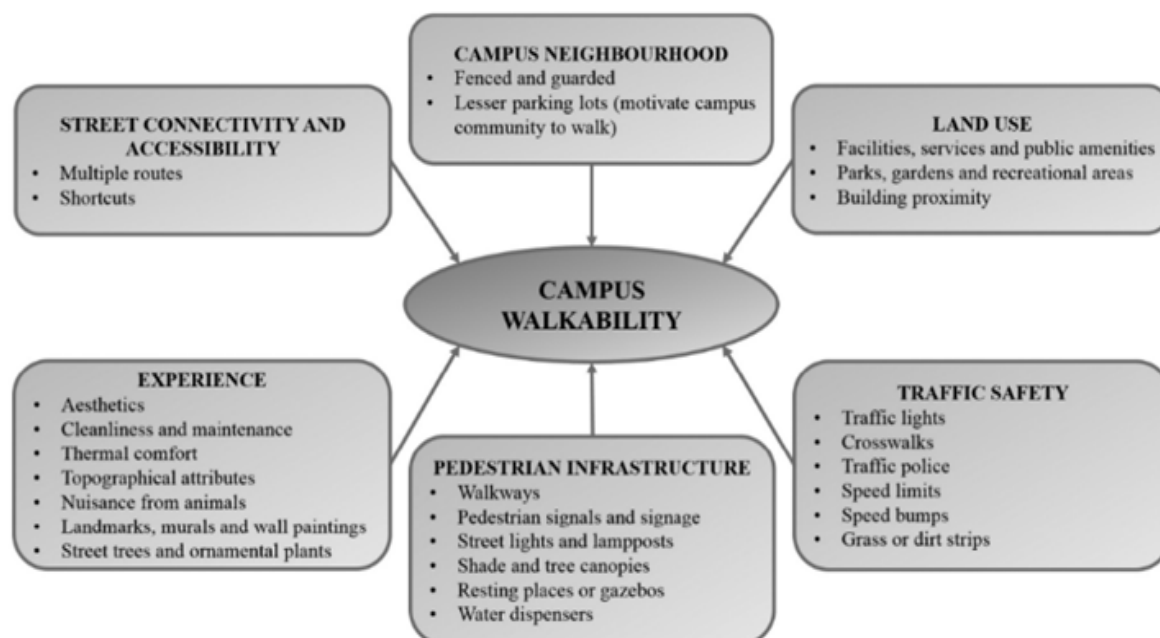



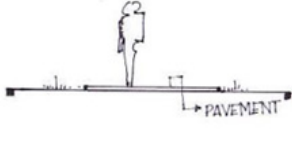

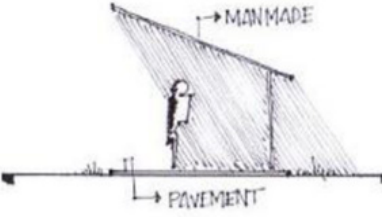

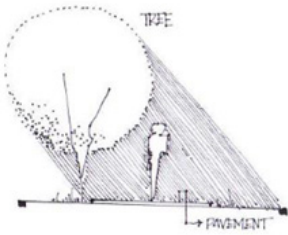

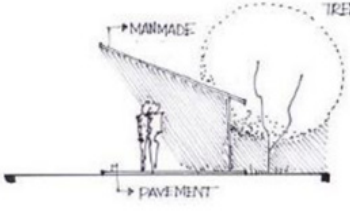

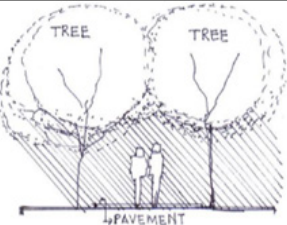
Figure 1: Framework of campus walkability factors (Ramakreshnan et al., 2020)

Ramakreshnan et al. (2020) declared framework of the campus walkability factors as shown in Figure 1. Then, they conducted a study of the importance of factors according to the respondent's choice. Drawing upon a foundation of literature research, Marzuki et al. (2022) provided a comprehensive exposition on the significance and intricacies of fostering a culture of walking in Malaysia to achieve the vision of establishing sustainable campuses. Their findings identified four significant challenges hampering the practice of walking on campuses: the inclement weather and tropical climate, deficient infrastructure facilities, heightened exposure to road accidents, and the attitudes held by campus residents. This study effectively culminates the insights garnered from Keat et al. (2016) and Ramakreshnan et al. (2020), both of which affirm the vital role of walking as a practice that bolsters campus sustainability. Beyond the formidable challenges posed by the hot and humid tropical climate, the pedestrian environment emerges as an essential element in facilitating walking in these campuses. The efficient coordination of traffic planning and management further enhances the campus environment towards its sustainability objective. The promotion of non-motorized transportation modes, such as cycling and walking, emerges as a catalyst for elevating campus sustainability, emphasizing the active participation of campus residents in safeguarding and advancing sustainability initiatives.

Summarising this discussion, it is abundantly clear that the challenges posed by tropical weather and climate for pedestrians on the path to sustainable campuses can be mitigated through the strategic design of a pedestrian-friendly environment. Specifically, the challenges associated with pedestrian thermal comfort and the establishment of comfortable walking distances have been rigorously explored by Kasim et al. (2018), Kasim et al. (2019), and Kasim et al. (2020). Through a series of case studies conducted at four Malaysian campuses, Kasim et al. (2018) introduced the concept of "Landscape Environmental Settings for Pedestrian" (LESP), encapsulating everything within a 3.0-meter radius of a pedestrian's path that influences thermal comfort and behaviour. Furthermore, Kasim et al. (2019) conducted an in-depth examination of microclimatic conditions within various LESP types at a university campus in Kuala Lumpur, delving into five key parameters: air temperature (T_a), globe temperature (T_g), wind velocity (v), surface temperature (T_s), and relative humidity (R_h). Their findings underscored the paramount importance of both natural and man-made shading and pavement materials in enhancing pedestrian comfort. Shading, for instance, was shown to reduce pavement temperatures, even for low-albedo materials like dark grey asphalt. This significantly contributes to pedestrian thermal comfort. In conclusion, a well-crafted microclimate can substantially enhance pedestrian comfort, stimulate walkability, and support sustainability efforts.

A literature review by Arif & Yola (2020), reveals that the domain of microclimate and thermal comfort within the context of walkability in urban settings, especially tropical regions, warrants further in-depth investigation. Their review underscored the pressing need for a holistic examination of the two pivotal variables: microclimate and thermal comfort, in actualising the concept of walkability in the outdoor spaces of tropical cities. These locales often grapple with the challenges posed by exceptionally hot and extreme microclimates that fail to provide the necessary comfort for outdoor activities. In relation to findings by Arif & Yola (2020), Kasim et al. (2020) carried out a study in focusing more on five distinct types of Landscape Environmental Settings for Pedestrian (LESP), as meticulously detailed in Table 2.

Table 2: Five types of pedestrian microclimate in tropical climate (Kasim et al. 2020)

Types of LESP	Illustrations	Descriptions
<p>Type 1 No shade</p> 		<p>Pavement is the only landscape element in walkway environment.</p>
<p>Type 2 Metal deck</p> 		<p>There are two landscape elements in the walkway environment, which are pavement and man-made shading.</p>
<p>Type 3 One row of trees</p> 		<p>There are two landscape elements in the walkway environment which are pavement and tree shading.</p>
<p>Type 4 Combined deck and trees</p> 		<p>There are three landscape elements in the walkway environment which are pavement, man-made shading and tree shading.</p>
<p>Type 5 Two rows of trees</p> 		<p>There are three landscape elements in the walkway environment which are pavement and two rows of tree shades.</p>

They then proceeded to implement field surveys and measurement activities, meticulously assessing five critical microclimate parameters across the five LESP types within the same campus environment explored in their earlier study. Their research has empirically demonstrated the profound influence of microclimatic conditions on pedestrian thermal comfort, a factor of great significance within tropical climates. The study highlighted the consequential relationship between Landscape Environmental Settings for Pedestrian (LESP) and the establishment of comfortable walking distances in tropical environments. It is established that when pedestrians experience thermal comfort, they exhibit a heightened inclination to traverse longer distances on foot. The findings from this study further affirm that LESP Type 5 has the capacity to facilitate a comfortable walking distance of up to 1.0 kilometre. This finding holds the potential to serve as a valuable guiding principle for designers operating within tropical climates to promote walkability.

Walkability in Tropical Urban Centres

In the ever-evolving realm of urban planning, the concept of a walkable environment has garnered considerable attention and significance. A walkable environment exemplifies an urban landscape that prioritises pedestrians, meticulously crafting a secure, comfortable, and convenient domain for individuals to traverse on foot. Nevertheless, tropical climates introduce unique challenges for pedestrians. The elevated temperatures and pervasive humidity prevalent in these regions can render extended outdoor walking not only uncomfortable but also potentially hazardous.

This study undertakes a comprehensive examination of the walkable environment within the context of tropical cities. Several studies have investigated into the prevailing conditions and pedestrian experiences in cities across Indonesia (Alfanadi Agung Setiyawan et al., 2020; Kurniawati, 2019; Lestari & Pramita, 2020), Kuala Lumpur, Malaysia (Mansouri & Ujang, 2016; Nasrudin et al., 2018), and Johor Bharu, Malaysia (Abdullah et al., 2019).

The allocation of pedestrian zones in Jakarta, for instance, has raised concerns about the proportion of investment dedicated to cultivating a pedestrian-friendly urban environment when compared to other public infrastructure (Kurniawati, 2019). Furthermore, this study has shed light on the unsatisfactory pedestrian experience along prominent thoroughfares in Jakarta, particularly Jalan Jenderal Sudirman and Jalan Salemba Raya. This deficiency significantly hampers the walking experience, making it challenging for pedestrians to navigate comfortably and, consequently, discouraging walking as a preferred mode of transportation. Compounding this issue, sidewalks in Jakarta often serve as spaces for street vendors, leading to conflicts between pedestrians and vendors vying for limited sidewalk space (Alfanadi Agung Setiyawan et al., 2020; Lestari & Pramita, 2020).

In Surabaya, Indonesia, Irmawandari & Handayeni (2020) found that the quality of the walking environment hinges on various factors, encompassing the quality and service level of transit-based railway stations, the presence of supporting activities surrounding these stations, and the distance and time required for accessing them. Then Saraswati (2020) has noted that pedestrians frequently opt to walk on roadways rather than using designated pedestrian paths due to a myriad of obstacles, including damaged walkways, vehicle parking, and the presence of street vendors, all of which negatively affect the overall walking environment. Collectively, these studies conducted across Indonesian cities underscore the notable absence of research emphasis on climate-related factors, particularly within tropical regions. This discrepancy arises from the nuanced challenge of creating a walkable environment in tropical climates, necessitating a delicate equilibrium between addressing the issues presence and maximizing the advantages of outdoor pedestrian activity.

Meanwhile, in Kuala Lumpur, Malaysia, Mansouri & Ujang (2016) did a study looking at tourists' expectations and satisfaction levels regarding pedestrian networks in the historical district of Kuala Lumpur. The objective of their investigation was to scrutinize the expectations, satisfaction levels, and sentiments of pedestrian tourists who preferred to explore the historical district on foot. Their findings revealed that most respondents agreed that there was easy access and a short walking distance to the destinations they wished to visit, with places being readily accessible from transit stations. However, most respondents also acknowledged numerous obstructions along walkways, including street furniture, business activities, parked motorcycles, and other vehicles as well as uncovered drains. Additionally, participants highlighted a scarcity of suitable walkways in Kuala Lumpur city centre. As a result, this study

advocates for enhancements in the walking environment, including increased landscaping, the provision of walkways along all streets, the use of quality pavement materials, well-designed street furniture, and availability of effective signage.

In another study by Nasrudin et al. (2018), assessed pedestrian environments along Jalan Tuanku Abdul Rahman in Kuala Lumpur, Malaysia. Their findings revealed that the road network in this area was notably narrow, spanning approximately 1.5 to 3 meters in width as well as the lack of sheltered walkways along the pedestrian walkways. These factors collectively contributed to unpleasant walking experience, as pedestrians were required to traverse through a hot and humid atmosphere to fulfil their needs within the vicinity. The results derived from the questionnaire indicated that respondents generally rated comfort-related elements as satisfactory. These elements encompassed the condition of pedestrian walkways, the acceptability of walkway width, and the connectivity of pedestrian walkways to adjacent areas. Respondents expressed strong agreement regarding the accessibility of the walkway area. However, they concurrently highlighted issues related to cleanliness and unpleasant odours affecting the quality of pedestrian walking experience.

In the Malaysian context, the concept of a “walkable street” aligns with the objectives outlined in the 10th Malaysia Plan, intended to promote green neighbourhoods through the provision of high-quality pedestrian pathways. Abdullah et al. (2019) conducted a case study that concentrated on the local community’s perspective regarding the provision of pedestrian pathways within Setia Tropika, Kempas Johor Bharu, Malaysia. This study was structured around the examination of five key elements: safety, comfort, sustainability, support facilities, and landscaping. An in-depth exploration of these five elements within the context of issues and challenges associated with walking in tropical climates provides valuable insights, as delineated in Table 3.

The study unveiled that safety emerged as the paramount factor, boasting the highest mean score among the elements that significantly influenced users, with comfort ranking closely behind. Conversely, comfort garnered high levels of satisfaction, while landscaping earned a moderate level of satisfaction. Safety and connectivity were rated as moderately satisfying, whereas support facilities were unsatisfactory. These findings concurred with prior research conducted by Mansouri & Ujang (2016) and Nasrudin et al. (2018).

Table 3: Five elements of a walkable street (Abdullah et al., 2019)

Safety	The pedestrian path is free from motor vehicles
	Low accident rates between pedestrians and vehicle
	The design of the pedestrian path does not cause an accident
	The surface of the pavement material used is not smooth
	Bright lighting at night
	Pedestrian paths are not exposed to criminal risks
Comfort	The appropriate width of the pedestrian path
	The slope of the pedestrian path is not too high
	Air quality does not make the users having breathing difficulties
	Enriching and intersting sorrrounding colours
	The pedestian walkway is free of vehicle noise
	Users are comfortable with the cleanliness of the pedestrian path
Connectivity	The distance of places is reasonable for walking
	The usage of pedestrian path saves time to reach the destination
	The walkways are connected with housing, neighbourhood and business areas
Support Facilities	Covered walkways are provided
	Support facilities are provided to the disabled person
	Signboards are available on the pedestrian path
	Signboards are available on the pedestrian path
	The layout of the road furniture is interesting and systematic
	Dustbins are provided along the route
Landscape	Users' views on pedestrian paths are not restricted by buildings and landscape
	The green landscape attracts users to walk
	Surface pattern and surface pavement are interesting
	The decoration has a statistical value

Walking Facilities, Walking Distance, and Travel Behavior in Tropical Climates

Pedestrian infrastructures constitute a foundational pillar of urban walkability, encompassing the vital facilities and amenities required to ensure that walking remains a safe, convenient, and enjoyable mode of transportation and recreation. Sufficient investments in well-designed and meticulously maintained walking facilities empower cities to position walking as the preferred choice of transit, thereby enhancing the overall well-being of residents and visitors alike. Asadi-Shekari et al. (2019) suggested that the availability of walking facilities exhibits a positive correlation with walking rates and physical activity, underscoring the fundamental role of a walkable environment.

Among the key components contributing to the comfort and safety of pedestrians are sidewalk facilities, curb ramps, bollards, driveways, surface materials, tactile pavements, lighting, landscaping, and trees (Asadi-Shekari et al., 2019). However, they noted the frequent misuse of existing facilities along pedestrian pathways with street vendors making use of the amenities resulting in a reduction of available space for pedestrians. This observation is also

substantiated by research conducted by Alfanadi Agung Setiyawan et al. (2020) and Lestari & Pramita (2020). Street vendors view the sidewalk corridor, including street furniture and infrastructure, as accommodating their commercial activities. Regrettably, the conversion of sidewalks into trading areas compromises the comfort and safety of pedestrians, compelling them to navigate alongside roadways, consequently leading to an insufficient allocation of pedestrian facilities within the city (Lestari & Pramita, 2020).

In a different context, the examination focuses on the accessibility of pedestrian infrastructure catering to individuals with disabilities in a tropical climate. Designing such facilities poses a formidable challenge due to the persistent hot and humid weather conditions prevailing year-round. These facilities serve pedestrians who walk, skate, or rely on wheelchairs and other mobility aids. Travel behaviour encompasses the intricate process through which individuals allocate their time resources to meet these demands, considering various constraints such as time, cost, and social commitments.

The modern transportation system in Malaysia has evolved in alignment with the requirements of local residents, irrespective of their socioeconomic status or accessibility needs. A study conducted by Mohamad Surani et al. in 2020 investigated the amenities provided for individuals with disabilities at the Kuala Lumpur Monorail Station and examined the obstacles encountered by them while utilising these provisions. Their findings indicate that the facilities at the Kuala Lumpur Monorail Station satisfactorily address the demands of the users. However, there is room for improvement to enhance the convenience and usability for individuals with disabilities.

Noor et al. (2022) underscore the critical importance of addressing the travel requirements of the elderly population to mitigate social exclusion and promote self-care. The research also draws attention to the ongoing demographic transition in Malaysia, characterised by a rising population of the elderly. Consequently, it becomes important to proactively prepare for their transportation needs and optimise their mobility, overall health, and well-being. The study's findings reveal a decline in travel activity among older adults in Malaysia as they aged, coupled with a shift towards greater reliance on private vehicles for daily commuting. However, several challenges exist, including the proliferation of vehicles on the road, the absence of age-friendly features within the transportation infrastructure, and limited accessibility to public transit options. Considering these findings, it is vitally important to initiate comprehensive strategic planning efforts aimed at providing accessible and affordable transportation solutions as well as a safe and accommodating environment tailored specifically to the unique needs of older adults.

Walking distance plays an essential role in promoting pedestrian activity. In a recent study conducted by Pueboobpaphan et al. (2022), explored the concept of Acceptable Walking Distance (AWD) to transit stations, catering specifically to pedestrians utilising bus and train services in Bangkok, Thailand. Their study challenges the adequacy of the existing AWD standard, indicating its incompatibility with the tropical climate conditions prevalent in Bangkok. The study establishes a distinct AWD for pedestrians accessing public transportation in Bangkok, setting the distance at 320 meters to the train station in environments lacking shade and subject to high temperatures. The study's outcomes demonstrate that enhancing walking environments, transitioning from sun-exposed and hot conditions to shaded and cooler ones, can substantially increase the maximum AWD by a factor of 1.6 to 1.77, specifically tailored to the tropical climate of Bangkok, Thailand.

The above study aligns with the assertion made by van Soest et al. (2020), emphasizing the necessity for precise measurements of walking distances to and from public transportation in various geographical regions, considering the cultural and climatic influences on such distances. Similarly, a study conducted by Kurmanbekova in 2020 in Putrajaya, Malaysia, highlights that a significant 85% of respondents opt for private vehicles as their preferred mode of transport. This preference is primarily attributed to the natural humidity of the tropical climate, compounded by the lack of shaded pathways in that city, underscoring the key role of climate and environmental conditions in transportation choices.

CONCLUSION

This paper addresses the multifaceted challenges associated with walking in tropical climates through a comprehensive review of twenty (20) relevant research papers pertaining to pedestrian mobility and public transport. The initial segment of our investigation highlights that a principal challenge of walking within tropical campus environments arises from the inadequate provision of essential infrastructure, including robust street connectivity, accessibility features, and well-designed pedestrian facilities.

Subsequently, this study analysis uncovers compelling evidence of numerous impediments along walkways, such as damaged pathways, indiscriminate vehicle parking, and the presence of street vendors, all of which detrimentally affect the overall pedestrian experience. To enhance the walking environment, recommendations include augmenting landscaping efforts, implementing covered walkways, ensuring walkable pathways on all streets, utilising high-quality pavement materials, employing well-crafted street furniture, and implementing effective signage systems.

Furthermore, this investigation identifies the misappropriation of existing pedestrian facilities, with street vendors encroaching upon valuable pedestrian spaces, thereby necessitating strategies to mitigate such encroachments. Additionally, the study emphasize the imperative need to upgrade walking facilities catering to individuals with disabilities and the elderly, ensuring their comfort, safety, and accessibility. A key finding underscores that by establishing an appropriate walking distance and creating a comfortable pedestrian environment characterised by shade, coverings, isolation from vehicular traffic, and enhanced connectivity and accessibility, the challenges associated with walking in a tropical climate can be significantly mitigated. Ultimately, the study anticipate that the insights gleaned from these studies will serve as a valuable resource for designers operating in tropical climates, fostering a culture that promotes walking as a sustainable mode of transportation.

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