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Characteristics and Risk Factors for High Fasting Blood Glucose among Managers and Government Officials in the Philippines

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Diabetes ranks fifth among the top causes of mortality in the Philippines. In the 2013 National Nutrition Survey (NNS), prevalence of high fasting blood glucose (FBG) was highest among government officials and managers (10.3%) compared to all other occupation groups. Thus, the study aimed to determine the association between socio-demographic characteristics and selected non-communicable disease (NCD) risk factors with the prevalence of high FBG among government officials, executives, managers, supervisors, and proprietors in the Philippines. The study was a cross-sectional analysis of the 2013 NNS using a multi-stage stratified sampling design. Filipinos – 20 years old and above working as managers of any enterprise, government office and other organizations, with data on FBG and other NCD risk factors – were included in the study. Descriptive statistics were generated using Stata version 12.0. Simple logistic regression was used to determine the association of NCD risk factors with high FBG. Result showed that in this occupation group, factors such as age (≥40 years old), elevated blood pressure (≥140/90 mmHg) and triglyceride level (≥150 mg/dL), family history of diabetes, BMI of ≥25 kg/m^2, high waist circumference and waist-hip ratio, and currently drinking alcoholic beverages were associated with high FBG. No significant relationship was observed between sex, educational background, HDL-cholesterol level, smoking status, fruit and vegetable consumption, and physical activity with high FBG. This study identified a high prevalence of high FBG among managers in the Philippines and the risk factors that are significantly associated with this condition. Interventions in the workplace to prevent and control high FBG and diabetes through early diagnosis and risk management, treatment, and explicit health policies should be initiated.

Key words: diabetes, government officials, managers, non-communicable diseases

INTRODUCTION

Diabetes has been increasing for the past decades and individuals with impaired to high blood glucose level are highly at risk for cardiovascular diseases, kidney failure, blindness, and lower-limb amputation.

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Worldwide, diabetes nearly quadrupled since 1980 – from 108 million people to 422 million people in 2014 – and is rising more rapidly in middle- and low-income countries (WHO 2017). Driven by lifestyle-related factors such as unhealthy diet, smoking and physical inactivity, it has become a cause of concern that diabetes now ranks fifth among the top causes of mortality in the Philippines (PSA 2013).

In the 2013 National Nutrition Survey (NNS), prevalence of high fasting blood glucose (FBG) in the Philippines has increased rapidly from 3.4% (2003) to 5.6% (2013), while the prevalence of impaired fasting blood glucose almost doubled from 2.7% (2008) to 4.3% (2013). High FBG was more prevalent in males (5.8%) and older adults 60.0–69.9 years of age (12.5%), followed by the 50.0–59.9 year age group (10.6%) (FNRI-DOST 2015).

To address the increasing prevalence of diabetes globally, the World Health Organization (WHO) has set nine NCD Global Targets for 2025, which includes halting the rise in diabetes. In the Philippines, the Department of Health (DOH) offers free diabetes risk screening and free medicines to diagnosed patients in an effort to control diabetes and prevent its complications. A Diabetes Prevention and Control Program was also launched to develop and promote an integrated and comprehensive program on the prevention and control of lifestyle-related diseases in the country. Since programs and policies are more effective when targeted and evidence-based, high risk population groups can be identified. Hence, it would be also beneficial to initiate programs specifically for occupational groups where workers are most likely to have diabetes.

According to the 2013 NNS, prevalence of high fasting blood glucose was highest among adults working as managers (10.3%); this was almost twice the national prevalence (5.6%). Based on the Philippine Standard Occupation Code (PSOC), there are 10 major occupation groups: (1) managers; (2) professionals; (3) technicians and associate professionals; (4) clerical support workers; (5) service and sales workers; (6) skilled agricultural, forestry, and fishery workers; (7) craft and related trades workers; (8) plant and machine operators and assemblers; (9) elementary occupation; and (10) armed forces occupation (PSA 2012). Each of the major occupation groups has subgroups, and for managers it includes: (1) officials of the government and special interest organizations, (2) corporate executives and specialized managers, (3) general managers or managing proprietors, and (4) supervisors. The workers in this specific occupation group plan, direct, coordinate, and evaluate overall activities of enterprises, governments, and other organizations and are mostly doing office work; thus, the nature of their work is sedentary. One of the risk factors of diabetes is physical inactivity; the less active a person is, the higher the risk. Other risk factors are age $\geq$40 years old, overweight and obesity, family history of diabetes, hypertension (blood pressure level of $\geq$140/90 mmHg), low high-density lipoprotein (HDL)-cholesterol (<35 mg/dL), and/or high triglycerides (>250 mg/dL) (Diabetes Philippines *et al.* 2013). Moreover, this specific occupation group is likely to experience work-related stress due to the responsibilities they hold, and stress has also been suspected to be a contributing factor in the development of diabetes. According to a review, work stress (*e.g.*, excessive overtime, imbalance in effort-reward, tense working situation, burn-out) is associated with an increased risk for developing diabetes, and the association was stronger among women compared to men (Pouwer *et al.* 2010).

In a cross-sectional study conducted in India, obesity was found to be a key risk factor for diabetes among government employees (Gadhavi & Jakasania 2017). Another study conducted in India found that increased sitting duration for $\geq$180 min/d at the workplace was associated with elevated random capillary blood glucose particularly among individuals with family history of diabetes (Aravindalochanan *et al.* 2014).

Likewise, a cross-sectional study found that 9% of local government employees who participated in the research have a high risk of developing diabetes within 10 years while 29% have moderate to high risk (Agu *et al.* 2015). This is due to high prevalence of obesity, physical inactivity, sedentary lifestyle, family history of diabetes, and large waist circumference. The study of Ayana and co-authors (2015) also found a statistically significant association between hip circumference, waist circumference, and type 2 diabetes among government employees in Eastern Ethiopia. The study also found that a 10-point increase in systolic blood pressure increases the risk for diabetes by 6%, while consumption of fruits and vegetables for three or more days reduces the risk (Ayana *et al.* 2015). However, the study of Tairea and co-authors (2014) found that obesity was not associated with diabetes among government workers in Cook Islands. They also found no significant association with consumption of fruits and vegetables and presence or absence of diabetes.

Since there is a dearth of information on the association of NCD risk factors with diabetes among high risk groups, this study aimed to determine the association between socio-demographic characteristics and the presence of selected NCD risk factors with high FBG among government officials, executives, managers, supervisors, and proprietors in the Philippines – as well as identify the factors that may have led to high prevalence of high FBG in this specific occupation group. The results of this study would help improve existing interventions and policies, and address the issue on the increasing prevalence of high FBG in the country – particularly for Filipino managers. An appropriate and intensive intervention program for screening and management for pre-diabetes and diabetes among managers can be formulated to reduce the burden of diabetes and its complications.

MATERIALS AND METHODS

The study was a cross-sectional analysis of the 2013 National Nutrition Survey using a multi-stage stratified sampling design. Filipinos – 20 years old and above, who were working as officials of the government, executives, managers, supervisors, and proprietors – were purposively included in the study. However, only those with complete data on FBG and other NCD risk factors were included in the analysis.

Blood samples were collected from the participants using vacutainer tubes with lithium heparin for FBG and plain tubes for lipid profile in the morning after a 10–12 h overnight fasting, with blood drawn by a trained registered medical technologist (RMT). These were stored on ice and later centrifuged to separate plasma, which was later packed, labeled, and frozen at –20 °C until ready for analysis in the laboratory. Enzymatic colorimetric method was used using Roche COBAS Integra and Hitachi 912. FBG of $\geq$126 mg/dL was considered high FBG or diabetes based on the WHO (1999) and International Diabetes Federation (IDF) (2006) classification.

Blood lipids (HDL-cholesterol and triglycerides) were classified based on the National Cholesterol Education Program – Adult Treatment Panel (NCEP–ATP) III (NHLBI–NIH 2001). HDL-cholesterol level of <40 mg/dL was considered low while triglyceride levels of 200–399 mg/dL and $\geq$400 mg/dL were considered high and very high, respectively.

Blood pressure (BP) was measured by trained nurses prior to blood extraction using a non-mercurial sphygmomanometer (A&D UM-101™) and stethoscope. Participants were asked to rest for at least 5 min before measuring their blood pressure. The average of two measurements, taken at least 2 min apart, was recorded as the patient's blood pressure. If the first two measurements differ by more than 4 mmHg, a third reading was taken. Systolic blood pressure (SBP) of 140–159 mmHg or diastolic blood pressure (DBP) of 90–99 mmHg was classified as hypertension stage 1, while SBP of $\geq$160 mmHg or DBP of $\geq$100 mmHg was classified as hypertension stage 2 according to the 7th Joint National Committee for the Detection, Diagnosis, Treatment and Follow-up of Hypertension (NHLBI–NIH 2004).

Weight was measured using mechanical Detecto® platform beam balance scales. At least two measurements were obtained, with the average weight recorded to the nearest 0.1 kg. A third measurement was only taken if the difference between the two measurements were greater than 0.3 kg. Standing height was obtained using the Microtoise, an L-shaped device (head-bar) to which a spring-loaded coiled tape measure was attached. At least two measurements were also obtained, and average was computed and recorded to the nearest 0.1 cm. A third measurement was only taken if the difference of the two measurements was greater than 0.5 cm. Body mass index (BMI) of 25.0–29.9 kg/m^2 and $\geq$30.0 kg/m^2 were classified as overweight and obese, respectively, based on the WHO classification (WHO-NCHS 1978).

The waist circumference (WC) was measured as the perimeter or distance around the natural waist (midway between the lowest rib and the tip of the hip bone) or a measure of the distance around the narrowest portion of the trunk. The tape measure was placed at the midpoint and the respondent was asked to breathe normally; measurement was taken at the end of normal expiration. The hip circumference was measured as the distance around the largest area of the hips, usually the largest part of the buttocks or the greater trochanter. If the largest area of the buttocks was not prominent, the hip was determined by measuring four inches from the iliac crest. At least two measurements were obtained for both waist and hip circumferences; average was computed and recorded to the nearest 0.1 cm. Third measurement was only taken if the difference between the two measurements was greater than 0.5 cm. Waist-hip ratio (WHR) was calculated by dividing the WC with the hip circumference. WC of $\geq$102 cm for males and $\geq$88 cm for females were classified as high WC based on International Diabetes Federation. On the other hand, WHR of $\geq$1.0 for males and $\geq$0.85 for females were classified as high WHR based on the WHO classification.

Questions on socio-demographic information, smoking, alcohol consumption, unhealthy diet, and physical inactivity were asked through face-to-face interview with the participants. Data on unhealthy diet was based on a two-day, non-consecutive 24-h food recall and only used 50% of one replicate (a sub-sample that possesses the properties of the full master sample such that each replicate was able to generate national level estimates of adequate precision) unlike the other variables wherein 100% of one replicate was used; thus, a smaller sample size (n) for this variable was generated. Questions on behavioral risk factors (smoking, alcohol consumption, and physical inactivity) were adapted from the WHO-STEPS instruments or the STEPwise approach to non-communicable disease risk factor surveillance. Responses were collected on an electronic Data Collection System (e-DCS) developed by FNRI-DOST.

For the purpose of this study, the following terms were defined.

- **Current Smokers** are those who smoked during the survey either on a 'daily' (at least one cigarette a day) or on a regular/occasional basis; those who do not smoke daily but who smoke at least weekly or those who smoke less often than weekly (WHO 2008).

- **Former Smokers** those who have ever smoked in the past year prior to survey whether on a daily basis or an aggregate lifetime consumption of at least 100 cigarettes but not daily, and are no longer smoking at the time of the survey (WHO 2008).
- **Never Smokers** are those individuals who never smoked at all (WHO 2008).
- **Current Drinkers** are those who have consumed any alcohol during the past 12 months at the time of the survey (WHO 2015a).
- **Former Drinkers** are those who have previously consumed alcohol but who have not done so in the previous 12-month period (WHO 2015b).
- **Lifetime Abstainers** are those who have never consumed alcohol (WHO 2015b).
- **Insufficiently Physically Active** is a person not meeting any of the following criteria: 1) three or more days of vigorous-intensity activity of at least 20 min/d; or 2) five or more days of moderate-intensity activity or walking of at least 30 min/d (WHO 2008).

The 2013 National Nutrition Survey with Protocol Code FIERC-2012-001 was approved and given ethical clearance by the FNRI Institutional Ethics Review Committee (FIERC) on Jan 2013. Information on the objectives and methods of the survey were explained to the respondents, 20 years old and above, by trained researchers. Written consent to participate in the survey was obtained prior to data collection.

Descriptive statistics were generated using Stata version 12.0. Simple logistic regression was used to determine the association of risk factors with high FBG and *p*-value of <0.05 was considered statistically significant.

RESULTS

Out of 1,120 Filipino adults aged 20 years old and above with data on FBG and were working as officials of the government, executives, managers, supervisors, and proprietors, only 1,021 have complete data on FBG and other NCD risk factors. Data from these adults were analyzed to determine the association between socio-demographic characteristics and selected NCD risk factors with the prevalence of high FBG in this specific occupation group.

Majority of the participants were females and had a mean age of 46.5 years. This group had a mean blood pressure of 123.2/79.7 mmHg, which is considered prehypertension based on JNC VII (Table 1). Mean triglyceride and HDL-cholesterol level were found to be within the borderline (171.6 mg/dL) and low level (39.7 mg/dL), respectively. Moreover, this occupation group had a mean FBG of 100.9 mg/dL, which is considered normal based on the WHO cut-off. Mean intake of fruits and vegetables was also low with only 121.1 g/d.

The major occupation group "Managers" (based on PSOC, PSA 2012) has four sub-groups: officials of the government and special interest organizations, corporate executives and specialized managers, general managers or

Table 1. Mean background characteristics of adults, 20 years old and above, who were officials of the government, executives, managers, supervisors, or proprietors.

Variables	Mean	SD[a]	Range	
			Min	Max
Age (y)	46.5	12.7	20.0	88.9
Weight (kg)	62.3	12.8	28.7	136.9
Height (cm)	157.1	8.5	132.1	188.5
BMI (kg/m²)	25.2	4.5	12.5	43.9
Waist Circumference (cm)	85.3	11.4	55.2	138.6
Waist-hip Ratio	0.9	0.1	0.7	1.3
Systolic Blood Pressure (mmHg)	123.2	20.1	73.0	262.0
Diastolic Blood Pressure (mmHg)	79.7	12.0	40.0	130.0
Fasting Blood Glucose (mg/dL)	100.9	44.8	50.3	431.8
Triglyceride (mg/dL)	171.6	109.7	45.1	1,036.3
HDL-cholesterol (mg/dL)	39.7	12.4	5.0	109.7
Physical Activity (min)	150.4	201.7	0.0	1,320.0
Occupational	120.8	191.3	0.0	1,200.0
Vigorous Activity (min)	22.5	92.9	0.0	780.0
Moderate Activity (min)	98.3	171.3	0.0	870.0
Recreational	10.1	31.7	0.0	240.0
Vigorous Activity (min)	5.0	24.9	0.0	240.0
Moderate Activity (min)	5.1	20.2	0.0	240.0
Transportation Activity (min)	19.5	47.1	0.0	720.0
Sedentary Activity (min)	161.9	125.5	10.0	780.0
Sleeping Time (min)	428.4	83.3	120.0	720.0
Intake of Fruits and Vegetables (g)	121.1	151.9	0.0	1,343.8

[a]SD – standard deviation

managing proprietors, and supervisors. On average, these four sub-groups were pre-hypertensive, had borderline triglyceride level, and normal FBG. Officials of the government and supervisors were within the normal BMI cut-off (18.5–24.9 kg/m^2); the rest were overweight. Only those who were under the corporate executives sub-group had borderline HDL-cholesterol level; the rest had low levels of HDL-cholesterol (Table 2).

Moreover, among these sub-groups, adults who were general managers or managing proprietors had the highest prevalence of high FBG at 10.2%, followed by those who were officials of the government and special interest organizations at 9.3% (Table 3). However, no significant differences were observed among the sub-groups. Overall, 9.6% of this population was found to have high FBG and 6.7% had impaired FBG (Table 4).

Result of the study also showed that prevalence of high FBG increased with age, peaking at age group 50.0–59.9 years (14.5%) and decreased thereafter. Prevalence was also highest among males (10.9%) and adults with primary and secondary education (10.8% and 10.3%, respectively) (Table 4).

Moreover, adults with elevated blood pressure categorized as stage 2 hypertension had very high triglyceride level, low HDL-cholesterol, with family history of diabetes, with a BMI of ≥30.0 kg/m^2, and high WC and WHR had the highest prevalence of high FBG (Table 4).

The study also found that more adults who were former or have never smoked and drink alcoholic beverages, and consuming fruits and vegetables of equal to or more than 400 g/d, had high FBG. Meanwhile, prevalence of high FBG was almost the same for those with insufficient and sufficient physical activity (9.9% and 9.2%, respectively).

Simple logistic regression was performed to determine the association between socio-demographic characteristics and selected non-communicable disease (NCD) risk

Table 2. Mean background characteristics of adults, 20 years old and above, by occupation sub-category: Philippines, 2013.

Variables	Officials of Government and Special Interest Organizations	Corporate Executives and Specialized Managers	General Managers or Managing Proprietors	Supervisors
	Mean±SD	Mean±SD	Mean±SD	Mean±SD
Age (y)	49.6±11.0	43.3±11.4	46.8±13.0	39.7±12.2
Weight (kg)	62.9±11.6	67.7±13.1	61.3±13.0	64.9±12.5
Height (cm)	159.7±8.1	161.4±9.1	155.2±7.9	161.3±9.3
BMI (kg/m^2)	24.6±4.1	25.9±3.7	25.4±4.7	24.9±3.8
Waist Circumference (cm)	85.1±10.8	88.3±10.6	85.2±11.7	83.8±10.7
Waist-hip Ratio	0.9±0.1	0.9±0.1	0.9±0.1	0.9±0.1
Systolic blood Pressure (mmHg)	124.3±23.0	125.1±16.6	122.7±19.7	123.0±18.2
Diastolic blood Pressure (mmHg)	79.2±11.9	82.5±11.0	79.4±12.1	80.8±12.3
Fasting Blood Glucose (mg/dL)	100.7±42.0	95.9±40.6	102.0±46.9	96.8±37.4
Triglyceride (mg/dL)	193.8±122.2	193.0±109.8	161.8±106.2	178.0±96.5
HDL-cholesterol (mg/dL)	39.7±14.1	41.6±9.8	39.8±12.4	37.9±10.1
Physical Activity (min)	189.4±229.0	110.7±194.1	142.2±190.9	150.7±209.6
Occupational	149.9±216.2	78.0±165.7	117.0±181.8	113.4±209.9
Vigorous Activity (min)	43.2±128.2	0.0±0.0	17.9±80.8	25.9±106.7
Moderate Activity (min)	106.7±177.1	78.0±165.7	99.1±168.9	87.5±180.1
Recreational	11.0±31.5	24.2±54.8	6.6±24.9	23.5±45.4
Vigorous Activity (min)	5.1±21.3	19.5±53.8	3.2±19.7	7.0±29.9
Moderate Activity (min)	5.9±24.2	4.7±17.0	3.4±14.6	16.6±37.4
Transportation Activity (min)	28.6±67.8	8.5±16.0	18.6±42.8	13.8±28.9
Sedentary Activity (min)	172.2±124.0	177.8±119.4	158.3±125.9	153.4±129.7
Sleeping Time (min)	433.8±85.9	425.2±77.2	427.1±84.1	427.4±75.8
Intake of Fruits and Vegetables (g)	131.0±156.4	113.2±98.1	123.2±160.7	89.9±95.1

SD – standard deviation

Table 3. Mean FBG (mg/dL) and prevalence of high FBG (≥126 mg/dL) among adults, 20 years old and above, by occupation sub-category: Philippines, 2013.

Occupation	n	Mean FBG (mg/dL)	%	SE	95% CI	
					LL	UL
Officials of Government and Special Interest Organizations	230	100.7	9.3	2.0	6.0	14.0
Corporate Executives and Specialized Managers	58	95.9	7.2	2.6	3.5	14.2
General Managers or Managing Proprietors	653	102.0	10.2	1.2	8.1	12.8
Supervisors	80	96.8	7.1	2.9	3.1	15.4

SE – standard error; CI – confidence interval; LL – lower limit, UL – upper limit

factors with the prevalence of high FBG.

Table 5 shows that adults 40 years old and above were six to nine times more likely to have high FBG as compared to adults aged 20–29 years. Adults with a blood pressure level of ≥140/≥90 mmHg were twice likely to have high FBG with *p*-value <0.05.

Significantly, among those with family history of diabetes, the odds of having high FBG were 13.5 times larger than those with no family history. For adults with borderline to very high triglyceride levels (≥150 mg/dL), the chance of having high FBG were two to four times higher than those with desirable triglyceride level of <150 mg/dL.

Moreover, being overweight or obese was also significantly associated with high FBG (OR = 1.5 and 2.6, respectively). Having a borderline to high WC (OR = 2.0 and 2.2, respectively) and high WHR (OR = 2.0) placed these adults at higher risk to have high FBG and

Table 4. Percent distribution of adults, 20 years old and above, who were officials of the government, executives, managers, supervisors, or proprietors – by FBG level and by background characteristics: Philippines, 2013.

Background Characteristics	n	Desirable <110 mg/dL % (95% CI)	Impaired FBG 110–125 mg/dL % (95% CI)	High FBG ≥126 mg/dL % (95% CI)
ALL	**1,021**	**83.7 (81.1–86.1)**	**6.7 (5.2–8.5)**	**9.6 (7.9–11.5)**
Socio-demographic				
Age (years)				
20–29.9	80	96.5 (89.3–98.9)	1.7 (0.2–10.6)	1.8 (0.4–7.4)
30–39.9	181	92.2 (87.1–95.5)	2.5 (1.0–5.9)	5.3 (2.9–9.5)
40–49.9	299	84.1 (79.1–88.0)	5.9 (3.7–9.4)	10.0 (7.0–14.2)
50–59.9	272	75.3 (69.0–80.6)	10.2 (6.8–14.9)	14.5 (10.8–19.2)
≥60	189	75.5 (67.7–82.0)	12.1 (7.5–18.9)	12.4 (8.2–18.2)
Sex				
Male	392	81.8 (77.6–85.4)	7.3 (4.9–10.6)	10.9 (8.2–14.4)
Female	629	85.0 (81.7–87.7)	6.3 (4.6–8.6)	8.7 (6.8–11.1)
Educational Background[a]				
No Grade Completed	8	100.0 (–)	–	–
With Primary Education	188	78.6 (71.1–84.5)	10.7 (6.7–16.6)	10.8 (6.7–16.8)
With Secondary Education	364	83.6 (78.5–87.6)	6.1 (3.8–9.7)	10.3 (7.7–13.6)
With Tertiary Education	458	85.2 (81.9–88.0)	6.0 (4.1–8.6)	8.8 (6.8–11.4)
Lifestyle-related risk factors				
Blood Pressure				
Normal (120/80 mmHg)	333	87.6 (83.3–90.9)	5.4 (3.4–8.5)	7.0 (4.7–10.3)
Pre-hypertension (120–139/80–89 mmHg)	375	86.1 (81.7–89.5)	6.7 (4.5–10.0)	7.2 (5.0–10.2)
Hypertension Stage 1 (140–159/90–99 mmHg)	202	75.7 (69.0–81.4)	9.3 (6.0–14.2)	15.0 (10.8–20.5)
Hypertension Stage 2 (≥160/≥100 mmHg)	105	76.9 (67.2–84.3)	6.3 (2.9–12.9)	16.9 (10.4–26.3)

Table 4. Percent distribution of adults, 20 years old and above, who were officials of the government, executives, managers, supervisors, or proprietors – by FBG level and by background characteristics: Philippines, 2013.

Background Characteristics	n	Desirable	Impaired FBG	High FBG
		<110 mg/dL	110–125 mg/dL	≥126 mg/dL
		% (95% CI)	% (95% CI)	% (95% CI)
Family History of Diabetes				
No	949	87.4 (84.9–89.5)	5.7 (4.4–7.5)	6.9 (5.4–8.7)
Yes	70	29.0 (19.3–41.0)	21.2 (12.9–32.7)	49.9 (38.2–61.6)
Triglycerides				
Desirable (<150 mg/dL)	519	89.8 (86.8–92.1)	4.1 (2.6–6.3)	6.2 (4.4–8.5)
Borderline (150–199 mg/dL)	231	79.3 (73.3–84.2)	8.8 (5.7–13.5)	11.9 (8.1–17.2)
High (200–399 mg/dL)	225	76.2 (69.7–81.7)	10.8 (7.1–15.9)	13.0 (9.2–18.1)
Very High (≥400 mg/dL)	46	72.1 (57.9–82.9)	6.0 (2.2–15.3)	21.9 (12.4–35.7)
HDL-cholesterol				
Low (<40 mg/dL)	572	78.6 (74.6–82.1)	9.4 (7.0–12.5)	12.0 (9.5–15.0)
Borderline (40–59 mg/dL)	394	88.9 (85.5–91.6)	3.6 (2.2–6.1)	7.4 (5.4–10.2)
Desirable (≥60 mg/dL)	55	91.2 (80.9–96.2)	4.9 (1.6–13.9)	3.9 (1.1–12.5)
Nutritional Status				
Chronic Energy Deficient (BMI <18.5 kg/m^2)	50	90.9 (76.2–96.9)	1.4 (0.2–9.0)	7.7 (2.2–23.4)
Normal (BMI 18.5–24.9 kg/m^2)	466	88.9 (85.9–91.2)	4.1 (2.6–6.3)	7.1 (5.3–9.4)
Overweight (BMI 25.0–29.9 kg/m^2)	373	79.3 (74.5–83.4)	10.2 (7.2–14.2)	10.5 (7.9–13.8)
Obese (BMI ≥30 kg/m^2)	125	75.2 (66.4–82.4)	8.3 (4.4–15.2)	16.5 (10.8–24.2)
Waist Circumference				
Low (Male: <90 cm; Female: <80cm)	454	90.9 (87.9–93.3)	2.8 (1.6–4.6)	6.3 (4.5–8.8)
Borderline (Male: 90–101 cm; Female: 80–87cm)	303	78.5 (73.6–82.8)	9.8 (7.0–13.6)	11.7 (8.5–15.8)
High (Male: ≥102 cm; Female: ≥88cm)	243	76.7 (70.5–81.9)	10.2 (6.8–15.0)	13.1 (9.4–17.9)
Waist-hip Ratio				
Low (Male: <0.90; Female: 0.80cm)	186	92.4 (87.6–95.4)	1.7 (0.6–4.6)	6.0 (3.5–10.0)
Borderline (Male: 0.90–0.99; Female: 0.80–0.84)	312	83.7 (78.5–87.9)	7.4 (4.8–11.0)	8.9 (6.1–12.9)
High (Male:1.0; Female: 0.85)	514	80.8 (76.9–84.1)	8.2 (6.0–11.1)	11.0 (8.7–13.9)
Behavioral Risk Factors				
Smoking Status				
Current Smoker	191	85.6 (79.4–90.1)	8.0 (4.9–12.9)	6.4 (3.6–11.1)
Former Smoker	185	80.4 (73.7–85.7)	9.0 (5.2–15.0)	10.6 (6.7–16.2)
Never Smoker	645	84.2 (81.1–86.9)	5.5 (4.0–7.6)	10.3 (8.2–12.7)
Alcohol Consumption Status				
Current Drinker	465	87.2 (83.7–90.1)	5.4 (3.6–8.0)	7.4 (5.2–10.3)
Former Drinker	153	79.0 (71.3–85.1)	9.4 (5.4–15.7)	11.6 (7.2–18.2)
Never Drinker	403	81.1 (76.4–85.0)	7.3 (5.0–10.5)	11.7 (8.9–15.1)

Table 4. Percent distribution of adults, 20 years old and above, who were officials of the government, executives, managers, supervisors, or proprietors – by FBG level and by background characteristics: Philippines, 2013.

Background Characteristics	n	Desirable	Impaired FBG	High FBG
		<110 mg/dL	110–125 mg/dL	≥126 mg/dL
		% (95% CI)	% (95% CI)	% (95% CI)
Unhealthy Diet				
Fruit and Vegetable Consumption (<400g/d)	522	83.2 (79.2–86.5)	7.0 (5.1–9.6)	9.8 (7.4–12.8)
Fruit and Vegetable Consumption (≥400g/d)	24	68.9 (49.2–83.5)	20.2 (8.6–40.5)	11.0 (3.3–30.5)
Physical Activity				
Insufficiently Physically Active	511	82.2 (78.3–85.5)	7.9 (5.8–10.7)	9.9 (7.7–12.7)
Sufficiently Physically Active	510	85.2 (81.6–88.3)	5.5 (3.8–8.0)	9.2 (6.9–12.2)

[a]with primary education (elementary undergraduate or graduate); with secondary education (high school undergraduate or graduate); with tertiary education (vocational undergraduate or graduate, college undergraduate or graduate, or higher)

Table 5. Association between presence of selected known risk factors and high FBG among government officials, executives, managers, supervisors, or proprietors, Philippines: 2013.

Factors	Odds			95% CI	
	Ratio	SE	*p*-value	LL	UL
Socio-demographic					
Age (years)					
20–29.9	Reference				
30–39.9	3.0	2.4	0.173	0.6	14.4
40–49.9	6.0	4.6	0.021	1.3	27.0
50–59.9	9.1	6.9	0.004	2.0	40.3
≥60	7.5	5.8	0.009	1.7	34.0
Sex					
Male	1.3	0.3	0.224	0.9	1.9
Female	Reference				
Educational Background[a]					
No Grade Completed	1.0	.	.	.	.
With Primary Education	1.2	0.4	0.473	0.7	2.3
With Secondary Education	1.2	0.2	0.393	0.8	1.8
With Tertiary Education	Reference				
Lifestyle-related Risk Factors					
Blood Pressure					
Normal (120/80 mmHg)	Reference				
Pre-hypertension (120–139/80–89 mmHg)	1.0	0.3	0.911	0.6	1.9
Hypertension Stage 1 (140–159/90–99 mmHg)	2.3	0.7	0.002	1.4	4.1
Hypertension Stage 2 (≥160/≥100 mmHg)	2.7	0.9	0.003	1.4	5.3
Family History of Diabetes					
No	Reference				
Yes	13.5	3.7	0.000	7.8	23.3

Table 5. Association between presence of selected known risk factors and high FBG among government officials, executives, managers, supervisors, or proprietors, Philippines: 2013.

Factors	Odds Ratio	SE	*p*-value	95% CI LL	95% CI UL
Triglycerides					
Desirable (<150 mg/dL)	Reference				
Borderline (150–199 mg/dL)	2.1	0.6	0.009	1.2	3.5
High (200–399 mg/dL)	2.3	0.6	0.002	1.3	3.9
Very High (≥400 mg/dL)	4.3	1.6	0.000	2.0	9.0
HDL-cholesterol					
Low (<40 mg/dL)	3.4	2.2	0.064	0.9	12.4
Borderline (40–59 mg/dL)	2.0	1.3	0.303	0.5	7.5
Desirable (≥60 mg/dL)	Reference				
Nutritional Status					
Chronic Energy Deficient (BMI <18.5 kg/m^2)	1.1	0.7	0.893	0.3	4.2
Normal (BMI 18.5–24.9 kg/m^2)	Reference				
Overweight (BMI 25.0–29.9 kg/m^2)	1.5	0.3	0.048	1.0	2.4
Obese (BMI ≥30 kg/m^2)	2.6	0.7	0.001	1.5	4.5
Waist Circumference					
Low (Male: <90 cm; Female: <80cm)	Reference				
Borderline (Male: 90–101 cm; Female: 80–87cm)	2.0	0.5	0.006	1.2	3.1
High (Male: ≥102 cm; Female: ≥88cm)	2.2	0.6	0.002	1.3	3.7
Waist-hip Ratio					
Low (Male: <0.90; Female: 0.80cm)	Reference				
Borderline (Male: 0.90–0.99; Female: 0.80–0.84)	1.5	0.5	0.214	0.8	3.1
High (Male:1.0; Female: 0.85)	2.0	0.6	0.031	1.1	3.6
Behavioral Risk Factors					
Smoking Status					
Current Smoker	0.6	0.2	0.109	0.3	1.1
Former Smoker	1.0	0.3	0.905	0.6	1.8
Never Smoker	Reference				
Alcohol Consumption Status					
Current Drinker	0.6	0.1	0.033	0.4	1.0
Former Drinker	1.0	0.3	0.990	0.5	1.9
Never Drinker	Reference				
Unhealthy Diet					
Fruit and Vegetable Consumption (<400g/d)	0.9	0.6	0.854	0.2	3.3
Fruit and Vegetable Consumption (≥400g/d)	Reference				
Physical Activity					
Insufficiently Physically Active	1.1	0.2	0.709	0.7	1.6
Sufficiently Physically Active	Reference				

[a]with primary education (elementary undergraduate or graduate); with secondary education (high school undergraduate or graduate); with tertiary education (vocational undergraduate or graduate, college undergraduate or graduate, or higher)
SE – standard error; CI – confidence interval; LL – lower limit, UL – upper limit

these were significant at *p*-values of 0.006, 0.002, and 0.031, respectively. On the contrary, consuming alcoholic beverages decreases the odds of having high FBG by 0.6 as compared to never and former drinking and it was significant at *p*-value = 0.033.

The study also found no significant relationship between sex, educational background, smoking status, fruit and vegetable intake, and physical activity with high FBG.

DISCUSSION

This study identified that high FBG among government officials, managers, supervisors, and proprietors was significantly associated with age (≥40 years old), elevated blood pressure (≥140/90 mmHg) and triglyceride level (≥150 mg/dL), family history of diabetes, overweight/obesity, high WC and WHR, and drinking alcoholic beverages – there were no significant association found with other variables.

Result of the study showed that the highest risk was contributed by family history, followed by age group 50–59 years. The Framingham Study also concluded that parental history of diabetes and age of >50 years old were significantly associated with the development of diabetes upon considering personal variables only (age, sex, parental history, and body mass index). Upon adding clinical variables (elevated blood pressure, low HDL-cholesterol, high triglyceride, WC, and impaired FBG) to the model, parental history remained significantly related to development of diabetes (Wilson *et al.* 2007). A prospective study also showed that a family history of diabetes is associated with a two-fold increased risk for developing diabetes and the risk quadrupled if the individual also has a high FBG (≥5.6 mmol/L) and a BMI of ≥30 kg/m^2 (Lyssenko *et al.* 2005). With these evidences supporting family history as a risk factor of diabetes, other studies have explored the role of genes in predicting the disease mentioned. However, existing genetic risk models still have many limitations such as small effect size of genetic loci, low discriminative ability of the genetic test, small added value of genetic information, questionable clinical relevance of some genetic variants, and the lack of appropriate models for gene-gene and gene-environment interaction (Lyssenko & Laakso 2013). Thus, there is no sufficient basis to explain the relationship of genes and the risk of developing diabetes.

Hypertension is also known to coexist with diabetes as both diseases are believed to have the same metabolic pathways such as obesity, inflammation, insulin resistance, and oxidative stress (Cheung & Li 2012). Studies even found that increased blood pressure is a significant risk factor of diabetes. The genome and epidemiology study in Korea found that pre-hypertension and hypertension are independent risk factors for type 2 diabetes (Kim *et al.* 2015). Moreover, the study of Ayana and co-authors (2015) found that a 10-point increase in systolic blood pressure increases the risk of type 2 diabetes by 6% among government employees in Eastern Ethiopia. Meanwhile, the study of Emdin and co-authors (2015) found a much higher risk – a 20 mmHg increase in systolic blood pressure and a 10 mmHg increase in diastolic blood pressure were associated with 58% and 52% increase in risk of newly-diagnosed diabetes, respectively. Thus, this study supports the hypothesis that increased blood pressure is a significant risk factor of diabetes or high FBG.

Overweight and obesity are known risk factors for diabetes. High prevalence of high FBG among overweight and obese adults was apparent in the current study and was found to be significantly associated with high FBG. However, contradicting results were found in other studies. In the study of Agu and co-authors (2015), there was a high prevalence of obesity (BMI≥30kg/m^2) and physical inactivity among government employees in south-eastern Nigeria leading to 9% of employees being highly at-risk to develop diabetes. Gadhavi and Jakasania (2017) also found a high prevalence of diabetes among government employees in India classified as overweight or obese, and the difference was significantly different from that of normal BMI. However, the study of Agu did not assess the association between obesity (by BMI) and diabetes but rather identified individuals at high risk to develop diabetes using a simple scoring system. as the same can be said to the study of Gadhavi wherein they only assessed if there was a significant difference between prevalences. The study of Tairea and co-authors (2014) also found a high prevalence of diabetes among obese government employees in Cook Island but found no significant association between obesity (BMI ≥30 kg/m^2) and diabetes (OR = 15.87; *p*-value = 0.18). The study of Ayana and co-authors (2015) also found no significant association between BMI of ≥25 kg/m^2 and diabetes (COR = 1.25; *p*-value = 0.455) despite the higher prevalence of diabetes in this group as compared to those with normal BMI (<25 kg/m^2).

Furthermore, this study significantly associates high FBG with high WC and high WHR. The study of Ayana and co-authors (2015) also found a statistically significant association between WC (COR = 1.94; *p*-value = 0.034) and diabetes. These measurements (WC and WHR) are used to measure central obesity and can distinguish fatness in the lower trunk and in the upper trunk unlike the body mass index, which does not account the distribution of fat in the body. Central obesity is strongly associated with diabetes than general fat and the ability of these obesity indicators differs by ethnicity, age, and sex (Vazquez *et al.* 2007). The DECODA study also concluded that central obesity indicators better predict high FBG than BMI (Nyamdorj *et al.* 2008). With this, the Philippine government may review current guidelines on nutritional status assessment and include measuring WC and WHR in routine screening for diabetes.

Moderate alcohol consumption is also associated with a reduced risk of developing diabetes, although the mechanism behind this is still unclear. It may be due to the anti-inflammatory effect of alcohol or the increase in insulin sensitivity after consumption (Baliunas *et al.* 2009). The meta-analysis study by Baliunas and co-authors (2009) confirms that moderate alcohol consumption is protective for diabetes, which was similar to the result of the current study (OR = 0.6; p-value = 0.033). Alcohol was most protective at a consumption of 24 g/d for females and 22 g/d for males and remained to be protective at 50 g/d and 60 g/d, respectively. However, consumption beyond this level was no longer protective (Baliunas *et al.* 2009); thus, heavy drinking is discouraged. Despite the beneficial effect of moderate alcohol consumption, it is still not encouraged as the risk to other diseases and health outcomes may outweigh the benefits shown in the study.

Another known risk factor of diabetes is physical inactivity. The study of Aravindalochanan and co-authors (2014) associated sitting for more than 3 h/d with increased risk for developing diabetes, particularly those with family history of diabetes. Note that the nature of work of adults included in the current study is sedentary since they do more supervisorial and administrative work and – on average – they spent 2.7 h sitting based on 2013 NNS, thus exposing them to higher risk to develop diabetes. However, the study did not find any association with physical inactivity and high FBG in contrast to other studies. The prevalence of high FBG was almost the same for those with low and high physical activity levels (9.9% and 9.2%, respectively). Participants in this study spent almost the same hours being active (2.5 h) and being inactive (2.7 h) on average. Moreover, adults in this specific occupation group spent a total of 103.9 min of moderate-intensity physical activity (from occupational and recreational activities) in a typical day. According to the Global Recommendations on Physical Activity for Health, to reduce the risk of non-communicable diseases such as diabetes, adults 18–64 years old are recommended to do at least 150 min of moderate-intensity aerobic physical activity throughout the week or do at least 75 min of vigorous-intensity aerobic physical activity throughout the week or an equivalent combination of moderate- and vigorous-intensity activity.

The World Health Organization recommends a minimum consumption of 400 g of fruits and vegetables per day for the prevention of non-communicable diseases such as diabetes, obesity, heart diseases, and cancer. Two meta-analyses have shown that consumption of fruits alone and vegetables alone were associated with diabetes mellitus (Li *et al.* 2014, Wu *et al.* 2014). However, both studies also showed that combined intake of fruits and vegetables was not associated with diabetes, which was similar to the result of the current study.

Among adults in this occupation group, this study identified a high prevalence of high FBG among males, aged 50–59 years, those with primary and secondary education, with blood pressure level of ≥140/90 mmHg, with family history of diabetes, very high triglycerides, low HDL-cholesterol level, obese, high WC and WHR, former and never smoker and alcohol drinker, and had adequate consumption of fruits and vegetables (≥400 g). However, high FBG was only found to be significantly associated with age (≥40 years old), elevated blood pressure (≥140/90 mmHg) and triglyceride level (≥150 mg/dL), family history of diabetes, overweight/obesity, high WC and WHR, and drinking alcoholic beverages. However, one of the limitations of the study is its cross-sectional design wherein the outcome and the risk factors were measured at the same time; thus, a causal relationship may be difficult to establish. Also, the study used the original WHO-BMI cut-off in classifying obesity rather than the Asia-Pacific cut-off but despite this, an association was still found between obesity and high FBG. Stress, which was found by other studies to be associated with diabetes, was also not measured in the study.

Result of the study may be used as basis to initiate intervention programs in the workplace to prevent and control high FBG and diabetes through early diagnosis and risk management, treatment, and explicit health policies.

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