

## Research

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Volume 2 : Issue 2

Article Ref. #: 1000OROJ2110

**Article History****Received:** June 28<sup>th</sup>, 2015**Accepted:** August 4<sup>th</sup>, 2015**Published:** August 4<sup>th</sup>, 2015**Citation**

Kneffel Z, Goebel R, Alkhatib A. Cardiovascular risk factors and their responses to a 10 weeks training program in young Qatari adults. *Obes Res Open J.* 2015; 2(2): 57-63. doi: [10.17140/OROJ-2-110](https://doi.org/10.17140/OROJ-2-110)

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# Cardiovascular Risk Factors and their Responses to a 10 Weeks Training Program in Young Qatari Adults

**Zsuzsanna Kneffel, Ruben Goebel and Ahmad Alkhatib\****Sport Science Program, College of Arts and Sciences, Qatar University, Doha 2713, Qatar***ABSTRACT**

Rapid development in Qatar in recent years has led to numerous changes, particularly the increased prevalence of lifestyle related health risks, with almost 50% obesity rates amongst Qataris of all ages. We investigated the effects of a 10-week exercise training program aimed at young Qatari adults, on a number of Cardiovascular disease (CVD) risk factors. With Qatar University IRB approval, we screened 158 (89 males, 69 females) Qatari student volunteers from Qatar University for CVD factors of hypertension indicated by Systolic Blood Pressure (BPS) and Diastolic Blood Pressure (BPD), overweight and obesity indicated by Body Fat percentage (%BF), Body Weight (BW) and Body Mass Index (BMI). Thirty six participants (23% of total number) were identified with one or more risk factors (hypertension and overweight), and were enrolled to follow a 10-week recreational-type exercise training program. The training involved 30-45 min of either walking, cycling, jogging and swimming at an exercise intensity corresponding to 50-85% of each participant's maximum heart rate, on 3-5 times/week. The intervention significantly reduced BW ( $93.4 \pm 14.1$  vs.  $86.7 \pm 14.5$ , and  $p < 0.05$ ), BMI ( $31.0 \pm 3.6$  vs.  $28.7 \pm 3.9$ ,  $p < 0.05$ ) and BF% ( $31.2 \pm 9.0$  vs.  $21.2 \pm 4.4$ ,  $p < 0.05$ ) in males, and there was a significant reduction in BPD ( $83.4 \pm 5.3$  vs.  $76.0 \pm 9.2$  mm Hg,  $p < 0.05$ ). The effects in female participants were not significant. This recreational-type exercise intervention was effective in substantially reducing the CVD indices. However, the alarmingly high prevalence of sedentary-related CVD risks amongst Qatari young adults, especially those related to obesity, overweight and hypertension necessitate further public health interventions in this age-group as an early prevention strategy.

**KEYWORD:** Physical Activity; Health risks; Interventions; University workplace.

**ABBREVIATIONS:** CVD: Cardiovascular disease; BPS: Systolic Blood Pressure; BPD: Diastolic Blood Pressure; BW: Body Weight; BMI: Body Mass Index; IRB: Institutional Review Board ; IPAQ: International Physical Activity Questionnaire; BH: Body Height; %BF: Body Fat percentage; PA: Physical Activity.

**INTRODUCTION**

Exercise is an established primary and secondary prevention strategy in a variety of populations of all ages, including sedentary and those at high CVD risks.<sup>1-4</sup> Multipronged interventions, particularly the exercise-based, in young people have been suggested as an effective preventative approach in identifying and reducing various CVD risks at an early stage and have shown various degrees of effectiveness.<sup>5,6</sup>

The university campus workplace serves as a unique and ideal setting for health promotion mainly because of its exposure of many healthy messages to a large number of young adult students and staff.<sup>7</sup> Effective health screening and exercise interventions within a university campus have been shown to increase the awareness of existing sedentary lifestyle risks such as elevated blood glucose, body fat percentage and blood pressure, and reduced cardiorespira-

tory capacity.<sup>7,8</sup> They also assist to devise effective interventions which have shown reductions in a number of CVD risks including reducing the elevated blood pressure, improving cardiorespiratory capacity and enhancing psychological and physical well-being.<sup>8,9</sup> Various health and fitness screening amongst university students around the globe have demonstrated alarming prevalence of CVD risks. For example, high prevalence of obesity indices have been reported in medical students including waist circumference  $\geq 90$  cm, BMI  $\geq 25$ , waist to-hip ratio  $\geq 0.9$ , waist to height ratio  $\geq 50$ , and those have been correlated with elevated blood pressure, glucose and serum lipoproteins amongst those students.<sup>10</sup> High prevalence for one or more CVD risk factors have also been found amongst Iraqi and Bahraini, American, Hungarian, and Spanish university students.<sup>11-14</sup>

Qatari population has received very little attention in terms of obesity research despite the country recording the highest obesity and physical inactivity rates across the WHO-classified regions,<sup>15</sup> perhaps due to recent emergence of wealth and natural resources in the GCC region, which has impacted on its populations' health and lifestyle.<sup>13</sup> Limited data available have indicated that over 41% of its population being physically inactive, 76% of its male adults being classified as overweight or obese reflecting the highest percentage among the GCC and Western countries,<sup>15</sup> whilst, hypertension rates are also high and over 32% of Qatari adults.<sup>16</sup> This obesity and physical inactivity prevalence was coupled with a dramatic increase in the prevalence and incidence of non-communicable diseases, particularly over the past 20 years.<sup>17</sup> The prevalence of cardiovascular diseases (CVD), account for significant levels of mortality (30.2%) in Qatar,<sup>18,19</sup> which is comparable with the highest recorded rates in the United States and European Union, of 30.4% and 40% respectively.<sup>16,20</sup> Therefore, effective interventions are very much needed amongst Qatari populations.

To date there are no studies on the CVD prevalence amongst Qatari young adults, especially given that half of Qataris (n=278,000) are under 20 years.<sup>21,22</sup> Despite some earlier CVD prevalence studies amongst Qataris and non-Qataris living in Qatar<sup>18,21</sup> neither screening nor efficacy of a physical intervention have been investigated.

Therefore, the aim of the study was to assess the prevalence of lifestyle disease risk factors amongst young Qatari adults students. A second aim is to test the effectiveness of a 10-week exercise-training program aimed at young Qatari adults, on a number of cardiovascular risk factors. We hypothesize that a university based intervention could reduce the CVD risk actors amongst young Qatari students.

## METHODS

### Participants and Design

All participants were students within Qatar University, Doha. The study was reviewed and approved by the Institutional

Review Board (IRB) for Human Subjects. All of the undergraduate Qatari students at the university received invitation e-mails to take part in the study (ca. 1300). In addition, leaflets and posters were distributed around the university campus. One hundred and fifty eight students (n=158, 89 males and 69 females) with the age of 18-30 years old, expressed interest to volunteer in the study and provided a written informed consent prior to participation in this study. The eligibility criteria used included: 1) no previous diagnosed health or current medication (anti-hypertensive medication and/or anti-depressive treatment), 2) ability to attend the whole duration of the intervention and 3) proved Qatari citizenship.

### Initial Screening and Testing Procedures

The testing adhered to the Helsinki declaration for the use of human subjects. All participants were individually interviewed and assisted in filling the short form of the International Physical Activity Questionnaire (IPAQ).<sup>23</sup> Body weight (BW) was assessed to the nearest 0.1 kg (Omron BF-400, Healthcare Co., Ltd., Japan), and Body Height (BH) was assessed to the nearest 0.5 cm. Systolic (BPS) and diastolic (BPD) blood pressure were assessed resting (sitting position) for 5 minutes using digital monitor (Omron HEM-780, Omron Healthcare Co., Ltd., Japan) and recorded twice with 1-minute break in between, and the taken value was within 10 mm Hg. Body composition was assessed for body fat percentage (%BF) using a single frequency bioelectrical impedance analyzer at 50 kHz (Omron BF-400, Healthcare Co., Ltd., Japan).<sup>24</sup> Body mass index (BMI) was calculated as weight/height<sup>2</sup> (kg/m<sup>2</sup>).

### Exercise Intervention

After the screening process, 36 participants (23% of total number) who were identified with one or more risk factors (elevated blood pressure or overweight) were enrolled to follow a 10-week recreational-type exercise training program. Eight students reported that they could not complete the intervention due to different reasons (e.g. injury, time conflict), and a further three dropped out during the intervention. Two female students dropped out because of pregnancy. At the end of the intervention overall 23 participants (13 males and 10 females) have completed the whole intervention and their results were analyzed.

The 10 weeks exercise training intervention involved either walking, cycling, jogging and swimming at an exercise intensity corresponding to 50-85% of each participant's maximum heart rate, (monitored by POLAR FT4, in every 2 minutes), lasting 30-45 min, five times per week. The first three training sessions were in the form of supervised training, whilst the participants performed the remaining two sessions individually after they were all given a training schedule. This training regime was similar to a previously recommended PA protocol for this age group<sup>25</sup> and according to the recommendations of the American Heart Association.<sup>26</sup> All training sessions were conducted at Qatar University's facility of the gymnasium and the outdoor track.

**Data Analysis and Statistics**

All screened cardiovascular risks (BPS, BPD, BMI, %BF) were reported as mean ± standard deviation. The results of each risk factor were compared against the recommended value based on WHO classifications. The Physical Activity (PA) levels were categorized into Walking (W), Moderate intensity activities (M), Vigorous-intensity activities (V) according to the number of hours reported and applied the recommended MET by IPAQ-short guidelines.<sup>23</sup> To determine the effects of the used intervention and compare the pre- and post- assessments, self-control trials (paired t-test) were used. Data were analyzed using SPSS, version 21.0 and the significance level was set at p<.05.

**RESULTS**

**Initial Screening Results**

Both males and females have demonstrated a high prevalence in the risk factors of BMI, %BF and BPS above the recommended thresholds (BPS>120 mm Hg, BMI>25, %BF>18.9), (Table 1).<sup>27</sup> For males, BPD was within the normal range (BPD<80 mm Hg) and nineteen participants (21.3%) had elevated blood pressure and exceeded the recommended thresholds, (Table 1). Twenty-eight (31.5%) of the participants were classified overweight and similarly 31.5% were obese by BMI. Additionally, %BF shown that twenty-two (24.7%) were overweight and twenty-seven (30.3%) were obese;

The total PA for males was (424.18 MET-minutes per week), which was below the recommended 500-1000 MET-minutes per week. The resulting classifications were as follows: the vigorous PA, 267.48 MET min/week, walking PA, 89.52 MET min/week and moderate PA, 67.18 MET min/week.

In terms of the female participants' data, thirteen

(18.8%) were classified overweight and seven (10.1%) were obese by BMI. Additionally, %BF shown that sixteen (23.2%) were overweight and twelve (17.4%) were obese; ten (14.5%) had elevated blood pressure above the recommended thresholds (Table 1).

Females' total PA (462.37 MET-minutes per week) was also below the recommended 500-1000 MET-minutes per week. The resulting classifications were as follows: the vigorous PA, 127.36 MET min/week, walking PA, 264.94 MET min/week and moderate PA, 62.51 MET min/week.

**Intervention results**

The intervention significantly reduced BW, BMI and %BF (all p<0.05), (Table 1). BPD was significantly reduced (83.4±5.3 mm Hg vs. 76.0±9.2 mm Hg, p<0.05), but not BPS (133.81±10.7 mm Hg vs. 130.5±9.1 mm Hg, p=0.52). Average BMI overweight and obesity percentages were significantly reduced among the participants (Table 1).

**DISCUSSION**

The study aimed to demonstrate the prevalence of cardiovascular risk factors and the efficacy of a 10-week physical activity intervention within a cohort of Qatari students with defined risk factors. Two main findings are that young Qatari adults in this setting demonstrate high prevalence of CVD risks, which is slightly higher than what is reported nationally for all Qatari adults.<sup>15</sup> The second main finding of the present study is that the intervention significantly reduced BW, BMI and %BF (Table 1).

Our results have shown that prevalence of overweight and obesity among this sample (each 31.5%) is similar to what have been reported among adolescent in seven Arab Countries including Qatar.<sup>28</sup> Comparing the initial screening results of BMI

Assessment	Initial data			Males				Females			
	Males	Females	P- value	Pre-inter- vention	Post- inter- vention	Mean difference	p- value	Pre-inter- vention	Post- inter- vention	Mean dif- ference (%)	p-value
Number (n)	89	69		13	13			10	10		
Age (years)	20.9±2.4	20.6±2.1	.92	20.5±2.4	20.5±2.4			21.4±2.5	21.4±2.5		
BPS (mm Hg)	128.4±12.9*	115.4±10.6	.05	133.8±10.7*	130.5±9.1*	-3.3±1.6 (-2.5)	.516	121.8±14.5*	122.7±14.3*	+0.9±0.2 (+0.7)	.86
BPD (mm Hg)	74.4±11.6	74.2±9.1	.21	83.4±5.3	76.0±9.2	-7.4±3.9 (-8.9)	.003	76.5±9.0	79.8±11.2	+3.3±2.2 (+4.3)	.12
BW (kg)	82.4±19.7	60.5±15.0	.03	93.4±14.1	86.7±14.5	-6.7±0.4 (-7.2)	.002	72.2±13.2	71.9±14.1	-0.3±0.9 (-0.4%)	.84
BMI	27.3±6.2*	23.2±5.6	.15	31.0±3.6*	28.7±3.9*	2.3±0.3 (-7.4)	.001	28.3±5.1*	28.1±5.8*	-0.2±0.7 (-0.6%)	.79
BF (%)	22.9±10.3*	29.6±10.5	.32	31.2±9.0*	25.8±7.0*	-5.4±2.0	.000	38.8±6.4*	36.6±8.0*	-2.2±1.6 (-5.6%)	.17

BPS: systolic blood pressure; BPD: diastolic blood pressure; BW: body weight; BF: percentage of body fat; BMI: body mass index.

\*Values indicating increased health risks according to WHO cut points.<sup>27</sup>

Table 1: Mean±SD for all assessments indicating cardiovascular risk factors.

to age matched results of two Western countries, we found that the percentage of obesity (Table 1) was close as data among Americans,<sup>29</sup> 33.2% and was markedly higher than obesity data in the UK,<sup>30</sup> 32.6%. The overweight prevalence of 31.5% in our study was close to that 33% which was reported in an earlier research of older Qatari population<sup>15</sup> and higher than it was reported for a younger Qatari adolescent cohort<sup>18</sup> of 28.6%. These results could demonstrate a rising tendency of bodyweight as a marked CVD risk factor in young Qatari adults. The prevalence of overweight and obesity indicated by BMI $\geq$ 25 of 63% in our study is similar to the 65% reported in earlier research for Qatari males when matched age in Qatar.<sup>15</sup> This alarming rate not only supports the global concern of rising obesity globally,<sup>28</sup> but is also a major concern for developing CVD, particularly diabetes at early adulthood in the GCC region.<sup>31</sup>

The intervention was effective in reducing obesity and overweight related measures. If those are distributed across the overall sample, it will equate to a 7.4%, 7.2% and 5.4% reduction in the average of BMI, BW, and %BF respectively (Table 1). This reduction rate is similar to what was found in other interventions with a similar period of time an 8 week long study, that applied an aerobic training program.<sup>32</sup> Those authors described a moderate physical activity promoted decrease in BMI (28.1 $\pm$ 1.59 vs. 25.7 $\pm$ 0.75,  $p < 0.05$ ) and body fat distribution (31.8 $\pm$ 3.7 vs. 28.6 $\pm$ 2.6,  $p < 0.05$ ) among obese, and enhanced their pulmonary indices (FVC, FEV<sub>1</sub>), VO<sub>2</sub>max.<sup>32</sup> The transition from adolescence to young adulthood is a critical period for obesity development with one study noting that obesity rates doubled from adolescence to the early twenties,<sup>33</sup> and another reporting that there is both a high incidence and maintenance of obesity from adolescence to early adulthood.<sup>34</sup> Therefore, this study contributes in addressing the measured risk factors in these young age-groups.

The initial screening revealed over 20% of BPS in both young males and females indicating pre-hypertension risks (BPS $>$ 120 mm Hg) in those participants, and a major risk factor for CVD.<sup>35</sup> Even though the mean reductions was significant after the 10-weeks of training program in three variables (BPS, BMI, %BF), there was still individual cases of pre-hypertension, and those individuals were referred to see their physician in order to continue being supervised following the intervention. In those where the initial BPS was  $\geq$ 130 mm Hg, the training program used resulted in significant reduction and the average decrease was 7 mm Hg ( $p < 0.05$ ), however in participants where the initial value was  $<$ 130 mm Hg the mean reduction was only 1.1 mm Hg ( $p = 0.4$ ). These results are quite similar to those experienced in some longer 6-month-long longitudinal studies in which the decrease of the BP depended on the initial values. When it was high, the decrease was more marked,<sup>36,37</sup> but in normotensive subjects it was only 3-4 mm Hg.<sup>38,39</sup>

According to a previous observation<sup>40</sup> the best age to produce a beneficial effect on BP is between 30 and 49 years.

In the present study participants' mean age was 20 years. suggesting that the training effects on BP at this age could be less marked than in older participants.<sup>5</sup>

The results of the IPAQ short version, used in this study, showed that approximately 15% of the participants reached the minimum requirement of the total weekly physical activity followed the UK's recommendation<sup>30</sup> (424.18 MET-minutes per week vs.  $>$ 450 MET-minutes per week). Perhaps the social images of body shape, the family obligations of practicing physical activity and the status of physical education in this country is different from most Western countries, it is possible that these barriers have influence on the insufficient PA, though no research has been found to back up this suggestion.

Failure to meet physical activity guidelines amongst university students has been reported as a reason for weight gain, especially amongst freshman year students<sup>41,42</sup> (five days of moderate activity for 30 min, or three days of vigorous activity for 20 min).<sup>43,44</sup> It is perhaps important to note that the student cohort we tested has had the option to sit on one of the sport courses that were offered within the curriculum, and had the option to use the campus-based sport facilities. However, the effectiveness of these approaches still appears inadequate for weight maintenance.<sup>5</sup> Our results appear to agree that integrating PA within the university curriculum does not necessarily reflect in meeting the PA levels amongst university students.

It is well established that exercise is a primary prevention for CVD and several exercise intervention studies have shown exercise training effectiveness in a number of cardiovascular and metabolic indices including reducing blood pressure and indices of the metabolic syndrome.<sup>36,39,45-47</sup> However, the majority of those studies have focused on older populations that are typically at an increased risk.<sup>1</sup> Our study is the first to have demonstrated the effectiveness of an exercise intervention in young Qatari adults, when this age-group is not commonly known to be at an increased risk. Limited number of exercise interventions have focused on a university age-students, mainly focused on psychological factors such as health-related behaviours, or approach-avoidance achievement and less on the cardiovascular prevention.<sup>48,49</sup> However, none were have focused on this age-group in the GCC region, despite stating the necessity of conducting such interventions.<sup>50-52</sup> Therefore, results of this study could inform further research within a university workplace, particularly in the GCC region.

## LIMITATIONS

The analyses of combined physical capacity and health risks factors for campus students in this study may provide a baseline for effective workplace PA interventions. We have used a validated assessment approach that relied on several direct physiological measurements of BF%, BMI and BP that have been shown to be effective to plan an university based PA intervention.<sup>7,53</sup> However, generalizing the results of this study

across age and gender matched-groups needs to rely on a larger sample size than we were able to involve within this intervention program. The diet was not controlled which could have influenced on changes in some of the variables we have tested.

## CONCLUSION

Our results suggest that overweight, obesity and physical inactivity are prevalent among young adult Qataris. Targeting those who are at risk with a physical activity programme demonstrated substantial reduction in CVD risk factors indicated by reduced blood pressure and body fat percentage. Combining health and exercise assessments with a follow up physical activity intervention can be effective strategy to reduce CVD risk factors within university campus. Interventions within the university campus-workplace reaching students and employees, alongside wider strategies to increase physical activity levels in the workplace are very much needed,<sup>53</sup> and Qatar could utilize its benefits to improve society's health significantly.

## DISCLOSURE

This study was made possible by a Qatar Foundation's Qatar National Research Fund grant award (UREP 12-048-3-009).

## ACKNOWLEDGEMENT

The authors would like to thank all participants who volunteered for this study.

## CONFLICTS OF INTEREST

The authors declare that they have no conflicts of interest.

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