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Research Article

SEDENTARY BEHAVIOR IN KITCHEN IS LIABLE TO FAT ACCUMULATION AND CARDIOMETABOLIC RISK

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ABSTRACT

Objective: Sedentary habits are considered one of the most important reasons for various cardiovascular complication and risks. Taking into this account the objective of the present study was to to explore the empirical association between accumulation of fat and heart health status among non-sedentary and sedentary habits in kitchen of our modernized society.

Method: The current study included 100 women (22-40 years old). Workers who met the inclusion criteria were assigned in to two groups: Group (I) Non-sedentary workers (n-58) and Group (II) - sedentary workers (n-42). Commonly, workers which used to do simple movement work in kitchen were considered as control and which mostly worked at one place in kitchen for more than 6-hours of total working schedule (8–hours). were included in sedentary workers, Anthropometric measurement like body fat ((%waist circumference(WC), waist hip (WH) ratio, and heart rate variability(HRV) were measured and analyzed by the independent student 't' test, followed by Pearson correlation and Linear regression.

Result: we observed, there was significant increase in body fat ((%, WC, WH ratio and sympathetic dominance among sedentary participants when compare to non-sedentary participants. There was significant negative correlation between LF and HF, body fat and HF, as well as WH ratio and HF, and significant positive correlation between body fat and LF as well as WH ratio and LF.

Conclusion: These results suggest that sedentary behaviour in kitchen is associated with accumulation of adiposity and alteration of sympatho-vagal balance, may lead to cardiometabolic risk in adult women.

Key words: Body fat distribution, Heart rate variability, Sedentary habit, physical activity.

INTRODUCTION

Sedentary behavior is a lack of physical activity, has been most often studied as a lack of moderate-to-vigorous exercise, where energy expenditure is not above the level of resting [1] and recently emerged as a unique risk factor for chronic disease [2]. Excess sedentary time has also been associated with increased accumulation of central adiposity and other markers of cardiometabolic risk [3]. In studies concerning health risk, body mass index (BMI) and other easily measured indices of fatness, including waist circumference (WC), and waist-to-hip ratio (WHR) are used and recommended by the World Health Organization as reliable in the assessment of body fatness [4,5]. Sedentary behavior and low resting heart rate variability (HRV) are associated with increased cardiovascular disease (CVD) incidence. Sedentary behavior is one of the most important public health problems in the 21st centurysince occupational activities have been changing over the years [6]. Non-exercise physical activity can be seen as light intensity physical activity such as standing or doing household responsibilities. Physical inactivity may lead to heart disease via increased adiposity, reduced lean body mass, reduced cardiovascular fitness, however, the relative importance of these mechanisms is unclear.

Disturbances in autonomic function may be associated with these potential mechanisms linking physical inactivity. Autonomic nervous system function is assessed clinically by measuring resting heart rate and HRV. The analysis of HRV is a simple non-invasive technique used to assess the instantaneous beat-to-beat variations in terms of R-R interval length. HRV has been considered as a suitable marker for the estimation of autonomic nervous system function [7]. Time domain analysis of HRV uses statistical methods to quantify the variation of the standard deviation (SD) or the differences between successive R-R intervals. Frequency domain analysis of HRV enables us to calculate the respiratory dependent high frequency (HF) and the low frequency (LF) powers. Alteration in the HRV pattern or more specifically the SD of internal between successive R waves (SDRR) of the cardiac cycle provides early and perceptive indication of compromised heart health. HF is mediated by variations in parasympathetic activity; the LF power reflects both parasympathetic and sympathetic modulations [8].

The association between sedentary behavior and accumulation of adiposity along with HRV could, therefore, make an important contribution to our understanding of the relationship between sedentary behavior and cardiometabolic risk. The objective of the present study was to determine whether sedentary behavior was associated with changes in cardiometabolic risk among kitchen workers.

METHODS

Participants

The current study included 100 women between the ages of 22 and 40 years old. We conduct an experiment on people's university kitchen workers, recruited altogether in kitchen existing in a hostel, hospital, and college. Healthy women, who are reporting that they are sitting more than 50% during their work time in people's university kitchen, were chosen to participate to the study. All participants were screened for medications and had no history of respiratory or cardiac diseases. Furthermore, there were exclusion criteria for participants such as self-reported chronic long-term musculoskeletal disease or progressive neurological disease, diagnosed cardiovascular or metabolic disease with regular medication, and pregnant women. The study was approved by the Institutional Review Board of Peoples University and committee of ethics in research involving human participation (PCMS/OD/2015/1069). All participants provided written informed consent to participate. Workers who met the inclusion criteria were randomly assigned into two groups: Group (I) non-sedentary workers (n=58) and Group (II) - sedentary workers (n=42). Commonly, workers who used to do simple movement work in the kitchen were considered as control and sedentary workers were included, which mostly worked at one place in the kitchen for more than 6 hrs of total working schedule (8 hrs).

Measurements

The following measurements and factors were used to determine whether or not a person is overweight to a degree that threatens their health: BMI - a measure of body fat, WC (size around the waist), WHR, skin fold measurement (anthropometry), and R-R intervals assessment.

Anthropometric examination

After all outer clothing and shoes were removed; body weight and height were measured to the nearest 0.1 kg and 0.1 cm, respectively, using the standardized equipment. WC was measured to the nearest 0.1 cm at the level of the iliac crest (WC, centimeter, one inch above the anterior superior iliac crests) while the subjects were at minimal respiration. Hip circumference (HC) was measured to the nearest 0.1 cm at the level of the maximum extension of the buttocks in a horizontal plane. Both measurements were performed using non-stretchable tape. All measurements were taken on the right side of the body according to the International Society for the Advancement of Kinanthropometry recommendations [9]. Each measurement was repeated 3 times and averaged. BMI was calculated as weight in kilograms/height in meters^2 as a measure of overall adiposity, whereas WC was considered a measure of central or visceral adiposity [10]. Body fatness of participants was classified based on the BMI classification for Asian population [11]. The WHR was calculated by dividing WC with the HC. The percentage of body fat was determined by the sum of the thickness of four skinfolds (biceps, triceps, supra-iliac, and sub-scapular), measured using a Harpenden Skinfold Caliper (British Indicators, Burgess Hill, UK) and calculated according to Durnin and Womersley [12].

HRV examination

Participants were asked, not to consume caffeine-containing products for 12 hrs, and to abstain from alcohol use and heavy work for 48 hrs before testing. Participants rested quietly for 25 minutes in a semi-dark room with a temperature between 25°C and 30°C. Participants were asked to breaths per minute normally. Beat-to-beat measurements of R-R intervals were made during the entire period. The R-R interval measurements were conducted at the same time of day for each participant. The computer program labeled each QRS complex, and the resulting signal was passed through a filter that eliminates ectopic beats and artifacts. HRV was quantified from the last 5 minutes of the R-R interval recording. The electrocardiogram signal was first analogically recorded and then digitally converted through an A/D converter to PC and analyzed using Digital data Acquisition system, HRV soft 1.1 Version. The measurements of HRV followed the standards suggested by the Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology set in 1996. The power spectra were quantified by measuring the area in three frequency bands: High-frequency power (0.15-0.40 Hz), LF power (0.04-0.15 Hz), and total-frequency power (PT, 0.00-0.40 Hz). The LF and HF oscillatory components are also presented in normalized units (nu). In addition, the SD of all R-R intervals (Standard deviation of normal to normal [SDNN]) over the given measurement period and the square root of the mean of the sum of the squares of differences between adjacent R-R intervals (root mean square of successive differences) were also calculated.

Blood pressure (BP) examination

Baseline BP measurements were obtained after 25 minutes of R-R interval collection. We are subsequently averaging the last 3 values (±5 mm Hg) to determine resting BP. All BP measurements were obtained through the use of a Colin STBP-780 automated BP monitor (San Antonio, Tex).

Statistical analysis

Data are expressed as mean±SD. All data were analyzed with the SPSS for windows statistical package (version 20.0, SPSS Institute Inc., Cary, North Carolina). Statistical significance between the different groups was determined by the independent Student's *t*-test and the significance level was fixed at $p \le 0.05$. Finally, Pearson correlation and linear regression were used between two variables.

RESULTS

Effects of kitchen non-sedentary and sedentary habit on classifications of BMI on the basis of Asian population

The data are summarized in Table 1: Among all the non-sedentary kitchen workers (n=58), one was underweight, 56 was normal weight, and one was overweight. However, among all sedentary workers (n=42), three was normal, 22 were overweight, and 17 were obese.

Effects of kitchen non-sedentary and sedentary habit on anthropometric measurement

The data are summarized in Table 2 with mean±SD. Among all non-sedentary and sedentary kitchen workers, heart rate, systolic arterial pressure, and the diastolic arterial pressure were comparable. However, BMI of the sedentary participant was significantly higher when compare to the non-sedentary participant.

Effects of kitchen non-sedentary and sedentary habit on body fat distributions

The data are summarized in Table 2 with mean±SD. The subcutaneous peripheral (biceps and triceps) and central (sub-scapular and supra-iliac) fat distribution in sedentary participants were significantly higher than non-sedentary participants. Moreover, body fat percentage, WC, and WHR were also significantly higher in sedentary participants when compare to non-sedentary participants.

Table 1: The classification of BMI on the basis of Asian population among kitchen non-sedentary and sedentary habit

Participants	Non-sedentary (n=58)	Sedentary (n=42)
Under-weight (≤18.50)	1	0
Normal-weight (18.50-23)	56	3
Over-weight (23-25)	1	22
Obese (≥25)	0	17

Effect of kitchen non-sedentary and sedentary habit on BMI, significance at p≤0.05. BMI: Body mass index

Table 2: The consequence of kitchen non-sedentary and sedentary habit on anthropometric measurement and body fat distribution

Parameter	Non-sedentary	Sedentary
Age (years)	28.80±6.40	30.12±4.50
Weight (kg)	62.56±10.23	67.34±12.22
Height (cm)	165.24±23.84	172.49±21.34
BMI (kg/m^2)	19.46±2.80	31.38±5.20*
Heart rate (bpm)	63.20±11.38	70.39±13.30
Systolic arterial pressure (mm Hg)	125.30±12.20	134.45±14.38
Diastolic arterial pressure (mm Hg)	80.37±6.89	84.16±9.49
Body fat distribution		
Biceps (mm)	5.82±0.74	9.14±1.10*
Triceps (mm)	13.68±2.49	19.25±2.32*
Sub-scapular (mm)	12.85±3.12	22.42±4.24*
Supra-iliac (mm)	15.78±2.53	25.22±3.20*
Body fat percentage	21.24±2.39	32.27±3.82*
WC (cm)	90.24±10.14	124.39±13.20*
WHR	0.73±0.05	0.92±0.08*

Effect of kitchen non-sedentary and sedentary habit on correlation between body fat and LF. BMI: Body mass index, LF: Low frequency, WC: Waist circumference, WHR: Waist-hip ratio

Effects of kitchen non-sedentary and sedentary habit on HRV

The data are summarized in Table 3 with mean±SD. Among all non-sedentary and sedentary kitchen workers, the frequency domain of sedentary participant showed significant increase in very LF, LF, and LF/HF ratio and significant decreased in total spectral power, HF when compare to non-sedentary participants. However, in the time domain, there was a significant increase in NN interval and a significant decrease in SDNN and RMSD in sedentary participant when compare to non-sedentary participants.

Effects of kitchen non-sedentary and sedentary habit on association between body fat distributions and HRV

The data are summarized in Figs. 1-5. Among all non-sedentary and sedentary kitchen participant, there was significant negative correlation between LF and HF (r [68]=−0.87; p=0.01), body fat and HF (r [98]=−0.91; p=0.01) as well as WHR and HF (r [98]=−0.81; p=0.01) and significant positive correlation between body fat and LF (r [98]=0.94; p=0.01) as well as WHR and LF (r [98]=0.85; p=0.01).

We also observed that body fat percentage was a significant predictor of sympathetic activity (LF) (β=0.94, t[98]=22.56; F[1,98]=509.14, p=0.01, R^2=0.88) and parasympathetic activity (HF) (β=−0.91, t[98]=−17.55; F[1,98]=308, p=0.01, R^2=0.82) as well as, WHR was a significant predictor of sympathetic activity (LF) (β=0.85, t[98]=13.43; F[1,98]=180.22, p=0.01, R^2=0.73) and parasympathetic activity (HF) (β=−0.81, t[98]=−11.29; F[1,98]=127.44, p=0.01, R^2=0.65).

DISCUSSION

Modern lifestyle, which predisposes to lower energy consumption and inadequate dietary habits and sedentary lifestyle lead to obesity [13]. Previous research had been demonstrated that increases in body weight, W:H and WC are related to aspects of occupation such as employment grade [14] and amount of overtime [15]. In the present study, we recruited kitchen workers associated with People University having sedentary and non-sedentary working habit in the kitchen. There is a natural tendency toward weight gain in sedentary people [16]. Sedentary behavior, make excess body weight [17] and has been associated with increased accumulation of adipose tissue, consequence increased cardiometabolic risk [18-20]. Excessive fat accumulation may because of an imbalance between calories consumed and expended, which may be the reason for higher BMI or overweight in sedentary individual [21], which may impairs their health. However, as to the heart rate, studies have shown a tendency toward reduction of the values of this variable in non-sedentary individuals which are different for sedentary participants [22]. We followed Asian BMI criteria and correlate association of fat accumulation with HRV. We observed that there was positive correlation between total body fat and LF and negative correlation between total body fat and HF, however, we also observed positive correlation between WHR and LF and as well as the negative correlation between WHR and HF. It indicates the link between fat accumulation and the sympatho-vagal imbalance. Previous

Table 3: The consequence of kitchen non-sedentary and sedentary habit on HRV

Parameter	Non-sedentary	Sedentary
Frequency domain		
Total spectral power (ms^2)	3280±434	2146±320*
VLF (ms^2)	850±125	1228±157*
LF (ms^2)	1173±132	1557±124*
LF (nu)	50.74±8.29	75.20±7.84*
HF (ms^2)	927±110	647±88*
HF (nu)	35.48±4.50	20.70±3.85*
LF/HF	1.15±0.20	2.20±0.33*
Time domain		
Mean NN (ms)	768±125	1220±172*
SDNN (ms)	45.32±6.28	28.29±4.54*
RMSSD (ms)	37.45±5.24	22.34±3.80*

Effect of kitchen non-sedentary and sedentary habit on HRV, significance at p≤0.05, where, *Significant change when compare with non-sedentary participants. nu: Normalized unit, NN: Normal to normal, SDNN: Standard deviation of normal to normal, RMSSD: Root mean square of successive differences, LF: Low frequency, HF: High frequency, VLF: Very low frequency, HRV: Heart rate variability

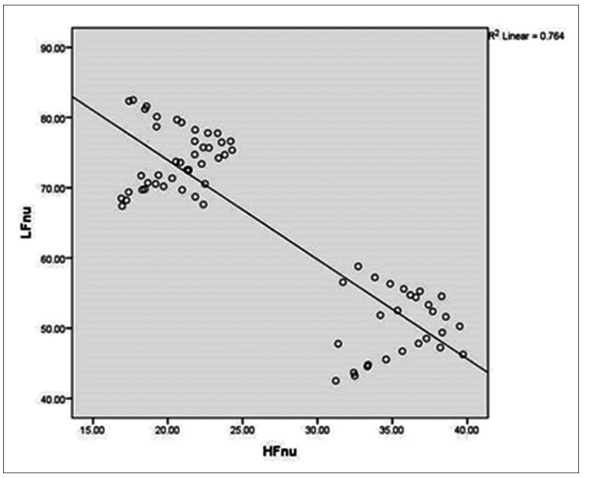

Fig. 1: Effect of kitchen non-sedentary (n=58) and sedentary habit (n=42) on correlation between low frequency and high frequency

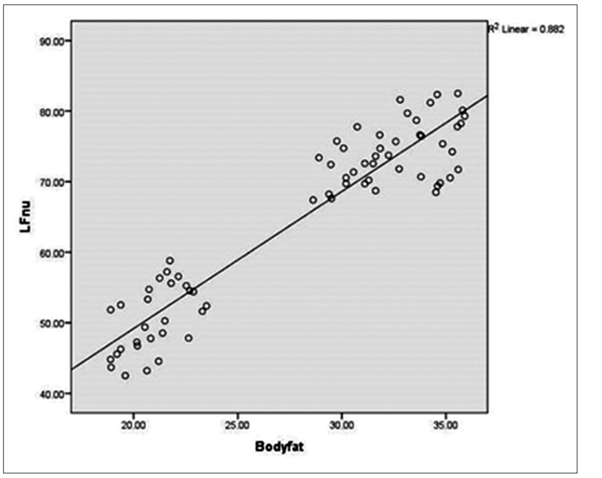

Fig. 2: Effect of kitchen non-sedentary (n=58) and sedentary habit (n=42) on correlation between body fat and low frequency

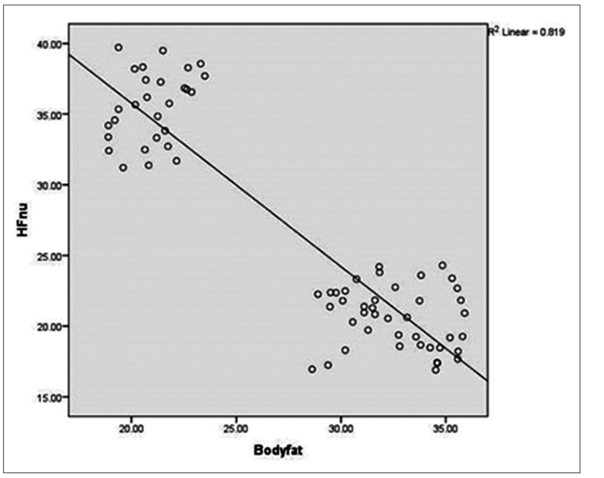

Fig. 3: Effect of kitchen non-sedentary (n=58) and sedentary habit (n=42) on correlation between body fat and high frequency

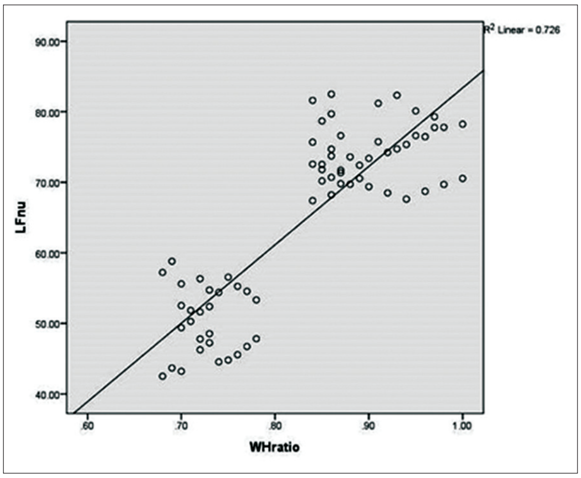

Fig. 4: Effect of kitchen non-sedentary (n=58) and sedentary habit (n=42) on correlation between waist-hip ratio and low frequency

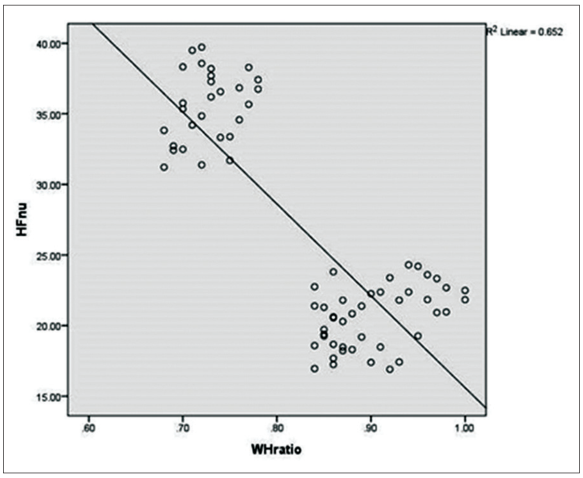

Fig. 5: Effect of kitchen non-sedentary (n=58) and sedentary habit (n=42) on correlation between waist-hip ratio and high frequency

studied had revealed and maintained physical activity, i.e. (non-sedentary lifestyle) has been related to an increased in HRV while non-sedentary activity may lead to lowered HRV [23]. Low physical capacity involving the accumulation of fat tissue in the abdominal region lead to alterations in the cardiac autonomic control [24,25]. Sedentary lifestyle reduces vagal tone, whereas physically active lifestyle, resulting in increased vagal tone [26]. It is known that vagal and efferent activities directed at the sinoatrial node are characterized by a discharge highly synchronized with each cardiac cycle which can be modulated by central (vasomotor and respiratory centers) and peripheral (BP oscillations and respiratory movements) oscillatory components [27], generating rhythmic fluctuations in the efferent nervous discharges that are manifested in the heart by short and long duration oscillations of the R-R intervals, affording a greater or lesser HRV, and therefore, a greater or lesser autonomic cardiac tone [8]. The time domain measurements concerning the vagal activity were lower. More relevant than the R-R intervals, the SDs of the mean R-R intervals more adequately reflect vagal modulation of the heart [28]. Since greater the SD of the RR is found, greater the parasympathetic tone, we observed in this study, there was a significant difference of R-R intervals, and significant lowest value of SD intervals was shown by the sedentary as compared to non-sedentary participants. This study also showed the significantly lower TP, HFnu and high LFnu, and LF-HF ratio in sedentary individuals. Findings of this study of increased sympathetic activity in the form of increased LFnu and decreased parasympathetic activity in the form of decreased HFnu depicts the nature of alteration in the sympatho-vagal imbalance, as the mechanism for risk of CVDs in higher BMI individuals [29]. Riva *et al*. [30] recommended that the obesity may alter sympatho-vagal dysfunction, characterized by a decrease in the parasympathetic activity and increase in the sympathetic activity. Martini *et al*. [24], also observed lower values of HF components (nu) in the obese individuals.

CONCLUSION

From this study, it is concluded that sedentary habits in the kitchen may increase accumulation of adiposity, lead to overweight. This may also be associated for alteration of sympatho-vagal balance by increasing sympathetic dominance and decreasing parasympathetic dominance, lead to cardiometabolic risk in adult women. Early detection and management by weight reduction and regular exercise/yoga may reduce these risks. Next to sedentary behavior, light physical activities, such as cleaning, cooking, and slow walking, are considered for interventions lifestyle to promote active in the long-term. Considering barriers to pursuing physical activity such as lacking time, non-exercise physical activity could be a smaller and more effective step to take in stimulating people to a healthier lifestyle. Moreover, the prevention of CVD is an important challenge for public health in developing countries.

LIMITATIONS

The lipid profile was not measured for participants and as well as biochemical marker like plasma catecholamine estimations and estimation of metabolites of catecholamines in urine.

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