Non-communicable diseases (NCDs) are one of the important determinants that are associated with longevity of human life. Among this group of diseases, cardiovascular disease (CVD) is one of the leading global causes of death, accounting for 17.3 million deaths per year; this figure is expected to reach 23.6 million by 2030 (Mozaffarian et al., 2015). It is also the main cause of disability and premature death in both men and women (Appelman et al., 2015).

The CVD risks for men and women are the same, but there may be gender differences in the prevalence of risk factors. In men, LDL-cholesterol levels usually increase with age and HDL-cholesterol levels decrease with age. However, such trends are not reflected by women, leading to a gradual, more or less 10mg/dL difference of HDL between genders (Kreisberg & Kasim, 1987). Atherogenic index of plasma (AIP) is defined as logarithm [log] of the ratio of plasma concentration of TG to HDL-C, and is positively correlated with CVD risks. AIP is the best determinant for fractionated esterification rate of HDL-C and thus a better predictor of CVD risks than other previously used lipid parameters (Dobiásová & Frohlich, 2001; Dobiásová et al., 2005).

It is generally assumed that employed people are more active and healthier than general population; however, recent reports have emphasized that the nature of the job and its environment can influence the mental and physical health of employees (Freak-Poli et al., 2010). An estimated 35% of deaths occur in individuals aged less than 60 years, which is the main demographic of the working population of Malaysia (Institute for Public Health, 2015).

This cross-sectional study was carried out among staff of Universiti Malaysia Sarawak (UNIMAS) from October 2016 to April 2017. All respondents who fulfilled the inclusion criteria (no current acute illness, no known history of diabetes mellitus, hypertension, heart disease, liver disease and renal disease) were selected. Those who were taking lipid lowering drugs were excluded from the study. The study was approved by the Medical Ethical Committee of UNIMAS [UNIMAS/NC-21.02/03-02 Jld. 2 (22)]. All respondents were brief and signed informed consent. Sample size was calculated using EpiInfo (version 3), based on sampling frame of 1469, prevalence of overweight and obesity=53.1% (Wan Nazaimoon et al., 2011), confidence level of 95%, attrition rate of 10%, estimated minimum sample size needed is 335.

Blood samples were collected from all respondents after 10–12 hours fasting. A private laboratory was engaged in assisting in the blood collection and carry out the respective test. According to the Malaysian clinical practice guidelines on management of dyslipidemia (Academy of medicine of Malaysia, 2011), hypercholesterolemia is defined as total cholesterol of more than 6.3 mmol/L, high LDL-cholesterol is defined as more than 4.1 mmol/L, low HDL-cholesterol is classified as less than 1 mmol/L for
men and less than 1.3 mmol/L for women and high triglyceride is defined as more than 2.3 mmol/L.

Atherogenic index was calculated by using formula $= \log_{10} (\text{TG} / \text{HDL-C})$ (Nwagha et al., 2010). It can be classified as -0.3 to 0.1 for low risk, 0.1 to 0.24 for medium and more than 0.24 for high risk of CVD (Dobiasiö, 2006). For the fasting blood glucose levels, it can be classified as $< 6.1$ mmol/L as normal and $\geq 6.1$ mmol/L as high (Academy of medicine of Malaysia, 2015). Height was measured by using a stadiometer (model SECA 213, Germany). The weight, BMI, percentage of body fat, and visceral fat were measured through bioelectrical impedance analysis (model HBF-375, Omron Healthcare Co. Ltd., Kyoto, Japan). Body mass index is classified as underweight (BMI $< 18.5$ kg/m²), normal (18.5 to 22.9 kg/m²), overweight (BMI $\geq 23$ kg/m²) and obese (BMI $\geq 27.5$ kg/m²) (Academy of medicine of Malaysia, 2004). The percentage of body fat for men was classified as: $< 10\%$ for low, 10 to 19.9\% for normal, 20 to 24.9\% for high and $\geq 25\%$ for very high. For women, these figures changed to $< 20\%$ as low, 20 to 29.9\% as normal, 30 to 34.9\% as high and $\geq 35\%$ as very high body fat (Snitker, 2010). The visceral fat classification can be characterized as normal (1 to 9\%), high (10 to 14\%) and very high (15 to 30\%) for both genders (Omron, 2008).

Blood pressure measurement was performed by using a digital blood pressure monitor (model HBP-1300, Omron Healthcare Co. Ltd., Kyoto, Japan) with two times for each participant at 15 minutes apart (Pickering et al., 2005). According to the Malaysian clinical practice guidelines on management of hypertension (Academy of medicine of Malaysia, 2013), pre-hypertension is classified as systolic blood pressure 120 to 139 mmHg or diastolic blood pressure 80 to 89 mmHg and high blood pressure is classified as systolic blood pressure $\geq 140$ mmHg or diastolic blood pressure $\geq 90$ mmHg. Data entry and data analysis were performed by using Statistical Package for Social Science Program (SPSS) version 20. Descriptive and inferential statistics were carried out based on 95\% confident interval with p value less than 0.05 of significant.

A total of 349 respondents participated in the study. About 80\% of the respondents were overweight and obese, with mean BMI of 27.2±5.60 kg/m². More than 80\% of the respondents were found to have high and very high body fat percentage and 46.8\% had high and very high visceral fat percentage. More than 30\% of the respondents were pre-hypertension and 20.1\% were hypertension. For the fasting blood glucose, 12\% had elevated blood glucose level. About 15\% of the respondents had high total cholesterol, 16.1\% had high LDL-cholesterol, about 10\% of the respondents had high level of triglyceride and about 16\% of the respondents had high AIP.

For comparison between male and female respondents, significant differences were observed for SBP, DBP, LDL-C, HDL-C, TG, AIP, body fat percentage, and visceral fat with p<0.01. Except for HDL-C and body fat percentage, all other significant indicators showed higher reading in males as compared to females. The difference between cardiovascular risk factors for male and female are presented in Table 1.

The findings of this study indicated an alarming high prevalence of overweight and obesity (80\%) among the respondents, compared to other local studies (Wan Nazaimoon et al., 2011; Chee & Chai, 2013). Consistent with this, the prevalence of obesity in the form of total body fat and abdominal

| Table 1. Cardiovascular disease risk factors between male and female (N=349) |
|-----------------------------|-----------------------------|-----------------------------|
|                            | Male Mean (± SD)            | Female Mean (± SD)          | p-value |
| BMI (kg/m²)                | 27.8 (6.81)                 | 26.9 (4.88)                 | 0.140   |
| Body fat %                 | 26.7 (6.25)                 | 35.2 (4.48)                 | $<0.0001^{**}$ |
| Visceral fat %             | 12.7 (4.99)                 | 9.1 (5.23)                  | $<0.0001^{**}$ |
| SBP (mmHg)                 | 133.3 (16.02)               | 124.3 (18.78)               | $<0.0001^{**}$ |
| DBP (mmHg)                 | 81.8 (12.27)                | 75.9 (12.06)                | $<0.0001^{**}$ |
| BG (mmol/L)                | 5.3 (1.32)                  | 5.3 (1.30)                  | 0.838   |
| TC (mmol/L)                | 5.5 (0.98)                  | 5.3 (1.09)                  | 0.107   |
| LDL-C (mmol/L)             | 3.5 (0.92)                  | 3.2 (0.97)                  | $<0.0001^{**}$ |
| HDL-C (mmol/L)             | 1.3 (0.22)                  | 1.5 (0.40)                  | 0.007*  |
| TG (mmol/L)                | 1.8 (1.41)                  | 1.3 (0.88)                  | $<0.0001^{**}$ |
| AIP                         | 0.07 (0.30)                 | -0.13 (0.28)                | $<0.0001^{**}$ |


*significant at p<0.05; **significant at p<0.001.
fat (visceral fat) was also high with 87% and 46.8% respectively. These results are in alignment with the increasing prevalence of overweight and obesity (Institute for Public Health, 2008 and 2011). One possible explanation is that a majority of the respondents in this study were physically inactive due to sedentary lifestyle and desk job which made less physical movement and resulting less daily calorie expenditure lost in the workplace.

It was noted that prevalence of pre-hypertension and hypertension among the respondents was high with 36.8% and 20.1% respectively. Although this figure is lower than other studies (Cheong et al., 2010; Kiew & Chong, 2013), it is still an area of concern. According to literature, increased risks of hypertension and elevated blood pressure are associated with chronic job strain, stressful working conditions and job dissatisfaction (Pletzer et al., 2009). It was further explained that chronic stress can cause cumulative wear and tear and increase exposure to disease risk.

In terms of lipid profile, high total cholesterol, LDL-C, TG and AIP were observed among the respondents, ranging from 10.6% to 16.4%. Compared to another local study (Chee & Chai, 2013), the prevalence of elevated total cholesterol, LDL-C, TG and AIP was considerably lower. The recent study had indicated instead of focusing on HDL-C as one of the correctable residual cardiovascular risk factors, elevated triglyceride has re-emerged as one of the therapeutic target (Han et al., 2016). Besides that, another important lipid index that has been an area of interest is atherogenic index of plasma (AIP), used as a stand-alone index for cardiac risk stratification (Khazaal, 2013). Practically, the atherogenic index of plasma is more useful than routine lipid levels because many studies elucidated that AIP was more sensitive than either triglyceride or HDL alone, while reflecting the balance between atherogenic and protective lipoproteins (Holmes et al., 2008).

Further analysis indicated there were significant differences between males and females for SBP, DBP, LDL-C, HDL-C, TG, AIP, body fat percentage, and visceral fat. Usually, women would have 6 to 11 percent of more body fat than men due to level of estrogen. It was explained that estrogen affects the ability of energy burning and increase the storage of fat in the women’s bodies, most likely for childbearing (University of New South Wales, 2009). Some other explanation was women store more fats in the gluteal-femoral region, whereas men store more fat in the visceral (abdominal) depot (Blaak, 2001). This might explained why there is significant higher visceral fat in men as compared to women (Tchoukalova et al., 2008). Unlike total body fat, visceral fat which mainly composed of fats in abdominal cavity surrounding muscles and vital organs; significantly increase the risk of having diabetes, cardiovascular diseases and hypertension (Despres, 2007).

In term of hypertension, the systolic blood pressure of male respondents was significant higher than female respondents (133.3±16.02 mmHg vs 124.3±18.78 mmHg). Both systolic as well as diastolic blood pressures of respondents were within the pre-hypertensive stage. Such findings were consistent with other studies (Valentino et al., 2015). According to Reckelhoff (2001), men are at higher risk for hypertension than premenopausal women of same age. However, after menopause, blood pressure increases in women; even greater than men because female hormone estrogen may play a significant role in regulating the blood pressure. LDL-C, HDL-C, TG and AIP were found to be significant different between male and female participants in this study, supported by past studies (Niroumand et al., 2015; Valentino et al., 2015). Similarly to blood pressure, female hormone estrogen plays an important role in regulating lipids in the body (Russo et al., 2015). Before menopause, the relative risk of hypercholesterolemia was lower in women compared to men. But after menopause, total cholesterol and LDL-C levels rise by 10 and 14% respectively (Maas & Appelman, 2010). In this study, majority of the women were at their 30-40 year of age, before menopausal stage, which explained why significant lower prevalence of elevated blood lipids were found.

A limitation of this study was the population sample, which was predominately comprised of Malays, females and based on one government agency. Therefore, the findings cannot be generalized to other government agencies. However, the findings of this study provide a significant insight of the health status of this community which warrant an immediate intervention tailored to the needs of a similar working population.

As a conclusion, the obesity related indicators and blood profiles showed high prevalence of obesity among the respondents. As risk factors of cardiovascular disease are multifactorial, the control of a single risk factor is inadequate. A successful concomitant treatment of all risk factors remains the more effective way in prevention and control of cardiovascular diseases. There is an immediate need to develop an intervention program at the workplace to help to address this health issue. A routine screening should also in place to help to identify government employees at high risk for cardiovascular disease.
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