

Brief communication (Original)

The effect of physical activity on 6-minute walked distance among niqab wearing healthy Saudi women

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Background: Wearing a face veil (niqab) was found to have a negative effect on the ventilatory function of Saudi adult women, which may challenge their functional exercise capacity.

Objectives: To investigate the effect of physical activity on a 6-minute walked distance (6-MWD) among young adult niqab-wearing healthy Saudi women.

Materials and Methods: Forty healthy young Saudi women were recruited for this study. The study participants (aged 22.8 ± 2.5 years) were selected from students and administrative staff at King Saud University. They were normotensive, nonsmokers, and of normal or mildly overweight. They were divided into 2 groups on basis of niqab wearing. A 6-minute walk test was implemented as measure of the participant's functional exercise capacity. Their physical activity level was expressed as low, moderate, or high levels using the International Physical Activity Questionnaire-Short Form. Comparisons between the basal physiological characters of the 2 groups, 6-MWD, and physical activity level were conducted. A two-way independent ANOVA was used to study the interaction of niqab wearing and the physical activity level on the 6-MWD for niqab wearing women.

Results: Women in the niqab wearing group had a significantly higher physical activity level and longer 6-MWD than those in the niqab nonwearing group (370.7 ± 62.95 and 510.0 ± 81.75 m (mean \pm SD) respectively).

Conclusion: A physically active lifestyle improves and preserves the functional exercise capacity reflected by longer 6-MWD among the physically active niqab-wearing Saudi adult healthy women compared with less active women who did not wear the niqab.

Keywords: Cardiovascular function, face veil, functional exercise capacity, niqab, pulmonary function, 6-minute walk test

Niqab (face veil) wearing is most common in gulf countries, particularly in Saudi Arabia [1]. Saudi women wear the niqab in public places. A previous study showed mean values of ventilatory function parameters including; forced vital capacity (FVC), forced expiratory volume in the first second (FEV1), and its ratio with the FVC (FEV1/FVC %) and the maximum voluntary ventilation (MVV) for niqab wearing women were significantly lower than the values for women who did not wear the niqab [1].

The important role of the pulmonary system in determining a person's functional exercise capacity [2, 3] and the significant reduction of ventilatory function with niqab wearing [1] raised the question: does niqab wearing affect the functional exercise

capacity of Saudi women and how might physical activity alter any affect?

Functional exercise capacity is the integrated effort of the cardiovascular and pulmonary systems to deliver oxygen to metabolically active muscles [2-4]. Functional exercise capacity implies that an individual has performed to their maximum effort, but it is occasionally used to express also an individual's capacity to perform submaximal activities [2]. The exercise stress test and the cardiopulmonary exercise test with measurement of maximum oxygen consumption (VO_2 max) are the criterion standard tests for determining functional exercise capacity. Nevertheless, most daily activities do not require maximum effort [4]. By contrast, the 6-minute walk test (6-MWT) is widely used as a submaximal functional exercise test [4-7]. The 6-MWT has many advantages; it is safe, self-paced, and easy to apply. It requires no expensive equipment or comprehensive

training of the examiner, has negligible cost, is better tolerated, and better reflects the functional capacity of the individual in their daily activities than other walk tests [5, 7-13]. The main outcome of the 6-MWT is the 6-minute walked distance (6-MWD), which represents the greatest distance walked within the 6-minutes of the test [14]. The 6-MWD correlates to the VO_2 max [6] and to the peak VO_2 ($r = 0.52$ to 0.71) [13]. It is highly reproducible ($r = 0.86$ to 0.95) with intrasubject coefficients of variation averaging less than 10% [13]. Different studies revealed different correlative or predictive factors for the 6-MWD. Sex, age, and physical activity level were predictive factors for the Saudi 6-MWD [15]. The short form of the International Physical Activity Questionnaire (IPAQ) is a valid and reliable instrument with which to monitor an individual's physical activity level [16]. The IPAQ is a self-administered questionnaire composed of 4 questions. Through answering the 4 questions, the metabolic equivalent (MET) of the study participant is calculated and is used to categorize the participant as a low, moderate, or highly physically active individual [16]. Other outcomes of the 6-MWT include the participant's rating of perceived exertion through the Borg scale, heart rate, and oxygen saturation [5, 9]. This study aimed to investigate the effect of physical activity on 6-MWD among young adult niqab-wearing healthy Saudi women.

Materials and methods

This comparative study was approved by the Rehabilitation Research Chair at King Saud University and the procedures followed were in accordance with current ethical standards. The aim and procedure of the study was explained to all participants who signed a consent form. Participants of this study were 40 Saudi healthy women aged from 20 to 30 years. Half were wearing the niqab. They were recruited through verbal invitation and bulletin board announcement at the campus of King Saud University, Riyadh, Saudi Arabia from April to August 2013. Participants were in acceptable or mildly overweight categories according to their body mass index, none were smoking, nor taking any medications known to affect the measured variables, not participating in regular exercise programs or sport activities beyond normal daily activities, and free from any cognitive problem that may affect implementing and following the instructions for the 6-MWT.

Without wearing the niqab, the 6-MWT was implemented using the American Thoracic Society instructions [8]. The 6-to-20 Borg Scale was used to rate the participants' perceived exertion of general fatigue [3] before and after the 6-MWT. Participants' normal physical activity level was categorized into low, moderate, or high physical activity levels [16]. For the group using the niqab, participants calculated in minutes the estimated duration of their wearing of the niqab per week.

Statistical data analysis

Data were treated using SPSS statistical software version 17 and the 0.05 level was adopted as the level of significance. Descriptive statistics were used to present the participants' characters. Mean and standard deviation were used for continuous variables and frequency was used for categorical variables. Independent *t* tests were used to compare the 6-MWD and basal cardiovascular response (systolic and diastolic blood pressure and heart rate) of niqab wearing and nonwearing women. Chi-Square was used to compare the physical activity level of niqab wearing and nonwearing women. A two-tailed Pearson correlation test was used to study the relationship between the 6-MWD and the time (minutes/week) of wearing the niqab. A two-tailed Spearman's correlation was used to study the relationship between the 6-MWD and the physical activity level of all participants. A two-way independent ANOVA was used to study the interaction of niqab wearing and the physical activity level on the 6-MWD for niqab wearing women.

Results

Results showed that there were nonsignificant differences between niqab wearing and nonwearing participants regarding age, weight, and BMI (**Table 1**). Women who did not wear the niqab were significantly taller than niqab-wearing women ($P = 0.045$). Niqab-wearing women had a significantly ($P = 0.0001$) longer 6-MWD than women who did not wear the niqab (370.7 ± 62.95 and 510.0 ± 81.75 meters (mean \pm SD) respectively). Participants' data revealed a significant ($P = 0.039$) association between wearing the niqab and physical activity level. A two-tailed Pearson correlation showed that there is no significant relationship between the 6-MWD and the duration of niqab wearing per week for niqab-wearing participants (**Table 2**). A two-tailed Spearman's

correlation revealed significant ($P = 0.0001$, $r_s = 0.634$) relationship between the 6-MWD and physical activity level among the 40 participants; an increase in the physical activity level increased the 6-MWD (Table 3). A two-way independent ANOVA showed a significant main effect of niqab wearing on the

6-MWD, $F_{1,34} = 22.818$, $P < 0.0001$ and a significant main effect of the physical activity level on the 6-MWD, $F_{2,34} = 9.382$, $P < 0.001$. Meanwhile, there was a nonsignificant interaction effect between niqab wearing and the physical activity level on the 6-MWD, $F_{2,34} = 1.569$, $P = 0.22$ (Table 4).

Table 1. Basal physiological character and 6-minute walked distance of healthy young Saudi adult women (n = 40)

Variable	Niqab (mean \pm SD)		P
	Nonwearing (n = 20)	Wearing (n = 20)	
Age (years)	22.1 \pm 2.3	23.4 \pm 2.5	0.098
Weight (kg)	61.1 \pm 10.2	56.1 \pm 9.7	0.12
Height (cm)	164.5 \pm 7.9	160.2 \pm 4.8	0.045*
BMI (cm ² /kg)	22.4 \pm 2.6	21.9 \pm 2.7	0.50
HR (beats/min)	79.4 \pm 12.1	82.6 \pm 9.8	0.36
SBP (mmHg)	114.1 \pm 10.1	108.8 \pm 13.9	0.18
DBP (mmHg)	76.0 \pm 8.1	69.4 \pm 9.8	0.03*
6-MWD (m)	370.7 \pm 63.0	510.0 \pm 81.8	0.0001*
Job			
Students	15 (75%)	18 (90%)	0.21
Administrative staff	5 (25%)	2 (10%)	
BMI			
Normal (18–25%)	17 (85%)	18 (90%)	0.63
Over weight (25–30%)	3 (15%)	2 (10%)	
Physical activity level			
Low	13 (65%)	5 (25%)	0.04*
Moderate	3 (15%)	7 (35%)	
High	4 (20%)	8 (40%)	

BMI, Body Mass Index; HR, Heart Rate; SBP, Systolic Blood Pressure; DBP, Diastolic Blood Pressure; 6-MWD, 6-Minute Walked Distance. * $P < 0.05$.

Table 2. Correlation between the 6-minute walked distance and face veil wearing time in minutes/week for the healthy young Saudi adult women (n = 20)

Variables	N	Pearson correlation (r)	P
Wearing time (min/week)	20	0.317	0.17
6-Minute walked distance (meters)	20		

Table 3. Correlation between the 6-minute walked distance and physical activity level of the Saudi healthy young adult women (n = 40)

Variables	N	Pearson correlation (r)	P
Physical activity level	40	0.634**	0.0001
6-Minute walked distance (meters)	40		

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

Table 4. Interaction effect of face veil wearing and physical activity level on the 6-minute walked distance of the healthy young Saudi adult women (n = 40)

Correlation	df	Mean square	F	P
Face veil wear	1	80556.523	22.818	0.0001
Physical activity level	2	33123.054	9.382	0.001
Face veil wearing *Physical activity level	2	5539.310	1.569	0.22

Discussion

Ability to perform physical activity and to withstand exertion is a crucial factor of an individual's quality of life. That is why determining an individual's ability to exercise has incremental importance for healthy individuals and for others; particularly those with cardiovascular and cardiopulmonary disabilities. Most daily activities are of a submaximal type [4]. For that reason the 6-MWT was selected for the current study to measure the submaximal functional exercise capacity of Saudi young adult women. The authors hypothesized that wearing a niqab would negatively affect the functional exercise capacity of the Saudi women in performing the 6-MWD. This assumption was based in part on results of a previous study in which there was reduction in the ventilatory function parameters for niqab wearing Saudi women compared with women who did not wear the niqab [1]. Also in part on the fact that the respiratory system is an integral determinant of an individual's exercise capacity [2, 4, 17]. Accordingly, a reduced respiratory function would reduce the functional exercise capacity and result in a reduced 6-MWD.

The authors included the participant's age in the study participant's selection criteria as a one decade range; from 20 to 30 years. The reasons for this one decade range were; first, because the cardiovascular and pulmonary systems are influenced to age-related changes. Examples of these age-related changes that can solely and directly affect the 6-MWD is a reduction of VO_2 max, which explains the 8%–10% reduction in functional exercise capacity per decade in nonathletic participants [4]. Second, the reference value for the Saudi 6-MWD was found to be age-based [6, 15]. The results of the current study revealed that the 6-MWD is significantly longer for niqab wearing women than for women that did not wear the niqab. Does this mean that functional exercise capacity for niqab wearing women is better than the functional exercise capacity women who do not wear the niqab? Surprisingly, the answer is “yes”.

More surprisingly, this result is logical because the niqab wearing women were found to be physically more active than women who did not wear the niqab. The difference in the physical activity level between the two study groups is explained by the longer duration of walking practiced by the niqab wearing group than the women in the group that did not wear the niqab. The correlation test documented that there was a significant relationship between the physical activity level and 6-MWD. The more active the woman, the longer the 6-MWD. The results of the study by El-Sobkey et al. emphasized this significant relationship between the 6-MWD and an individual's physical activity level [15]. Moreover, the physical activity level was a predicting factor in the regression equation for the Saudi 6-MWD [15]. Nearly half (40%) of the niqab wearing women were categorized by the IPAQ as highly physically active. By contrast, almost two thirds (65%) of the women who did not wear the niqab were categorized as having low physical activity. Are there any other factors that could explain the longer 6-MWD of niqab wearing women? In other words, were the niqab wearing women of younger age, with more normal body weight, or more acceptable BMI? However, reviewing the participants' characteristics showed that there were no significant differences in the age, weight, or BMI between niqab wearing and nonwearing women. Furthermore the women who did not wear the niqab were significantly taller than the niqab wearing women. According to the American Thoracic Society guidelines for 6-MWT, being taller is a factor that would increase the length of the 6-MWD [8]. Applying the American Thoracic Society findings, the women who did not wear the niqab would have a longer 6-MWD. However, this was not the case in our study population and may even mask the results. All participants followed strictly the instructions of the American Thoracic Society guidelines for the 6-MWT and all started the test from a resting condition. They all rated their level of exertion with a score 6 in the 6-to-20 Borg scale for general fatigue.

They were all nonsmokers, nonathletic, and were all either students or administrative staff at the same King Saud University campus. Homogeneity of study participants increases the validity of the current study results.

The physiology of exercise and effect of activity can provide a clear picture about the relationship between physical activity level and functional exercise capacity. Physical activity is defined by the world health organization as any bodily movement produced by skeletal muscles that requires energy expenditure [18]. Evidence regarding the health benefits of physical activity are overwhelming [19, 20]. Individuals who are more physically active have these benefits [19]. Regular physical activity has beneficial effects on the vascular system. These effects are both structural and functional [21]. Regular physical activity guarantees the integrity of the endothelial function and vascular smooth muscle function, promotes the decrease of oxidative stress, decreases the sympathetic tone, enhances the parasympathetic autonomic tone, and prompts the development of new muscular capillaries [19-22]. In addition moderate aerobic effort has positive effects on fibrinolysis, blood viscosity, and vascular tone [19-21]. That is why the World Health Organization recommends moderate intensity physical activity such as walking for significant benefits of health [18]. The World Health Organization advises aerobic physical activity of structured or unstructured character at moderate-intensity for 150 min, 75 min of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate-intensity and vigorous-intensity activity throughout a week as means of health enhancement [23, 24]. Moderate physical activity is proven to reduce in a significant way the risk of appearance of ischemic heart disease in healthy adults of both sexes through lowering of blood pressure, improving the glucose tolerance, reducing the obesity, and improving the lipid profile [19-22, 25]. It increases the maximal oxygen uptake, stroke volume, cardiac output, coronary artery function, and the maximal systemic arteriovenous oxygen difference [26-28]. Comfortably, we can say that there is a positive relationship between physical activity and the cardiopulmonary function [29] and that physical activity had resulted in increased functional exercise capacity [19, 21, 29], with consequent increase in the 6-MWD. Moreover there is a quantity response between the total volume of weekly physical activity and cardiopulmonary fitness

[30]. By contrast, physical inactivity is now considered a risk factor for cardiovascular diseases [19, 20, 22, 31].

We conclude that the physical activity level for young adult Saudi women had powerful effect on the functional exercise capacity and 6-MWD that can even mask the negative effect of niqab wearing on pulmonary function.

Muslim women who wear the niqab can minimize the negative pulmonary effect of wearing the niqab by engaging in moderate to high physical activity to maintain their cardiopulmonary fitness and functional exercise capacity.

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