Prevalence of Abdominal Obesity Among Malaysian Workers in Peninsular Malaysia

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Abstract:

Introduction: Abdominal obesity increases the risk of non-communicable diseases such as diabetes mellitus and hypertension due to fat accumulation in the intra-abdominal area. **Methods:** This study used the Waist Circumference (WC) and Waist-Hip Ratio (WHR) cut-off for the Asian population to test 683 male and 603 female Malaysian workers who volunteered for this study. The participants' age is between 18 – 64-year-old. **Results:** Based on the WC, 54.3% of males and 60.9% of females are categorized as having abdominal obesity. Meanwhile, the WHR recorded a higher prevalence of abdominal obesity among females at 65.0%. On the other hand, the percentage is lower among males by 16.1%. Several associations with abdominal obesity were found with gender, ethnicity, age, marital status, and job position. **Conclusion:** Therefore, new strategies are needed to increase awareness of abdominal obesity among the Malaysian workforces.

Keywords: abdominal obesity, waist circumference, waist-hip ratio, Malaysian workers

Introduction:

Being overweight and obese has become a major health problem globally. According to the latest National Health and Morbidity Survey 2019 (NHMS 2019), the prevalence of overweight and obesity among women is 54.7% and 64.8% for abdominal obesity (National Institute of Public Health, 2020). Overweight and abdominal obesity may increase the risk of non-communicable diseases such as hypertension, heart disease and diabetes (World Health Organization, 2018). In addition, obesity has contributed to cardiovascular diseases, pulmonary embolism, osteoarthritis, and cancers (Ghesmaty Sangachin, Cavuoto, & Wang, 2018). Moreover, obesity is often correlated with declining overall physical function and cognitive abilities (Rongen, Robroek, Van Lenthe, & Burdorf, 2013). Past studies also found that central obesity is linked to atherogenic dyslipidemia, which predisposes cholesterol deposition in the vascular endothelium and subsequently causes atherosclerosis (Bosomworth, 2019).

According to World Health Organization (2000), obesity can be characterized as the abnormal or excessive fat accumulation in the adipose tissue, to the point that it may impair health. Typical indicators of obesity include undesirable positive energy balance and weight gain. An analysis of life insurance data in the early 20th century revealed increased mortality associated with obesity. There are several ways of determining obesity, including body mass index (BMI), waist circumference (WC), waist-to-hip-ratio (WHR), skinfold thickness (ST), bioelectric impedance (BIA), underwater weighing (densitometry), Air-Displacement Plethysmography, Dilution Method (Hydrometry), Dual Energy X-ray Absorptiometry (DEXA), Computerized Tomography (CT) and Magnetic Resonance Imaging (MRI) (C. H. Kim, 2016). Some methods require special equipment and done in a suitable environment, such as a laboratory, except for BMI, WC, WHR and ST. While BMI has been extensively used to measure obesity due to its simplicity, WC and WHR have been used to measure abdominal obesity to distinguish between central obesity at the lower body and general obesity. Both methods could also predict a higher mortality rate than BMI (Ghesmaty Sangachin et al., 2018). Thus, several studies have recommended using WC and WHR to predict mortality among people with obesity (Błaszczyk-Bębenek et al., 2019).

According to WHO, WC and WHR are superior to BMI in identifying abdominal obesity (World Health Organization, 2008). This is because BMI is considered an indicator of a person's weight, which may be influenced by fat or muscle mass. Meanwhile, WC and WHR directly measure the intra-abdominal fat, which directly affects the risk of diabetes and cardiovascular (World Health Organization, 2000). Therefore, this study is determined to identify the prevalence of abdominal obesity using WC and WHR and factors associated with obesity among workers from peninsular Malaysia.

Materials and Methods:

Study design and subject selection

A cross-sectional study was conducted among Malaysian workers from March 2019 – September 2020. The subjects were selected using non-probability convenience sampling. Invitations for this study were sent through email, social media, instant messaging application and advertisement to recruit prospective participants.

Inclusion and exclusion criteria

The inclusion criterion is that the participants should be Malaysian citizens aged between 18 – 54 years old. Meanwhile, the exclusion criteria included pregnancy or any neurological and musculoskeletal diseases that may affect the measurement process. In addition, participants with increased abdominal girth not related to adiposity were also excluded from the study.

Study tools

A demographic background questionnaire was used to gather information on the participants' age, gender, ethnicity, marital status, and occupational category. Participants involved with manual handling at work were categorized as operation workers, while those not involved with manual handling were categorized as management workers. Their waist circumference and waist-hip ratio were measured using a calibrated measuring tape. Five trained measurers, two males and three females, were involved in each measurement session. The participants' WC measurements were recorded at the end of several consecutive natural breaths, specifically at the level parallel to the floor, at the midpoint between the top of the iliac crest and the bottom of the last palpable rib in the midaxillary line (Ahmad, Adam, Nawi, Hassan, & Ghazi, 2016).

Furthermore, their Hip Circumference (HC) measurement was taken from the widest part of the buttocks at the level parallel to the floor (World Health Organization, 2008). Each participant was asked to

wear minimal clothing during the measurement session. The WHR was calculated by dividing WC (in cm) and HC (in cm). The WC cut-off point is 90cm for men and 80cm for women (National Institute of Health, 2020), in line with the cut-off point for WHR among Asians, which is 0.95 for men and 0.80 for women (World Health Organization, 2008).

Research ethic

The study has received approval from the NIOSH Ethical Committee. Informed consent was also obtained from all participants before the measurement process.

Statistical analysis

All collected data were analyzed using the IBM SPSS Statistics software Version 19 (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp). Prior to the analysis, a normality test was conducted on the data based on the recommendation for a large sample. It was found that the data were normally distributed (Kim, 2013). The categorical variables were presented as frequency (percentage), while the continuous variables were presented as mean (M) and standard deviation (SD). Furthermore, the association between abdominal obesity and participants' characteristics was calculated using chi-square while the statistical significance was set at $P < 0.05$.

Result:

Table 1 shows that most participants are between 20 and 29 years old with n= 403(31.3%), and most are male, n=683(53.1%). In terms of ethnic composition, most of the respondents are Malay, n= 1019 (52.7%), while the least participants come from the indigenous group, n=39 (3.0%). Out of the respondents, 792 (61.6%) participants are married, 462 (35.9%) are single, and 32(2.5%) are widowed. More than half of the participants are categorized as operation workers, n= 831 (64.6%).

Table 2 shows the results of the descriptive analysis on the participants. It shows that the average WC, HC, and WHR are higher among male participants, M= 90.82(±26.63); M= 102.32 (±9.90), 0.88 (±0.07), respectively. Based on the recommended cut-off points for WC and WHR as by the National Institute of Health (2020) and World Health Organization (2008), a comparison of abdominal obesity frequency between gender is presented in Table 3. The prevalence of abdominal obesity, as indicated by WC, is higher among the male participants with n= 371 (54.3%). On the other hand, abdominal obesity indicated by WHR is higher among female participants with n= 392 (65.0%).

Table 4 presents the frequency of abdominal obesity based on age group. Using WC as an indicator, the highest percentage of participants with abdominal obesities in both genders are recorded among 50-59 years old at n= 57 (76.0%) for males and n= 44 (77.2%) for females. Similarly, the WHR indicator shows a similar trend among participants in the same age group.

The chi-square test results in Table 5 and Table 6 indicate a significant association between gender and abdominal obesity on both WC and WHR. In this regard, females are more likely to have abdominal obesity for both WC $\chi 2$ (1, n= 1286) = 5.342, p = .021; WHR $\chi 2$ (1, n= 1286) = 319.78, p = < .000.

Table 1: Demographic background of participants

Demographic data	Frequency (n)	Percentage (%)
Age		
<19-year-old	38	3.0
20-29-year-old	403	31.3
30-39-year-old	393	30.6
40-49-year-old	302	23.5
50-59-year-old	132	10.3
60-69-year-old	18	1.4
Total	1286	100.0
Gender		
Male	683	53.1
Female	603	46.9
Total	1286	100.0
Ethnicity		
Malay	1019	79.2
Chinese	103	8.0
Indian	125	9.7
Other	39	3.0
Total	1286	100.0
Marital Status		
Single	462	35.9
Married	792	61.6
Widowed	32	2.5
Total	1286	100.0
Occupational Category		
Operation	831	64.6
Management	455	35.4
Total	1286	100.0

Table 2: Descriptive analysis of WC, HC and WHR based on gender

Gender	Mean (SD)		
	WC	HC	WHR
Male (n= 683)	90.82 (23.63)	102.32 (9.90)	0.88 (0.07)
Female (n= 603)	84.18 (12.18)	101.91 (10.76)	0.82 (0.06)
Total (n= 1286)	87.00 (12.85)	102.13 (10.31)	0.85 (0.07)

SD= standard deviation, WC= waist circumference, WHR= waist-hip ratio

Table 3: Prevalence of abdominal obesity according to WC and WHR based on age-group

Age-group	Abdominal Obesity, n (%)	
	Male	Female
<19-year-old (n= 38)		
WC	10 (28.6)	0 (0)
WHR	2 (5.7)	2 (66.7)
20–29-year-old (n= 403)		
WC	57 (30.3)	95 (44.2)
WHR	9 (4.8)	102 (47.4)
30–39-year-old (n= 393)		
WC	126 (58.9)	122 (62.2)
WHR	26 (12.1)	119 (66.5)
40–49-year-old (n= 302)		
WC	110 (70.5)	106 (72.6)
WHR	37 (23.7)	118 (80.8)
50–59-year-old (n= 132)		
WC	57 (76.0)	44 (77.2)
WHR	29 (38.7)	49 (86.0)
60–69-year-old (n= 18)		
WC	11 (73.3)	0 (0)
WHR	7 (46.7)	2 (66.7)

WC: Male: Yes ≥ 90cm, No < 90cm, Female: Yes ≥ 80cm, No < 80cm WHR: Male: Yes ≥ 0.95, No < 0.95, Female: Yes ≥ 0.80, No < 0.80

Further analysis of the association between abdominal obesity and ethnicity was presented in Table 7 and Table 8. Chi-square tests also found significant association between the two factors where Indian ethnic were more likely to have abdominal obesity both WC $\chi 2$ (3, n= 1286) = 22.93, p = < .000 and WHR $\chi 2$ (3, n= 1286) = 11.07, p = .011.

Table 4: Prevalence of abdominal obesity according to WC and WHR based on gender

Gender	Abdominal Obesity, n (%)	
	Yes	No
Male (n= 683)		
WC	371 (54.3)	312 (45.7)
WHR	110 (16.1)	573 (83.9)
Female (n= 603)		
WC	367 (60.9)	236 (39.1)
WHR	392 (65.0)	211 (35.0)

WC: Male: Yes ≥ 90cm, No < 90cm, Female: Yes ≥ 80cm, No < 80cm WHR: Male: Yes ≥ 0.95, No < 0.95, Female: Yes ≥ 0.80, No < 0.80

Table 5: Abdominal Obesity based on WC by Gender

Variable	Abdominal Obesity (WC)	
n= 1286	Yes (%)	No (%)
Male	54.3	45.7
Female	60.9	39.1

$\chi 2$ (1) = 5.342, p = 0.021**

Table 6: Abdominal Obesity based on WHR by Gender

Variable	Abdominal Obesity (WHR)	
n= 1286	Yes (%)	No (%)
Male	16.1	83.9
Female	65.0	35.0

$\chi 2$ (1) = 319.78, p = <0.000**

Table 7: Abdominal Obesity based on WC by ethnicity

Variable	Abdominal Obesity (WC)	
n= 1286	Yes (%)	No (%)
Malay	58.7	41.3
Chinese	35.9	64.1
Indian	64.8	35.2
Others	56.4	43.6

$\chi 2$ (3) = 22.93, p = <0.000**

Table 8: Abdominal Obesity based on WHR by ethnicity

Variable	Abdominal Obesity (WHR)	
n= 1286	Yes (%)	No (%)
Malay	37.6	62.4
Chinese	37.9	62.1
Indian	52.8	47.2
Others	35.9	64.1

$\chi 2$ (3) = 11.07, p = 0.011**

Table 9: Abdominal Obesity based on WC by marital status

Variable	Abdominal Obesity (WC)	
n= 1286	Yes (%)	No (%)
Single	39.4	60.6
Married	67.3	32.7
Widowed	71.9	28.1

$\chi 2$ (2) = 95.73, p = <0.000**

Table 10: Abdominal Obesity based on WHR by marital status

Variable	Abdominal Obesity (WHR)	
n= 1286	Yes (%)	No (%)
Single	26.4	73.6
Married	45.2	54.8
Widowed	68.8	31.3

$\chi 2$ (2) = 55.49, p = <0.000**

Table 11: Abdominal Obesity based on WC by Job Position

Variable	Abdominal Obesity (WC)	
n= 1286	Yes (%)	No (%)
Management	66.4	33.6
Operation	52.5	47.5

$\chi 2$ (1) = 22.69, p = <0.000**

Table 12: Abdominal Obesity based on WHR by Job Position

Variable	Abdominal Obesity (WHR)	
n= 1286	Yes (%)	No (%)
Management	47.7	52.3
Operation	43.2	30.4

$\chi 2$ (1) = 21.61, p = <0.000**

The study also found a significant association between abdominal obesity and marital status. The results show that abdominal obesity is more prevalent among those who are married or widowed group, as shown in Table 9 and Table 10, WC $\chi 2$ (2, n= 1286) = 95.73, p = < .000; WHR $\chi 2$ (2, n= 1286) = 55.49, p = < .000.

Lastly, Table 11 and Table 12 show abdominal obesity is more common among management workers, WC $\chi 2$ (1, n= 1286) = 22.69, p = < .000; WHR $\chi 2$ (1, n= 1286) = 21.61, p = < .000.

Discussion:

This study found a high prevalence of abdominal obesity among the workers from peninsular Malaysia when the WC was used as an indicator compared to WHR.

Consistent with previous studies, the present study descriptively found that female workers are more likely to have abdominal obesity for both WC and WHR indicator (Ahmad, Adam, Nawi, Hassan, & Ghazi, 2016; Chen et al., 2019; Jacobsen & Aars, 2016; Munyogwa & Mtumwa, 2018). Additionally, a chi-square analysis also found a significant association between female workers and abdominal obesity. Physiological differences and daily activities may influence the present study finding (Blair, 2007; National Institute of Public Health, 2020). Naturally, the male will have more muscles and spend more calories during daily activities (Wu & O'Sullivan, 2011). The finding of the National Health Morbidity Survey 2019 reported that females tend to be less active than males, contributing to the positive energy balance.

It was found that the prevalence of abdominal obesity increases among participants aged between 40 and 69. More than 70% of the participants in this age group reported abdominal obesity when WC was used as an indicator. However, the prevalence of abdominal obesity was higher among female participants in the same age group if WHR used as an indicator. Possible reasons are the lower metabolic rate and physical activity in this age group. According to the Ministry of Health Malaysia (2017), the basal metabolic rate is reduced by approximately 1-2% per decade after one reaches 30. In addition, the NHMS 2015 and 2019 reported a similar trend where physical inactivity began to increase as one's age increased (Chan et al., 2019; National Institute of Public Health, 2020).

Ethnicity is also significantly associated with abdominal obesity, where Indian workers are more likely to have greater WC and WHR than the other ethnicities. The finding was consistent with the National Institute of Public Health report. One contributing factor was positive energy balance due to physical inactivity (Chan et al., 2019). Some of the reasons for lacking physical activity were lack of time, joint pain, lack of interest or energy, and age factors (Waheeda, Rheshara, Nasreen, & Sabariah, 2018).

This study also reported a higher percentage of widowed workers with abdominal obesity than married and single workers. A higher prevalence of abdominal obesity was also found when WC used as an indicator. Several previous studies have also reported similar findings (Ismail et al., 2002; Munyogwa & Mtumwa, 2018).

The present study is also determined to find the association between job position and abdominal obesity. A significant association was found between job position and abdominal obesity for both WC and

WHR. Management workers were more likely to have abdominal obesity. One possible cause is that operation workers are more involved in manual handling activities like pulling, pushing, holding, and lifting. Manual handling activities might increase the energy expenditure of management. In contrast to operation workers, management workers spend more time sitting as they involve in document management, report writing and data management (Mahmud, Bahari, & Zainudin, 2014). Prolonged sitting at work also increased the risk of developing musculoskeletal disorders (Zemp, Fliesser, Wippert, Taylor, & Lorenzetti, 2016).

Overall, the study's strength is the large gathered sample of workers from peninsular Malaysia. Therefore, it may provide an insight into the current obesity trend among workforces. However, the limitation of the present study is that it used convenience sampling as a sampling method. As a result, the study's participants are mostly Malay. Meanwhile, the age distribution is more varied with workers sampled are between 20 and 59-year-old. The next limitation is related to the participants' cultural and religious belief. As all the measurements were taken with minimal clothing, some participants cannot follow the instruction properly as it opposes their cultural and religious beliefs. Still, the researcher managed to overcome the issue by assigning assistants from the same gender to take the participants' measurement at a specialized measurement area.

Conclusion:

In summary, the study found a high prevalence of abdominal obesity when WC was used as an indicator. In addition, higher WC and WHR were observed among married or widowed Indian female participants between the age of 40-69-year-old who are involved with non-manual handling task at work. Therefore, interventions and strategies should be implemented to reduce the prevalence of abdominal obesity among Malaysian workers.

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