

Nutritional Status and Prevalence of Other Non-Communicable Diseases Among Hypertensive Patients in Malawi

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Abstract

Malawi is experiencing increasing prevalence of hypertension and other non-communicable diseases (NCDs). Lifestyle and diets are significantly and rapidly changing, where people are consuming diets higher in fats, carbohydrates, sugars and salt, and have reduced their physical activity. Hypertensive patients were recruited to be evenly distributed between two categories: patients who had been attending hypertensive clinics for <24 months and those who had been attending the clinics for >24 months. Data were collected using a structured hypertension questionnaire, a 24-hour dietary recall and food frequency questionnaire. About one quarter of hypertensive patients had mild hypertension, with more of these patients being in the >24 months category. More than half of hypertensive patients were overweight and obese, with a higher proportion being in the >24 months category. A third of hypertensive patients had hypertension co-existing with another NCD, and the most common NCD was diabetes (as reported by 83.8% of the hypertensive patients). Additional research is needed to find interventions for this population to have better access to healthy diets and lifestyle.

Keywords: hypertension, type 2 diabetes, non-communicable diseases, dietary intake, BMI

INTRODUCTION

Hypertension is a strong risk factor for cardiovascular diseases such as stroke, coronary artery disease and heart failure [1], leading to more than 1.8 million deaths worldwide every year [2]. Most of these deaths occur in low- and middle-income countries (LMICs). In 2002, non-communicable diseases (NCDs) accounted for 54% of deaths in LMICs, compared with 36% of deaths attributed to communicable diseases, maternal and perinatal conditions and nutritional deficiencies combined. The NCD contribution to deaths was predicted to rise to 65% by 2030 [3].

Hypertension is epidemiologically associated with metabolic diseases such as obesity and diabetes [4]. In developing countries, there is growing 'double burden' of under and over nutrition occurring simultaneously among different population and demographic groups [5]. Rapid

urbanization and internal migrations, demographic shifts in population, sedentary lifestyles and the wide range of contributions from the liberalization of markets with globalization and environmental degradation (including food systems of societies and diets of individuals) are contributing to increase in these NCDs [6].

Poor dietary patterns and low energy expenditure are significant causative agents of disability and premature deaths due to chronic NCDs, including obesity, diabetes mellitus, cardiovascular disease, hypertension and stroke, and some types of cancer [5].

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Although infectious diseases still predominate in sub-Saharan Africa, NCDs accounted for 79% of the worldwide deaths in developing countries [7]. Most of these NCDs are co-morbidities associated with obesity. A study in Tanzania found that the probability of dying from NCDs in developing countries is higher than in developed countries [8]. Patients with NCDs are badly managed in sub-Saharan Africa [9]. As NCDs spread around the globe, some countries may be less able to cope with the adverse impacts due to their financial constraints. The World Economic Forum warns that NCDs are a severe threat to economic development and that the economic burden of NCDs will reach \$47 trillion by the year 2030 [10].

Like other developing countries, Malawi is experiencing rapid urbanization and changes in diet composition (diets high in fats, sugars and salt). In addition, urbanization has resulted in decreased physical activity, hence creating the pre-conditions for an increase in the prevalence of NCDs [11]. The increasing burden of hypertension and other NCDs in Malawi is a major setback for health systems that are already overburdened and under-funded [11]. However, the Malawi health system maintains hypertension clinics in hospitals to manage hypertensive patients with pharmaceuticals and dietary advice. Patients maintain their own clinical records and return to the clinic periodically for prescription renewal and evaluation. The objective of this study was to investigate blood pressure, body mass index (BMI), and the prevalence of diabetes in two categories of hypertensive patients who have been attending hypertensive clinics for less than 24 months (Category 1) and more than 24 months (Category 2) in four central hospitals in Malawi. The outcomes of these assessments were correlated to energy and nutrient intakes and hypertension-related incidence of other NCDs.

METHODS

Study Design

This study recruited hypertensive patients who attend hypertensive clinics in any of the four central hospitals

in Malawi (Mzuzu, Kamuzu, Queen Elizabeth and Zomba). Adult males and non-pregnant females more than 18 years old were invited to participate in the study and for the purposes of data analysis, placed into groups of (1) hypertensive patients who have been attending hypertensive clinics for less than 24 months and (2) hypertensive patients who have been attending hypertensive clinics for more than 24 months. A total sample size of 344 hypertensive patients from the four hospitals was interviewed and their height, weight, and blood pressure taken. A 308-person sample size was calculated for a predicted 95% confidence interval between the groups. A non-response factor of 10% was considered to get a final sample size of 344. Both Category 1 and Category 2 had 172 hypertensive patients. For each hospital, 86 hypertensive patients were interviewed (43 patients in each of Category 1 and Category 2)). Quota sampling design (nonprobability sampling) was used [12] to select participants for each hospital and category. The use of human subjects in research was approved by the N.C. State University Institutional Review Board as Protocol Number 6369.

Data Collection

Three research assistants recorded weight, height, and blood pressure of hypertensive patients after patients consented to the study and responded to a hypertension questionnaire. Standard protocols [13] for taking weight and height were followed. Scales were calibrated every day with standard weights (a 1-kg packet of sugar) to make sure they were accurate. Height boards were checked to make sure they were calibrated to the nearest 0.1 cm [13]. Data were collected with the same digital weighing scales and height boards/stadiometers throughout the study, and used the sphygmomanometer provided by each clinic. Three measurements of blood pressure were averaged for a single recorded value [14]. Table 1 presents the cut off points for blood pressure. BMI (kg/m^2) was categorized as in Table 2 below. Measurement of weight and height followed standard protocols as outlined by Gibson (2005) [13].

Table 1. Cut off points for hypertension patients

BP Category	Systolic (mmHg)	Diastolic (mmHg)
Optimal	<120	<80
Normal	<130	<85
Pre-hypertensive	130-139	85-89

Hypertension		
Grade 1 Hypertension (mild)	140-159	90-99
Grade 2 Hypertension (moderate)	160-179	100-109
Grade 3 Hypertension (Severe)	≥ 180	≥ 110
Isolated Systolic Hypertension		
Grade 1	140-159	<90
Grade 2	≥160	<90

Source: Williams et al., [14]

Table 2. Cut off points for body mass index

Cut off points	Interpretation
<18.49	Thin/underweight
18.50-24.99	Normal
25.00-29.99	Overweight
30.00-39.99	Grade 1 Obesity
40.00-49.99	Grade 2 Obesity
>50.00	Grade 3 Obesity

Research assistants administered a 24-hour dietary recall and a food frequency questionnaire (FFQ) to collect data on type and amounts of foods eaten, and frequency of consumption of those foods respectively. A 5-step multiple pass approach was used to administer the 24-hour dietary recall [15]. FFQ Assessed intake for the past 12 months. The FFQ consisted of 8 food groups that are commonly eaten in Malawi, consisting of the six food groups from the Malawi food guide with staples split into cereals or roots and tubers, and eggs and fish listed as separate food groups.

Data Analysis

Anthropometric data were analyzed using Microsoft Excel where BMIs were calculated for each individual and later exported to SPSS version 22 [16] for further analysis and

comparison between the two categories of hypertensive patients. Blood pressure measurements were analyzed by analysis of variance and correlation to other variables using SPSS.

RESULTS

Blood Pressure Assessment

Overall, a quarter (25.7%) of patients had mild hypertension, followed by moderate hypertension (16.1%) and the least proportion was in isolated systolic hypertension grade 2 (5.8%) (Table 3). Comparison of Category 1 and Category 2 (time visiting the clinics) did not show noticeable differences except that there were significantly more patients in the more than 24 months category who had high blood pressure ($P < 0.05$).

Table 3. Distribution of blood pressure by category of patients

Category	Less than 24 months (n=172)		More than 24 months(n=170)	
	Freq	%	Freq	%
Optimal (<120/ ^o <80 mm Hg)	10	5.8	13	7.6
Normal (<130/ ^o <85 mm Hg)	26	15.1	20	11.8
High-Normal (130-139/ ^o 85-89 mm Hg)	19	11	13	7.6
Mild Hypertension (140-159/ ^o 90-99 mm Hg)	47	27.3	41	24.1
Moderate Hypertension (160-179/ ^o 100-109 mm Hg)	27	15.7	28	16.5
Severe Hypertension (>180/ ^o >110 mm Hg)	17	9.9	21	12.4
Isolated Sys HTN G1 (140-159/ ^o <90 mm Hg)	17	9.9	23	13.5
Isolated Sys HTN G2 (>160/ ^o <90 mm Hg)	9	5.2	11	6.5

Analysis also compared distribution of blood pressure by sex (Figure 1). The highest proportion of women were found to have mild hypertension while more men

were found to have moderate hypertension. There were significantly more men with isolated systolic hypertension than women ($P < 0.05$).

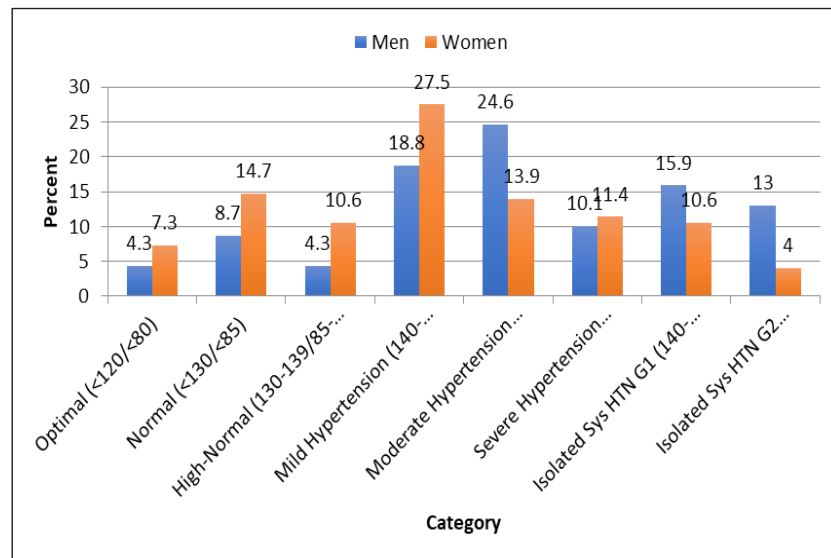


Figure 1. Distribution of blood pressure among hypertensive patients attending hypertensive clinic by sex

Body Mass Index (BMI) Assessment

More than half of the hypertensive patients in this study were found to have a BMI of more than 25.0 (67.2%) with a higher proportion being overweight (37.0%) than with Grade 1 obesity (25.5%) or Grade 2 obesity (4.7%). Patients with normal BMI (18.5 to 24.99) were 29% of the population and thin/underweight (≤ 18.4) were 3.8% of the population.

In terms of patient category, there were significantly more patients (33.5%) of less than 24 months in the normal category (18.5 – 24.99) than those in the more than 24 months (24.6%) ($P < 0.05$). More patients (41.5%) in overweight category were from the more than 24 months category and 32.4% in the less than 24 months category (Figure 2). Across all the hospitals and categories, more women had higher BMIs than men (Figure 3).

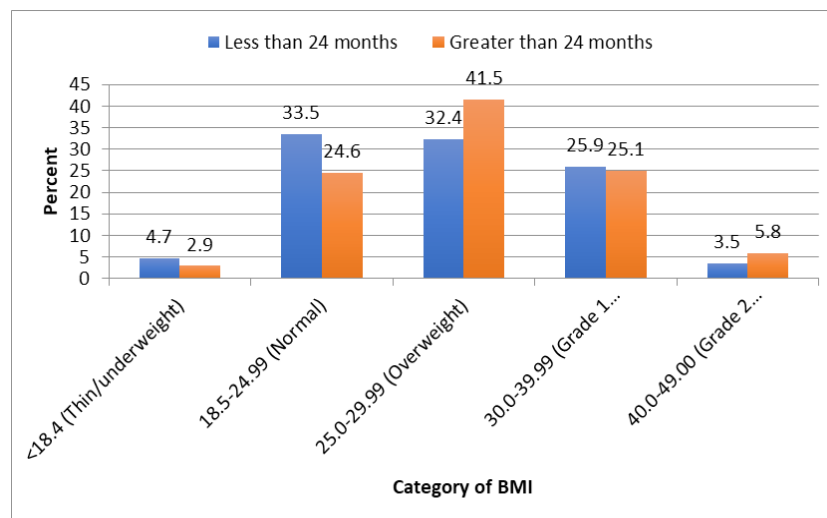


Figure 2. Distribution of hypertensive patients by time attending hypertensive clinic and by BMI-related obesity category.

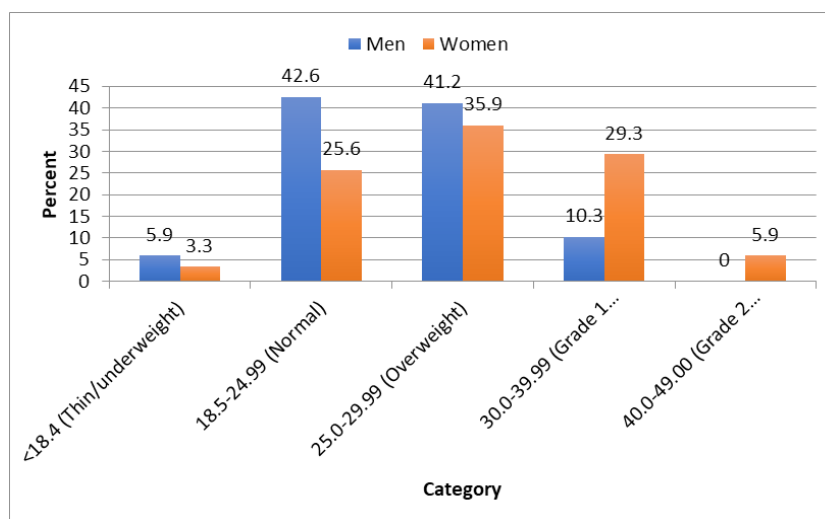


Figure 3. Distribution of BMI of hypertensive patients attending hypertensive clinic by sex

Despite a majority of hypertensive patients being overweight and obese, a majority of them (83.1%) were not on any weight reduction program. This was also the case when categories of patients were considered. For hypertensive patients in the less than 24 months category, 82.5% were not on any weight control program and 83.7%

of patients in the more than 24 months category were not on any weight control program.

Correlations Among Variables

Dietary intakes, BMI and age were correlated with blood pressure, and a summary of the correlations is presented in Table 3.

Table 3. Correlation of blood pressure and other risk factors

		Systolic	Diastolic	Age	BMI	Energy	Sodium	Fat	Potassium	Calcium	Cholesterol
Systolic	Pearson Correlation	1	.747**	.164**	.222**	.013	-.026	.060	-.020	.014	-.049
	Sig. (2-tailed)		.000	.002	.000	.815	.629	.272	.711	.796	.367
Diastolic	Pearson Correlation	.747**	1	-.112*	.231**	.009	-.027	.050	.003	.019	-.039
	Sig. (2-tailed)	.000		.038	.000	.869	.626	.352	.959	.727	.476
Age	Pearson Correlation	.164**	-.112*	1	-.127*	.024	-.040	-.017	-.032	.016	-.070
	Sig. (2-tailed)	.002	.038		.019	.656	.462	.759	.560	.769	.197
BMI	Pearson Correlation	.222**	.231**	-.127*	1	.000	.045	-.003	-.042	-.025	-.075
	Sig. (2-tailed)	.000	.000	.019		.993	.403	.954	.441	.643	.164
Energy	Pearson Correlation	.013	.009	.024	.000	1	.231**	.699**	.789**	.542**	.240**
	Sig. (2-tailed)	.815	.869	.656	.993		.000	.000	.000	.000	.000
Sodium	Pearson Correlation	-.026	-.027	-.040	.045	.231**	1	.190**	.218**	.270**	.034
	Sig. (2-tailed)	.629	.626	.462	.403	.000		.000	.000	.000	.530
Total Fat	Pearson Correlation	.060	.050	-.017	-.003	.699**	.190**	1	.604**	.505**	.345**
	Sig. (2-tailed)	.272	.352	.759	.954	.000	.000		.000	.000	.000
Potassium	Pearson Correlation	-.020	.003	-.032	-.042	.789**	.218**	.604**	1	.834**	.238**
	Sig. (2-tailed)	.711	.959	.560	.441	.000	.000	.000		.000	.000
Calcium	Pearson Correlation	.014	.019	.016	-.025	.542**	.270**	.505**	.834**	1	.205**
	Sig. (2-tailed)	.796	.727	.769	.643	.000	.000	.000	.000		.000
Cholesterol	Pearson Correlation	-.049	-.039	-.070	-.075	.240**	.034	.345**	.238**	.205**	1
	Sig. (2-tailed)	.367	.476	.197	.164	.000	.530	.000	.000	.000	

** . Correlation is significant at the 0.01 level (2-tailed) * . Correlation is significant at the 0.05 level (2-tailed)

In Table 3 there is negative correlation between sodium intake and diastolic ($r=-0.027$) and systolic ($r=-0.26$) blood pressure, although the correlation was weak and not significant ($P>0.05$). Despite total energy intake being high among hypertensive patients, there was a nonsignificant positive but weak correlation with blood pressure ($r=0.009$ for diastolic and $r=0.013$ for systolic). Blood pressure and total fat intake showed a positive weak and not significant correlation ($r=0.05$ for diastolic and $r=0.06$ for systolic). Dietary fiber had a negative correlation with diastolic ($r=-0.016$) and systolic ($r=-0.015$) values, but correlations were not significant ($p>0.05$). The correlation between diastolic blood pressure and potassium intake was weak ($r=0.003$) and non-significant ($P>0.05$). Systolic blood pressure vs. potassium was negative, weak ($r=-0.020$) and not significant ($p>0.05$). Diastolic blood pressure and age had a negative ($r=-0.112$) non-significant correlation ($P>0.05$). On the other hand, a positive ($r=0.164$) and significant correlation ($P<0.05$) was noted between age and systolic blood pressure. The correlation between calcium intake and blood pressure was positive, weak ($r=0.019$ for diastolic and $r=0.014$ for systolic) and not

significant ($P>0.05$). Cholesterol intake and blood pressure correlation was negative and not significant ($r=-0.039$ for diastolic and $r=-0.049$ for systolic). Body mass index had a positive and significant ($P<0.05$) correlation with diastolic ($r=0.231$) and systolic ($r=0.222$) blood pressure. The different nutrients were positively correlated with each other, probably because they were confounded by the quantity of food eaten on the day of record.

Co-existence of Hypertension with Other NCDs

One third of hypertensive patients had other diagnosed NCDs, of which diabetes was the most common (occurring in 83.8% of the patients). Other NCDs included stroke (occurring in 10.3% of the patients), ulcers (occurring in 1.7%), cancer (occurring in 0.9%) and asthma (occurring in 1.7%). In terms of category of patients, more (38.6%) of the patients in more than >24 months Category 2 had other NCDs than in <24 months Category 1 (28.7%). More patients with diabetes, HIV and cancer were in the less than 24 months category. On the other hand, the more than 24 months category had more patients with stroke, ulcers and asthma (Figure 4).

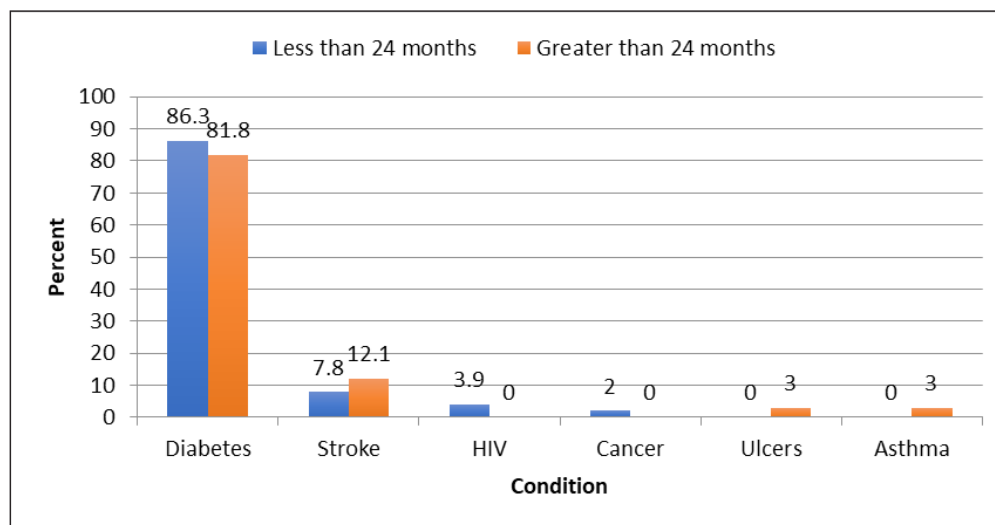


Figure 4. Types of NCDs co-existing with hypertension among hypertensive patients attending hypertensive clinic by category of time as a hypertension clinic patient.

The mean duration of existence of the other NCD for the less than 24 months category patients was 38.7 ± 31 months. The range of duration was 2 to 144 months. The mean duration of other diseases is more than the treatment for hypertension (less than 24 months) because some patients were first diagnosed with the other condition (such as diabetes, stroke) before being treated

for hypertension. For patients in the more than 24 months category, the mean duration of the existence of other NCD was 87.4 ± 54.1 months.

DISCUSSION

From the results obtained in this research, the mean age for hypertensive patients in the more than 24 months

category (60.9 ± 10.1 years) was not different than hypertensive patients in the less than 24 months category (56 ± 12.5 years) ($P > 0.05$). Incidence of hypertension increases with age [17,18]. Elevated systolic blood pressure was reported by Franklin et al. [17] to be a more potent predictor of adverse cardiovascular outcomes among the elderly population than is elevated diastolic blood pressure, and isolated systolic pressure was strongly age dependent [19].

We found that hypertension was more prevalent among females than males. Gu and others in 2013 found that the prevalence of hypertension increased with age and that men and women had similar prevalence, but more women were treating their hypertension than men [20]. Hammami et al. [21] found that the prevalence of hypertension was higher in females than in males and that higher body mass index, diabetes mellitus, and disability were important correlates of the prevalence of hypertension.

More than half of the hypertension patients in this study were overweight and obese, and women had higher BMIs than men. These findings are similar to prior studies [22,23] showing prevalence of overweight and obesity was higher in females than in males. Linear regression between blood pressure and other variables showed that age and BMI were the most important and significant predictors of high blood pressure among hypertensive patients in this study.

Our results found a positive but weak correlation between energy intake, total fat intake, potassium intake, calcium intake, BMI and blood pressure. Based on these results, the hypertension that we see among hypertensive patients in this research may not be sodium sensitive or related to intake of these nutrients. Svetkey et al. [24] found that a DASH diet and reduced sodium intake were negatively correlated with blood pressure. The dietary diversity for most Malawians is poor due to overdependency on maize as a staple food. Denning et al. [25] reported that maize accounts for 60% of total calorie consumption among Malawians and FAOSTAT reported that maize provides more than 70% of total daily energy intake among Malawians [26]. Other studies reported that Malawian diets are usually monotonous and undiversified because staples provide a bulk of the diet [27,28]. In contrast, diets rich in fruits, vegetables, and low-fat dairy products and reduced in saturated fat, total fat, and cholesterol, and modestly increased in protein significantly lowered blood

pressure in the absence of reduced sodium intake or weight loss [29]. In addition, studies have found that the effects of diet on blood pressure may be influenced by demographic characteristics such as race, age, and sex [24].

The risk of hypertension was found to decrease with increased consumption of dairy products such as milk and milk products, but we did not see a correlation between blood pressure and calcium intake in the groups under study, which generally have low dairy product intake. Hypertension clinics need to encourage hypertensive patients to consume more dairy products. The DASH trial showed that a diet rich in fruit, vegetables, and low-fat dairy products substantially reduced blood pressure [30,31]. Several epidemiological studies [32,33,34] and prospective studies [35,36,37,38] have reported an inverse relationship between dairy intake and hypertension. The National Heart, Lung, and Blood Institute Family Heart Study found a 36% lower prevalence of hypertension in American adults with a high intake of dairy products, independent of calcium intake [39]. A cross-sectional study among 912 middle-aged French men also showed that dairy products and dietary calcium were both significantly and independently associated with lower systolic blood pressure [33]. Beneficial effects of low-fat products have also been reported on childhood blood pressure in the Framingham Children's study [29].

Our results indicated a third of hypertensive patients had other diagnosed NCDs, of which diabetes was the most common (occurring in 83.8% of the patients). There were more patients with diabetes, HIV and cancer in the less than 24 months category. On the other hand, the more than 24 months category had more patients with stroke, ulcers and asthma. The co-existence of hypertension and other NCDs, especially diabetes and obesity, is associated with a worse health-related quality of life [40]. In that study, obesity and diabetes in women and men respectively were the factors most closely and significantly associated with diminished health-related quality of life [40], which could also apply to our population.

CONCLUSION

Overall, 70.5% of patients being treated in hypertension clinics had mild or more severe hypertension, and a higher proportion (72.9%) was found among the more than 24 months category patients. More than half of the hypertensive patients were overweight and obese, with

a higher proportion being hypertensive patients in the more than 24 months category. More women were obese while more men were overweight. Despite the majority of hypertensive patients being overweight and obese, more than 80% of the patients were not on any weight control program. A third of hypertensive patients had other NCDs apart from hypertension, of which diabetes was the most common, as found in 83.8% of the hypertensive patients who reported to have other NCDs. Because each of these diseases is commonly associated with diet and physical activity, additional research is needed to find interventions for this population to have better access to healthy diets and lifestyle.

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