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Association of Sedentary Behaviour and Cardiometabolic Risk Biomarkers among Chinese Females: A Cross-sectional Study

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Abstract

Introduction: Recent epidemiologic evidence suggests that long-term health consequences are related to habitual sedentary behaviour. Sedentary lifestyles are greatly influenced by increasing technological interaction and involvement among the young adults. Because of the prognostic importance of cardio metabolic risk biomarkers on health and mortality this knowledge could provide an insight into the mechanisms through which sedentary behavior influences cardiovascular disease risk among Chinese females. However, there has been no thorough exploration of the independent contributions of sedentary behaviour to metabolic risk factors among Chinese females and the relative importance of these factors.

Objective: The purpose of this study was to determine the association between sedentary behaviour and anthropometric measures among Chinese females.

Method: 210 Chinese females participated in this cross sectional study. Sedentary Behaviour Questionnaire was used to assess their sedentary behaviour and height, weight, waist and hip measurements were made. Multivariate linear regression analyses examined associations of self-reported sedentary behaviour with biomarkers.

Results: The highest sedentary behaviour engaged by the participants was doing paperwork or computer work, sitting ranked second and listening to music and the third being sitting reading book or magazine. The least sedentary behaviour that participants engaged was doing artworks or crafts. There was no significant association between sedentary behaviour and anthropometric measurements among Chinese females.

Conclusion: The study concluded that sedentary behaviour is not detrimentally associated with waist circumference, BMI and waist-hip ratio among young Chinese females. It is possible that factors not directly accounted for in our analysis could have contributed to the healthy range of cardiometabolic risk biomarkers.

Keywords: Sedentary behaviour; Anthropometric measures; Cardio-metabolic; Chinese females

Introduction

Sedentary behavior is a distinct behavior separate to that of merely being physically inactive. Public Health focuses on promoting exercise but neglects sitting, where people spend the majority of their time. Research shows the amount of time young people spend in sedentary behaviors has increased in recent years, and while this includes television time, it is a dramatic increase in other types of screen time, such as computers and video games, that appears to be driving the trend [1]. The new types of technological interaction appear to be more sedentary in nature and may have implications for obesity.

Sedentary behavior (SB) is characterized by waking time spent sitting, reclining, and lying down, and by low energy expenditure [2]. This behavior has two distinct effects: time spent in SB reduces engagement in physical activity (which reduces benefits from the well-researched health and well-being enhancing effects of physical activity) and specific deleterious effects of SB such as mortality associated with TV viewing [3]. Historically a sedentary lifestyle has been explained as a lack of moderate to vigorous physical activity. There are health benefits to be gained from meeting the WHO recommendations for moderate-intensity physical activity levels. However, research now suggests, even if an individual does achieve these exercise recommendations, they still face health risks from sitting for continuous periods of time. Therefore, exploring ways of breaking up periods of inactivity (i.e., standing up every so often) are becoming more important [4]. A good body of studies mentioned that when a person has a high cardio metabolic risk factor, it is more dangerous than a person who is currently smoking [5]. During sedentary behaviour, the energy expenditure is homogenous while physical activity had different intensity and movement patterns. It is stated sedentary behaviour as being at one end of a physiological continuum, above sleep, with vigorous intensity physical activity at the opposite end of the continuum and we can see that almost all of the population nowadays are at the sedentary behaviour continuum [6]. Sedentary behaviour is a major health risk, independent of being physically inactive. Even for those who meet the public health recommendations for physical activity, too much sitting can compromise metabolic health [7]. Therefore, sedentary behaviour is considered as major health risk as it related to a person who is physically inactive.

Although someone goes to the gym, exercise or walk for 30 to 45 minutes a day, but for the remaining hours they remain in sitting position, they are also considered as having a sedentary lifestyle. Sitting wrecks the body and as soon as you sit electric activity in the leg muscles shuts off; calorie burning drops to 1 per minute and enzymes that help break down fat drop 90%. People with sitting jobs have twice the rate to develop cardiovascular disease [8]. Among women, observational studies in Australia and the United States have investigated the associations between sedentary behavior and body mass index (BMI),

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obesity, and weight gain. Among studies in Australia, during a four year study, women who reported greater sitting time were less likely to maintain weight [9]. In another study among Australian men and women, with a separate analysis of women, sitting and television viewing time were detrimentally associated with BMI, independent of leisure time physical activity [10]. To our knowledge no study has been conducted to determine the association of sedentary behavior and cardiometabolic markers like BMI, waist circumference and waist hip ratio among Chinese females.

BMI is a better predictor of cardiovascular disease and diabetes than waist circumference (WC) in young and middle-aged. Moreover, measurement of both WC and BMI may be a better predictor of cardiovascular disease and diabetes mellitus than BMI or WC alone [11]. Waist circumference is used as an alternative to measure fat content. This study particularly explored how sedentary behavior will affect anthropometric measurements which are considered as the risk factors of cardio-metabolic diseases.

Methods

A cross-sectional survey was administered to Chinese females to determine the association of sedentary behaviour and anthropometric measurements. The participants of this study were Chinese female students recruited from University Tunku Abdul Rahman (UTAR), Sungai Long Campus, Malaysia. The participants were from Faculty of Medicine and Health Sciences (FMHS), Faculty of Accountancy and Management (FAM), Faculty of Creative Industries (FCI), Faculty of Engineering and Science (FES) and Foundation in Arts (FIA). A total of 210 students participated in this study. Out of 210 females, 76 students were from FMHS, 60 students from FAM, 31 students from FIA, 25 students from FES and 18 students from FCI.

Subjects who suffer from any form of cancer, thyroid disease, congenital malformations, skeletal deformities and those on walking aids were excluded. We obtained ethical approval for the study from UTAR ethical committee. Participants were informed regarding the procedure and confidentiality was ensured. Informed consent was obtained from all participants. Demographic data was gathered using a self-designed questionnaire.

Instrument: Sedentary Behaviour Questionnaire (SBQ)

Sedentary behaviour was assessed using sedentary behaviour questionnaire (SBQ). A recent systematic review suggests that self- and proxy-report tools generally display acceptable reliability and validity in assessing sedentary behavior [12]. The Sedentary Behavior Questionnaire (SBQ) was taken from the Sedentary Behavior Research Network (SBRN) and permission was received via E-mail. Other than using SBQ, other questionnaire has also been used that consist of the consent form, demographic data that consist of their name, faculty, age, telephone number, smoking and alcohol status and sleep duration and another questionnaire for me to filled in their weight, height, waist and hip circumference. The SBQ consist of two sections which are the weekday and weekend part. Both section have the same questions and they have to answer based on how much time they spend doing the nine sedentary behaviors that were listed there which are watching television, playing computer or video games, sitting and listening to music, sitting and talking on the phone, doing paperwork or computer work, sitting and reading books, playing musical instruments, doing artwork or crafts and sitting and driving in the car. The participants need to choose between none, 15 minutes or less, 30 minutes, 1 hour, 2 hours, 3 hours, 4 hours, 5 hours and 6 hours.

The body weight of the subjects was measured with no shoes and light clothes and height was measured using stadiometer. The waist and hip circumference were measured using a non-elastic measuring tape and the measurement was taken to the nearest 0.1 cm. For waist circumference measurement, the participants were asked to stand within shoulder width and they were asked to relax their abdomen and the measurement was taken in between the lateral part of iliac crest and the lowest part of the rib [13]. For hip circumference, measurement was taken at the most protruded of gluteal muscles (buttock). The privacy of the participant was ensured by the researchers. The BMI was calculated by dividing the weight in kg by height in metres squared while waist to hip ratio was calculated by divide the waist circumference by hip circumference.

Statistical analysis and results

The data collected was entered in Microsoft Excel based on their variables. The SPSS package was used for the analysis using Chi square tests. P-value below 0.05 was considered significant. A total of 210 students participated in this study. Participants belonged to the age range of 19-27 years. 94.3% of the participants do not consume alcohol while none of the participants is a smoker. The mean duration of sleep duration was 6.58 hours.

Anthropometric measurements

The researchers studied three anthropometric measurements in this cross sectional study. They were BMI, waist circumference and waist to hip ratio. Healthy weight had the highest frequency for BMI which accounted 68.1% (Table 1) Obese had the least frequency of 1.4%. 83.3% of the participants had waist circumference less than thirty two (32) inches, while only 35 participants had waist circumference more than thirty two (32) inches (Table 2). According to (Table 3); 46.7% of the participants had waist to hip ratio in between 0.75 and 0.79 and 17.1% had waist to hip ratio less than 0.75, while 31.4% have waist to hip ratio in between 0.80 to 0.86 and only 4.8% had waist to hip ratio more than 0.86.

Sedentary behaviour

Sedentary behaviour was measured using sedentary behaviour questionnaire. It was found that 27.1% of the participants spent less than 6 hours on a weekday while 72.9% of participants spent more than 6 hours on a weekday. Majority of the participants spent more time on sedentary behaviour during weekends. On weekends 167 (79.5%) spent more than 6 hours while 43 (20.5%) of participants spent less than 6 hours. The most sedentary behaviour that the students or participants involve is doing paperwork or computer work, where only 11 of the participants does not involve in doing paperwork or computer work during weekday and 23 participants during weekend (Table 4).

The second sedentary behaviour spent by the majority of the participants is sitting listening to music on the radio, tapes or CDs followed by sitting reading a book or magazine, watching television, sitting and talking on the phone, sitting and driving in a car, bus or train. Playing computer or video games, doing artwork or crafts and lastly, the most unpopular sedentary behaviour among participants was play musical instrument.

Participants with BMI that is under 18.5 spent their time doing sedentary behaviours on weekday (one day) less than 6 hours. Participants that have BMI in between 18.5 until 24.9 and have the summation of spent their time doing sedentary behaviours on weekend (one day) more than 6 hours is one hundred and eight (108)

BMI	Frequency
Underweight (<18.5)	42 (20.0%)
Healthy weight (18.5-24.9)	143 (68.1%)
Overweight (25-29.9)	22 (10.5%)
Obese (>30)	3 (1.4%)
Total	210 (100%)

Table 1: Frequency of BMI.

Waist Circumference	Frequency
<32 inch	175 (83.3%)
>32 inch	35 (16.7%)
Total	210 (100%)

Table 2: Frequency of Waist circumference.

Waist Circumference	Frequency
<32 inch	175 (83.3%)
>32 inch	35 (16.7%)
Total	210 (100%)

Table 3: Frequency of waist to hip ratio.

Doing paperwork or computer work	Frequency (weekday)	Frequency (weekend)	Total
0 (none)	11 (5.2%)	23 (11.0%)	33
1 (<15min)	18 (8.6%)	20 (9.5%)	38
2 (30 min)	25 (11.9%)	29 (13.8%)	54
3 (1 hour)	44 (21.0%)	37 (17.6%)	81
4 (2 hours)	44 (21.0%)	34 (16.7%)	78
5 (3 hours)	32 (15.2%)	37 (17.6%)	69
6 (4 hours)	14 (6.7%)	10 (4.8%)	24
7 (5 hours)	10 (4.8%)	6 (2.9%)	16
8 (> 6 hours)	12 (5.7%)	13 (6.2%)	25
Total	210 (100%)	210 (100%)	

Table 4: Frequency of doing paperwork or computer work.

participants, which is the highest compared to participants that have BMI in between 25 to 29.9 and more than 30.0 that only have fifteen (15) and three (3) participants respectively. Chi-square test had been done and the result is 3.436 and the P value is 0.329 which is more than 0.05 (Table 5). According to (Table 6), 25 participants that spent their time doing sedentary behaviours on weekday less than 6 hours have waist to hip ratio in between 0.75 until 0.79 while the lowest number of participants have waist to hip ratio more than 0.86 is four 4 participants. The highest number of participants that spent their time doing sedentary behaviours on weekday for more than 6 hours also have waist to hip ratio between 0.75 until 0.79 which is 73 participants and the least number of participants have waist to hip ratio more than 0.86 which is 6 participants. Chi square test have been done and the value is 1.946, the P value is 0.584 which is more than 0.05. As seen in Table 7, the number of participants that have waist to hip ratio less than 0.75 and in between 0.75 to 0.79 and spent their time doing sedentary behaviours on weekend less than 6 hours are 6 and 23 participants respectively, while participants that have waist to hip ratio in between 0.80 to 0.86 and more than 0.86 are 14 and none participants respectively. The highest number of participants that spent their time doing sedentary behaviours on weekend more than 6 hours have waist to hip ratio in between 0.75 until 0.79 which is 75 participants while the least participants have waist to hip ratio more than 0.86 which is 10 participants. Chi square test have been done and the value is 3.457 while the P value is 0.326 which is more than 0.05. The results show that the association between sedentary behaviour and anthropometric measures was not statistically significant.

Discussion

The study concluded that sedentary behaviour is not detrimentally associated with waist circumference, BMI and waist-hip ratio among young Chinese females. Participants spent more time in doing paperwork or computer work during weekday and weekend. This might be due to a lot of assignments from lecturers. The survey was conducted during short semester. Usually short semester is considered very rushing for the students since the classes will be over in two months' time.

The second common sedentary behaviour spent by the majority of the participants is sitting listening to music on the radio, tapes or CDs. Statistics show that students like to listen to music while doing their work because they find that when listening to music they can stay focus in doing their works and it helps to keep the environment quieter because when everyone is listening to music, they will not talk to each other [14]. People think that listening to music is very important and the first reason is for mood management as music can help to remove negative thoughts [15]. The most unpopular sedentary behaviour among participants is playing musical instrument. Out of 210 participants 163 participants did not involve in this activity during weekday and 155 participants did not involve during weekend and most of them who involved spent less than 15 minutes. This activity requires skills and not all of the participants know how to play musical instrument.

Body Mass Index (BMI) can be classified into four categories which are underweight (<18.5), healthy weight (18.5-24.9), overweight (25-29.9) and obese (>30.0) [5]. It is calculated by dividing the body weight in kilogram by height in m^2. BMI of majority of the participants fall under healthy weight category which is 68.1% and only 3 participants had high BMI under obese category. This result might be due to the population chosen for this study. Most of Chinese females are concerned about their looks and that is why majority have BMI in between 18.5 to 24.9. In Asian culture, it has become a trend that physical appearance is very crucial among young females. Most of the population is targeting to reach the thinnest body image as they think that it is fashionable. A study had found that Chinese females displayed at-risk eating attitude due to body shape concern [16]. Body shape concern contributes to the finding that 20% the participants are under underweight category. Dietary habits and physical activity play a major role than sedentary behaviour in maintaining a healthy body weight among Chinese females.

Waist Circumference is categorized under low risk and high risk categories. Low risk means, less risk to have cardiometabolic disease, while high risk is vice versa. A female who has waist circumference less than 32 inches has low risk to get cardiometabolic disease, while one who has waist circumference more than 32 will have higher cardiometabolic risk factors. Most of the participants had waist circumference less than 32 inches. Only 35 participants had waist circumference more than 32 inches. If we relate it to BMI, we can see the rationale why most of them falls under low risk category since most of the participants are under healthy weight category.

BMI has been widely used to measure health status, but waist to hip ratio is actually a better predictor for mortality than BMI and waist circumference [17]. Waist to hip ratio can be categorized into four categories for females which include excellent (<0.75), good (0.75-0.79), average (0.80-0.86) and at risk (>0.86) [18]. Waist to hip ratio under good category (0.75-0.79) has the highest number of participants while the least participants are under obese category (>0.86). When we compare the results between BMI and waist circumference, we can see that number of participants that have average (0.80-0.86) and at risk (>0.86) category are increasing. It was found that that excellent and

Sum of doing sedentary behaviours	BMI				Chi-Square value	Degree of freedom	P-Value
	<18.5	18.5 – 24.9	25.0 – 29.9	>30.0			
<6 hours	15 (26.3%)	35 (61.4%)	7 (12.3%)	0 (0.0%)	3.436	3	0.329
>6 hours	27 (17.6%)	108 (70.6%)	15 (9.8%)	3 (2.0%)			
Total	42 (20.0%)	143 (68.1%)	22 (10.5%)	3 (1.4%)			

Table 5: Associations of SB and BMI.

Sum of doing sedentary behaviours on weekday (one day) (hours)	Waist Circumference		Chi-Square value	Degree of freedom	P-Value	Prevalence Odds ratio
	<32 inch	>32 inch				
<6 hours	48 (84.2%)	9 (15.8%)	0.043	1	0.835	1.092
>6 hours	127 (83.0%)	26 (17.0%)				
Total	175 (83.3%)	35 (16.7%)				

Table 6: Association of sedentary behaviours with waist circumference.

good waist to hip ratio is consider less risk for cardiometabolic disease and both of them comprised of 17.1% and 46.7% respectively, while for BMI and waist circumference, most of the participants are categorized under less risk for cardiometabolic disease or health risk. Waist to hip ratio is considered as more efficient predictor for mortality than waist circumference and BMI.

According to Alpa et al. when a person spent more than 6 hours in sitting position or they said sedentary behavior, they will have a high mortality rate and increase in cardiometabolic risk. Based on this study, when a person spent more than 6 hours she may have high risk towards mortality. In this study, the researchers categorized sedentary behaviors based on hours spent doing the sedentary behaviors. We summed up the hours that participants spent and separate them into two categories which are less than 6 hours (<6) and more than 6 hours (>6).

The frequency of participants that spent more than 6 hours doing sedentary behaviors on weekend is more than on weekday which are 79.5% on weekend and 72.9% on weekday. In another study female student reported significantly higher levels of time spent engaged in homework while television viewing was not a competing behavior. This was in accord with the results of our study [19].

Association of sedentary behaviours and body mass index (BMI)

The association of sedentary behaviour and body mass index can be seen in (Table 5) for weekday and for weekend. Both of the results does not significant which is P value for association of sum of hours spent doing sedentary behaviour on weekday is 0.329 and on weekend is 0.832. On weekday, majority of the participants (70.6%) spent their time on doing sedentary behaviours more than 6 hours falls under healthy weight (18.5-24.9) category, less than on weekend. While during weekend, majority of the participants (69.5%) spent their time on sedentary behaviours more than 6 hours falls under healthy weight (18.5-24.9) category, whereas only 10.2% and 1.2% of the participants falls under overweight (25-29.9) and obese (>30) category. For both weekend and weekday, the second highest participants that spent their time on doing sedentary behaviour more than 6 hours belong under underweight (<18.5) category which is 70.6% and 69.5% respectively.

Association of sedentary behaviours and waist circumference

The s and waist circumference is shown in (Table 6). Both of the results for weekday and weekend are not statistically significant which the P value is for weekday is 0.835 and for weekend is 0.592. The number of participants who spent their time doing sedentary behaviours more than 6 hours on weekday belong under high risk (>32 inches) category is 26 participants (17.0%) which is lower than under low risk (<32 inches) category which is 83% of 210 participants. Same goes to the participants who spent their time doing sedentary behaviours more than 6 hours on weekend have higher frequency belong under less risk (<32 inches) category which is 82.6%. Even though majority of the students spent their time doing sedentary behaviours more than 6 hours but the result shows that most of the participants have low risk to cardiometabolic disease risk to waist circumference.

Association of sedentary behaviour and waist to hip ratio

The association of sedentary behaviour and waist to hip ratio for weekday and weekend is shown in (Table 7). Both of the results for weekday and weekend is not significant where the P value for weekday is 0.584 and for weekend is 0.326. Both of the results for weekday and weekend show that sedentary behaviour does not associate with waist to hip ratio. On weekday, the participants who spent their time doing sedentary behaviours more than 6 hours that have waist to hip ratio under average (0.80-0.86) and at risk (>0.86) category are 50 (32.7%) and 6 (3.9%) respectively, both categories have high risk to develop cardiometabolic disease but for categories that are consider low risk to develop cardiometabolic disease which are excellent (<0.75) and good (0.75-0.79) have lower frequency than average and at risk. Even though majority of the participants spent time in sedentary behaviours more than 6 hours, many of the participants have good waist to hip ratio. These findings indicate that the formulation of population strategies for Chinese women aimed at reducing cardiovascular disease risk should focus not only on sedentary behavior, but also identify the most appropriate targets for physical activity and healthy diet.

Sum of doing sedentary behaviours	Waist to hip ratio				Chi-Square value	Degree of freedom	P-Value
	<0.75	0.75 – 0.79	0.80 – 0.86	>0.86			
<6 hours	6 (14.0%)	23 (53.5%)	14 (32.6%)	0 (0.0%)	3.457	3	0.326
>6 hours	30 (18.0%)	75 (44.9%)	52 (31.1%)	10 (6.0%)			
Total	36 (17.1%)	98 (46.7%)	66 (31.4%)	10 (4.8%)			

Table 7: Association of sedentary behaviours with waist to hip ratio.

Conclusion

This is the first study to report the association of sedentary behavior with cardiometabolic risk biomarkers among Chinese females. These observations further highlight the role of other factors like dietary habits and physical activity more than sedentary behavior among Chinese females. As we did not distinguish between physical activity and leisure-time sitting, we are not able to argue that specific emphasis ought to be given to one context over the other with respect to targeted intervention strategies to improve health outcomes. It is possible that factors not directly accounted for in our analysis could have contributed to the healthy range of cardiometabolic risk biomarkers irrespective of sedentary behavior.

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References

1. Rideout VJ, Foehr UG, Roberts DF (2010) Generation M2: media in the lives of 8- to 18-year-olds. A Kaiser Family Foundation Study.
2. Chastin SF, Granat MH (2010) Methods for objective measure, quantification and analysis of sedentary behaviour and inactivity. Gait Posture 31: 82-86.
3. Katzmarzyk PT (2010) Physical activity, sedentary behavior, and health: paradigm paralysis or paradigm shift? Diabetes 59: 2717-2725.
4. Marshall S, Ramirez E (2011) Reducing sedentary behavior: A new paradigm in physical activity promotion. Am J Lifestyle Med 5: 518-530.
5. McArdle W, Katch F (2010) Exercise physiology: Nutrition, energy, and human performance (7th edn.). Baltimore, MD: Lippincott Williams & Wilkins.
6. Tremblay MS, Colley RC, Saunders TJ, Healy GN, Owen, N (2010) Physiological and health implications of a sedentary lifestyle. Applied Physiology, Nutrition, and Metabolism 35: 725-740.
7. Healy GN, Dunstan DW, Salmon J, Cerin E, Shaw JE, et al. (2008) Breaks in sedentary time: beneficial associations with metabolic risk. Diabetes Care 31: 661-666.
8. Lisa DeBruine (2013) The Truth About "The Truth About Sitting Down".
9. Ball K, Brown W, Crawford D (2002) who does not gain weight? Prevalence and predictors of weight maintenance in young women. Int J Obes Relat Metab Disord 26: 1570-1578.
10. Thorp AA, Healy GN, Owen N, Salmon J, Ball K, et al. (2010) Deleterious associations of sitting time and television viewing time with cardiometabolic risk biomarkers: Australian Diabetes, Obesity and Lifestyle (AusDiab) study 2004-2005. Diabetes Care 33: 327-334.
11. Ying X, Song ZY, Zhao CJ, Jiang Y (2010) Body mass index, waist circumference, and cardiometabolic risk factors in young and middle-aged Chinese women. J Zhejiang Univ Sci B 11: 639-646.
12. Lubans DR, Hesketh K, Cliff DP, Barnett LM, Salmon J, et al. (2011) A systematic review of the validity and reliability of sedentary behaviour measures used with children and adolescents. Obes Rev 12: 781-799.
13. Lamb MJ, Westgate K, Brage S, Ekelund U, et al. (2016) Prospective associations between sedentary time, physical activity, fitness and cardiometabolic risk factors in people with type 2 diabetes. Diabetologia 59: 110-120.
14. Flannigan D (2015) Student's thoughts on listening to music in school.
15. Lonsdale A, North A (2010) Why do we listen to music? A uses and gratifications analysis.
16. Liao Y, Knoesen NP, Castle DJ, Tang J, Deng Y, et al. (2010) Symptoms of disordered eating, body shape, and mood concerns in male and female Chinese medical students. Compr Psychiatry 51: 516-523.
17. Langtree I (2010) Male and Female Waist to Hip Ratio Calculator.
18. Newell J (2013) Physiological Assessments: Anthropometric Measurements.
19. Fountaine CJ, Liguori G, Mozumdar A (2010) The relationship among physical activity, television viewing, computer use, and video game playing in college students. International Journal of Fitness 6: 19-26.