



Evaluation of Pedestrians Walking Speeds in Baghdad City

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ABSTRACT

This research examines the factors which influence pedestrian's walking speed in Baghdad. the variations in walking speed of pedestrians are related to pedestrian characteristics such as gender, age group, and clothing traditions. Using the established methodology, the counts of pedestrians were performed using manual and video counting. The case study was performed in two streets located in a highly crowded commercial zone at the city center of Baghdad: Al-Karada Dakhel and Al- Sina'a Street. Data were subjected to statistical analysis using IBM SPSS Statistics 19 software. It has been found that Iraqi pedestrians walk slower than other pedestrians in the developed countries or in the region with minimum walking speed of 29.85 m/min. Age, gender, and clothing traditions were found to significantly contribute to pedestrian speed. Pedestrians in the age range from 18-50 years old were the fastest group of pedestrians and pedestrians over 50 years old were the slowest. Male pedestrians had significantly faster walking speeds than female pedestrians did. Pedestrians wearing western style were found to be faster than those wearing Arabic style.

Key words: walking speed; pedestrian characteristics; age; gender; clothing traditions.

تقييم سرعة مسير المشاة في مدينة بغداد

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الخلاصة

يتناول هذا البحث دراسة سرعة سير المشاة في مدينة بغداد والعوامل التي تؤثر على هذه السرعة ومن هذه العوامل الجنس والفئة العمرية ونمط الملابس. باستخدام المنهجية المتبعة اجريت عمليات العد للمارة باستخدام طريقة العد اليدوي وتقنية التصوير بالفيديو وقد تم اجراء الدراسة في شارعين يقعان في مناطق تجارية مزدحمة وسط مدينة بغداد ، هما شارع الكرادة داخل وشارع الصناعة. خضعت البيانات الى تحليل احصائي باستخدام البرنامج الاحصائي IBM SPSS 19 , وجد من خلال الدراسة والتحليل ان سرعة المشاة في العراق هي اقل من سرعة المشاة في البلدان المجاورة والمتقدمة ، حيث وجد ان الحد الأدنى لسرعة السير في بغداد هي 29.85 م/الدقيقة . وتم التوصل الى ان الجنس والفئة العمرية واسلوب الملابس من العوامل المؤثرة بشكل كبير على سرعة المشي والعبور للسابلة وان المارة الذين ينتمون للفئة العمرية بين 18-50 سنة هم الاسرع اما المشاة الاكبر من 50 عاما فهم الابطأ وان سرعة المشي للذكور هي اعلى منها للإناث. كما وجد ان المشاة الذين يرتدون نمط الملابس الغربية (البنطلون) هم الاسرع من حيث العبور والمشي الاعتيادي من الاشخاص اللذين يرتدون الزي العربي .



1. INTRODUCTION

Environment is being contaminated by the increment of vehicles, particularly in Central Business Districts (CBDs) where most of the government offices and trading centres of a city are located. To reduce environmental pollution, pedestrianization has become an integral part of sustainable modern urban design. Thus, the design, arrangement and development of support infrastructures should be in favour of pedestrian movements to popularize walking. To achieve so, pedestrian facilities should be planned and based on the concrete information on user characteristics, **Finnis and Walton, 2006**.

2. BACK GROUND

A 'pedestrian' is any person on foot or who is using a means of conveyance propelled by human power, other than a bicycle. Similarly, the term 'walking' refers to the act of self-propelling along a route, whether this is on foot or on small wheels, or assisted by additional aids, **Roads and Traffic Authority, 2007**. Pedestrians Free flow speed indicates the average movement speed of pedestrians when they are not hindered by other pedestrians in an obstacle-free environment under normal condition. Its value, however, requires extensive data collection for calibration as the walking speed is subject to many factors. **Daamen, 2004**, found that the walking speeds of individual appear to follow a normal distribution, with an estimated mean of 1.34m/s and standard deviation of 0.37. Besides, **Finns and Walton, 2006**, conducted survey on mean walking speed of different countries/cities. the results show that the mean walking speed of different countries can range from 0.7m/s (Itea, Greece) to 1.8m/s (Prague, Czech Republic). The literature review suggests men and women have different walking speeds, flows and density relationships. **White, 1994**, showed that pedestrians might vary their walking speeds over a wide range, when unimpeded by crowd density or other frictions.

a controlled study by **Murray, 1986**, of walking speeds for men, ranging in age from 20 to 87, revealed that normal walking speed declined with age, He concluded that this would indicate that a healthy person in their 40's in a hurry could exceed the normal relaxed walking speed of a 20-year-old. Normal walking speeds declined from 84 m/min for the 20-to-25 age group, to 65 m/min for the 81 -to-87 groups, with most of the speed decline occurring after the age of 65.

3. SCOPE OF THE STUDY

This study is mainly concerned with the effect of variables such as age, gender, and clothing style, on walking speed. To investigate how urban characteristics affect pedestrian mobility, field investigation was carried out in Baghdad at different land use locations, and data was collected regarding pedestrian characteristics and behaviour.

4. METHODOLOGY

4.1 Site Description

The case study was performed in the city of Baghdad. To conduct the speed studies in the concentrated CBD areas, several sidewalks along the main streets were selected as the observation sites. The pedestrian volume and speed data were collected at two selected locations in Baghdad



CBD area. The first site is located in a recreational and shopping zone (AL- karada Dakhil); the second site is a commercial and educational zone holding colleges, (Al- Sina'a Street). The studied segment of sidewalks has dimensions shown in **Table1**; where the arcades widths are measured as the available space for pedestrian to walk.

4.2 Sampling

The collection of the field data was made for sample lengths of 1 hour and during good weather conditions. The hours in which the counts were performed, were the ones where the peak hour was expected to take place. These hours were selected considering the background information of the place. Specifically, the ranges selected were 13:00-14:00 and 17:00-18:00 for Baghdad.

The workdays were used as the main sample days for this study. In this respect, random days among this group were chosen of April 2013.

4.3 Counts Method

The technique adopted in the field work is by marking a longitudinal section of known length and width on the pedestrian facility and continuously recording the movement of pedestrians within this section. Pedestrians were manually timed over a measured test length, volume and speeds were then calculated. Random pedestrian about to enter the section was selected and tracked through the study area. The time taken by a pedestrian to traverse the test length was measured using a digital stop watch, the entry and exit times in and out of the test area were recorded. Walking speed is then derived by dividing the known length of the section by the walking time. Data were subjected to statistical analysis using IBM SPSS Statistics 19 software. The speed was calculated using the mathematical models below, **Pignataro, 1973; Khisty and Lall, 1998**. From this data, regression models have been constructed and the predictive performances of these models were assessed.

$$S_N = L / T_N \tag{1}$$

$$S_S = L / T_S \tag{2}$$

Where:

$T_N; T_S$ represents travel time in each direction (min)

$S_N; S_S$ represents the space mean speed (meter / minutes) in each direction

L = the test section length (meters)

5. RESULTS AND DISCUSSION

5.1 Variation of Walking Speed with Gender

Table 2, shows pedestrian mean and 15th percentile speeds in relation to pedestrian gender for Baghdad. The 15th percentile speed is the one normally used in design and it means that 85% of pedestrians walk faster than this speed. As indicated in **Table 2**, male pedestrian walks faster than female for all of the tested sites. The walking speed detected for both gender at Baghdad site two, which is an educational zone (mean walking speed) is 35.84 m/min - 33.783 m/min. for male and female respectively, **Fig. 1**, show the minimum, maximum, and mean walking speed for males and females for Baghdad.



This may be attributed to the fact that most of the pedestrians at the educational zone are young. The present study findings are comparable to walking speeds reported by **koushki, 1988** for Saudi Arabia (mean walking speed 65 m/min).

5.2 Effect of Age Groups on Walking Speed

As indicated in **Table 3**, adult pedestrians (18-50 years) were the fastest compared to other age groups with an average speed of 43.092 m/min and 39.458 m/min for males and females respectively at Baghdad site 2. Pedestrians 50 years or older (elderly) were the slowest among others, with an average walking speed of nearly 20 m/min.

These findings are in agreement with those reported by **Fruin, 1971, koushki, 1988, Sarsam, 2002, and Sarsam, 2013**.

Fig. 2 shows the variation of walking speed with gender and age groups for Baghdad. On the other hand, **Fig.3** shows the variation of walking speed with gender and clothing tradition.

5.3 Effect of Clothing Tradition on Walking Speed

Table 4 shows pedestrian mean speed in relation to pedestrian clothing tradition for Baghdad and it detected two clothing styles: Arabic style, and western style (trousers) for both male and female. It was found that males who wearing trousers are faster than males with Arabic style for both sites by about 3.9 m/min. This may be attributed to the limitations practiced in the step length which is restricted due to clothing when using the Arabic clothing tradition. When female pedestrian are considered, females who wearing trousers are faster than whom wearing Arabic style by about 0.65 m/min and such variation was not significant for female pedestrians. This could be attributed to the slower average speed of female as compared to male. It found to be in agreement with results found by **kuishki, 1988** in Saudi Arabia, and **Sarsam, 2013** in Baghdad.

6. CONCLUSIONS

Within the limitations of field investigation procedure and assumptions, the following conclusions may be drawn:

1. Male pedestrian have significantly faster walking speeds than female pedestrians by about 5% with mean walking speed of 35.9m/min for Baghdad.
2. Pedestrians of 18–50 years old are the fastest group of pedestrians with an average speed of 43.092 m/min at Baghdad, Pedestrians over 50 years old were found to be the slowest group with an average walking speed of nearly 20 m/min.
3. Male wearing western style is walking faster than males with Arabic style by an average of 3.9 m/min and such variation was not significant for female pedestrians.



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**Table 1.** Dimension of sidewalk for each street.

City	Site	Street	Section length (m)	Section width (m)
Baghdad	1	Al-Karada Dakhil	10	2.5
	2	Al-Sina'a	10	3

Table 2. Pedestrian speed in relation to gender for Baghdad city.

Pedestrian walking speed (m/min)			
Site	Gender	Mean	15 th percentile
Site 1	Male	30.76	19.12
	Female	29.85	23.48
Site 2	Male	35.84	23.99
	Female	33.78	26.56

Table 3. Variation of walking speed with gender and age groups for Baghdad.

Pedestrian walking speed (m/min)						
Site 1	Male age group			Female age group		
	Young	Adult	Elder	Young	Adult	Elder
Site 2	35.13	37.16	20.11	31.59	34.30	19.57
	39.59	43.09	24.98	35.17	39.46	26.83

Table 4. Variation of Walking Speed with Gender and Clothing Tradition for Baghdad.

Pedestrian walking speed (m/min)				
Site	Male clothing tradition		Female clothing tradition	
	Arabic style	Western style	Arabic style	Western style
Site 1	28.84	32.73	29.54	30.17
Site 2	33.92	37.81	33.46	34.11

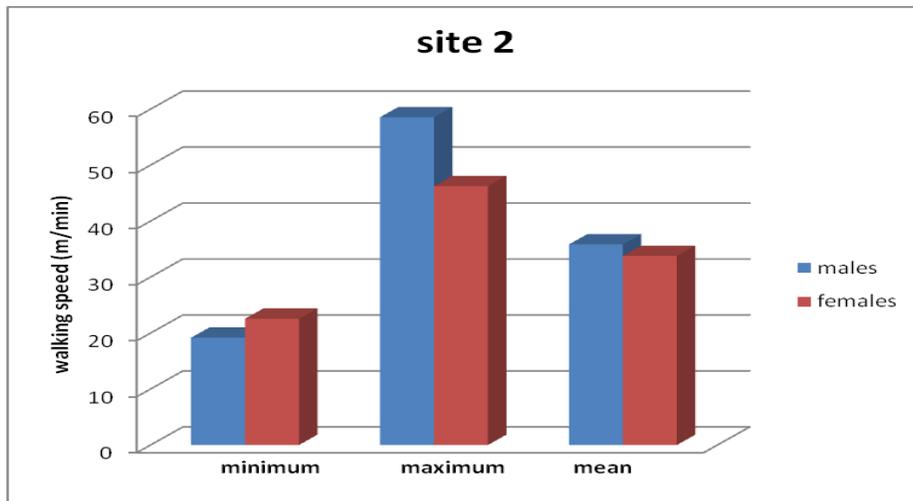
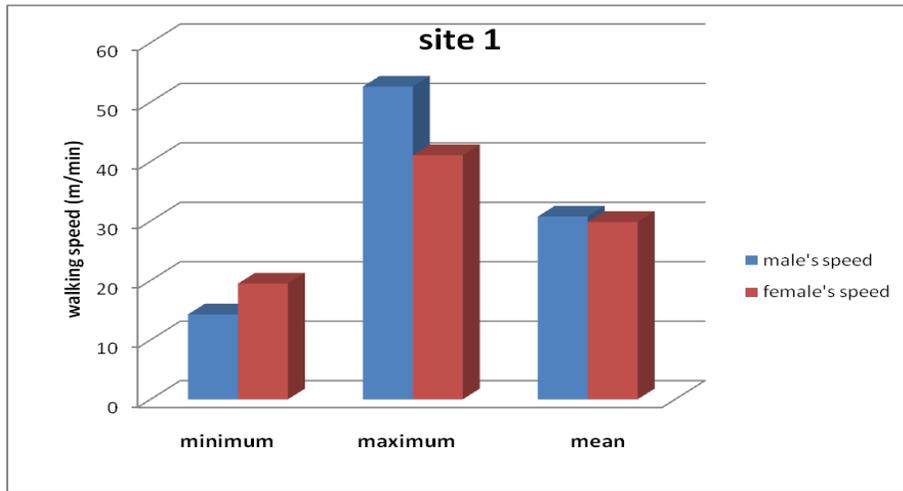


Figure 1. Variation of walking speed with gender for Baghdad city.

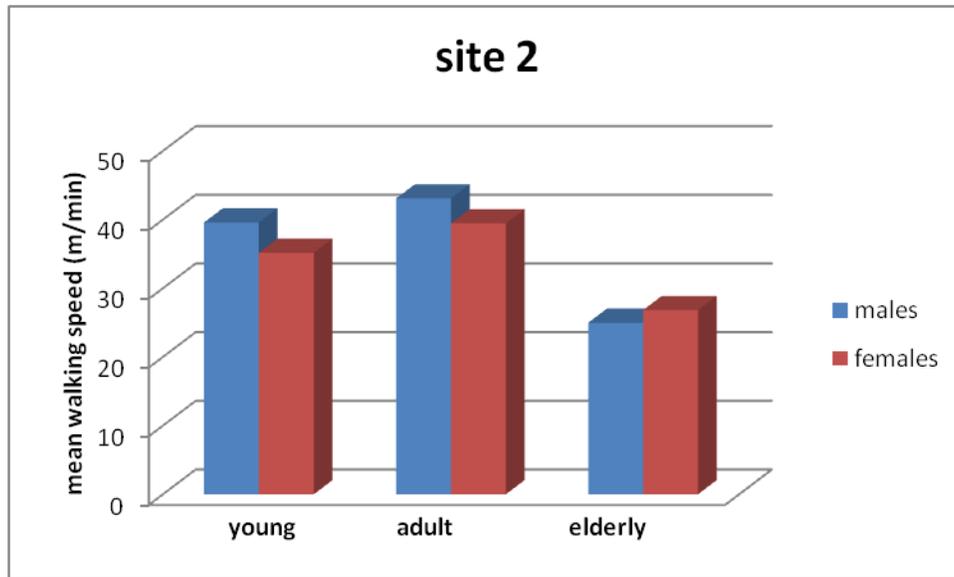
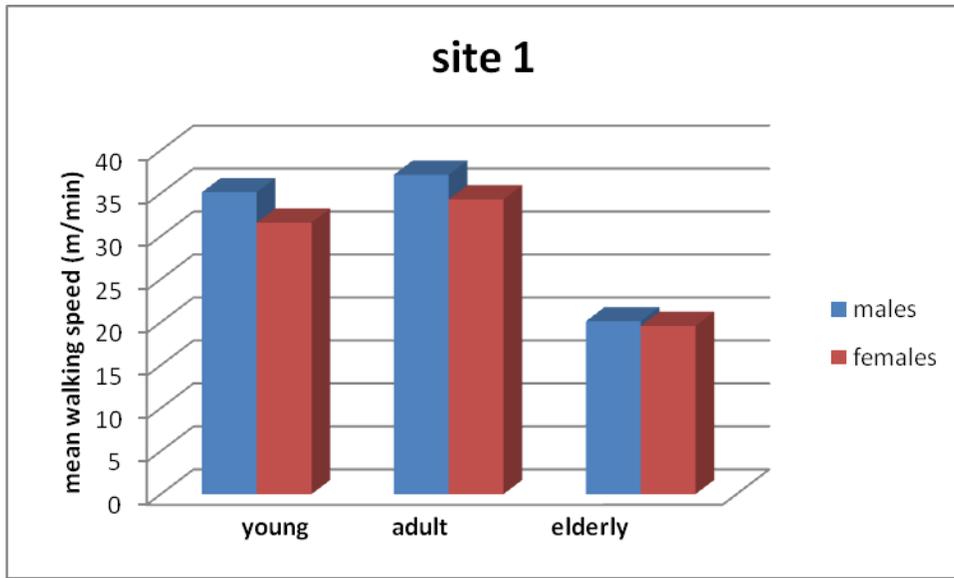


Figure 2. Variation of walking speed with gender and age groups for Baghdad.

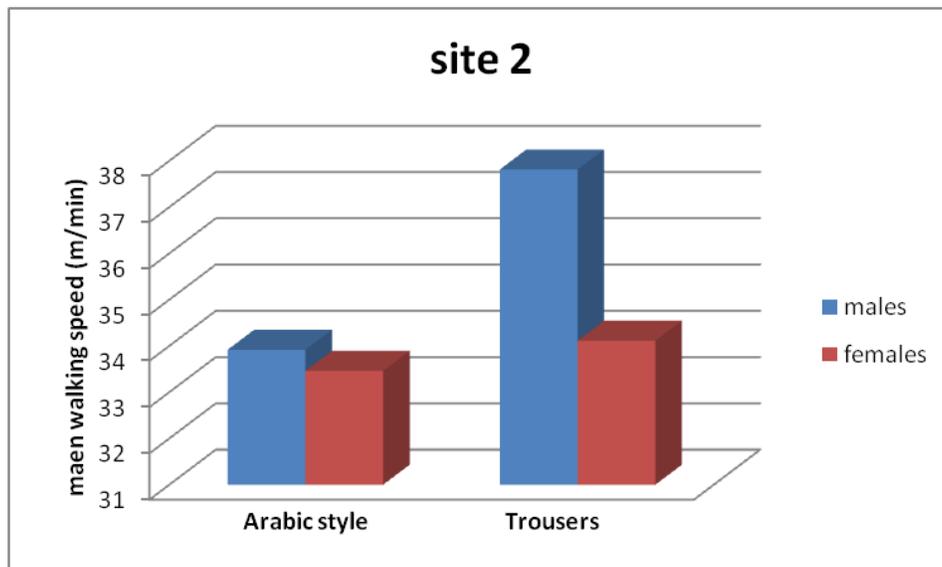
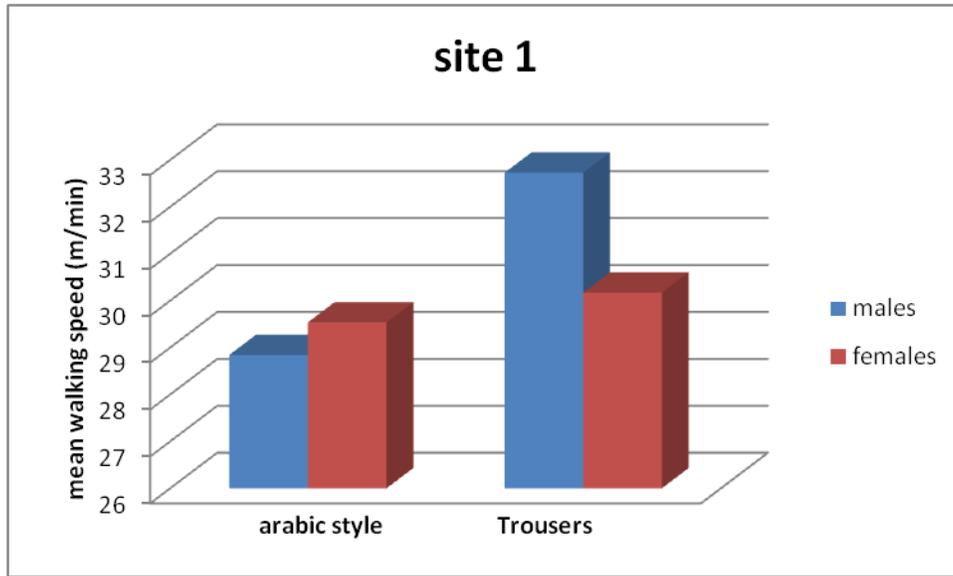


Figure 3. Variation of walking speed with gender and clothing traditions.