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Evaluation of risk factors for Libyan patients with hypertension and diabetes mellitus

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Abstract: Hypertension is a challenge for public health professionals all-over the world. It is the leading and most important modifiable risk factor for coronary heart disease, congestive heart failure, stroke, renal diseases, retinopathy and many other diseases. The aim of the present study is to evaluate and study the most identifiable risk factors for patients with diseases of hypertension and diabetes mellitus such as age, gender, marital status, tobacco smoking, life style and with associated diseases (dyslipidemia and diabetes) treated at city hospital in Tripoli (Tripoli Medical Centre). This was a cross sectional prospective study which was carried out during October 2013 and January 2014. The study included 200 consecutive patients (102 females and 98 males) who are older than 30 years and who came for a regular follow up at the OPD of Tripoli medical centre. During this study, variables like age, gender, diabetes, smoking and dyslipidemia were taken into account in relation to hypertension. In addition, it is assorted some important biochemical parameters such as total cholesterol, triglycerides, low density lipoprotein, high density lipoprotein and fasting blood glucose in the studied population and compared them with available data. The findings revealed that Libyan population not only old age and male gender are potential threat for an early hypertensive but other variables like diabetes, cardio-vascular diseases, dyslipidemia, obesity, migraine and obstructive apnea are also playing an important role in hypertension complications. It is concluded that this population is more prone to hyperglycemia and high pulse pressure with hypertension in the majority of survey population.

Introduction

Hypertension or high blood pressure, sometimes called arterial hypertension, is a chronic medical condition in which the arteries have transitory or sustained elevation of systemic arterial blood pressure to a level likely to induce cardiovascular damage or other adverse consequences (1). Hypertension is a common condition that will catch up with most people who live into older age, it affects millions even children and teens (2). About 95% of the cases are categorized as primary hypertension which means high blood pressure with no obvious underlying medical cause (3). Though, primary hypertension remains somewhat mysterious, it has been linked to certain risk factors. Hypertension tends to run in families and is more likely to affect men than women, age and race also play a role. It is also greatly influenced by diet and lifestyle, the link between salt and blood pressure is especially compelling. Other factors that were associated with hypertension include obesity, diabetes, stress, insufficient intake of potassium, calcium, and magnesium as well as lack of physical activity and chronic alcohol consumption (4).

Secondary hypertension consists of the rest (5%) of the cases and caused by other conditions such as chronic kidney disease, disorders of the adrenal gland, hyperparathyroidism, sleep apnea, alcohol addiction, pregnancy or preeclampsia and coarctation of the aorta. In such cases, when the cause is treated, blood pressure usually returns to normal (5-7). Treating hypertension is important for reducing the risk of stroke, heart attack and heart failure (1). Thus, treatment for hypertension was associated with reductions in stroke (about 40%), heart attack (25%) and heart failure (> 50%) see (8) for details. High pressure may be treated medically, by changing lifestyle factors, or combination of both. Important lifestyle changes include losing weight, quitting smoking, eating a healthful diet, reducing sodium intake, exercising regularly and limiting alcohol consumption (1). Cohen and others reported that yoga is effective in reducing blood pressure (9). The same lifestyle changes that can be followed to help control blood pressure will also help prevent high blood pressure from occurring in most cases (10).

Hypertension is the most important preventable risk factor for premature death worldwide (11). It increases the risk of ischemic heart disease (12), stroke (5), peripheral vascular disease (13), and other cardiovascular diseases (5). It is also a risk factor for cognitive impairment, dementia and chronic kidney disease (5, 14). Hypertension is a risk factor for development and worsening of many diabetes mellitus (DM) complications and likewise having DM increases the risk of developing high blood pressure (15). Researchers from Scotland reported that low testosterone levels are linked to insulin resistance (16). Type I DM is increasing in children (especially those aged < 5 years) and type II DM is increasing, particularly in black and minority ethnic groups (17). Gestational DM occurs in 2-5% of all pregnancies and may improve or disappear after delivery. However, 20-50% of affected women develop type II DM later in life. Though it may be transient, untreated gestational DM can

damage the health of the fetus or mother (18-23). Risks to the baby include abnormal weight gain before birth, breathing problems at birth and higher obesity and DM risk later in life and risks mother include needing a caesarean section due to an overly large baby and damage to heart, kidney, nerves, eye (24, 25). The goal of treatment is an HbA1C level of 6.5%, but should not be lower than that, and may be set higher (26-28).Other forms of DM include congenital DM, which is due to genetic defects of insulin secretion, latent autoimmune diabetes of adult, cystic fibrosis-related DM, steroid DM induced by high doses of glucocorticoids and several forms of monogenic DM or maturity onset diabetes of the young (29). The prevalence of hypertension in patients who have type II DM is up to three times higher than in patients without DM. The coexistence of hypertension in diabetic patients greatly enhances their likelihood of developing CVD and chronic kidney disease (30, 31). One of the factors that may influence the choice of blood pressure lowering agents in DM is the influence of the agents on metabolic parameters, especially glucose metabolism (32-34).

Indeed, studies conducted in the Framingham population with DM type (I) indicated that the presence of hypertension in these participants was a resulting risk factor for the presence of CVD. This data and others suggested that a two-fold increased risk of CVD events and deaths in diabetic persons with hypertension compared with those with normal blood pressures. The increased association between hypertension and DM can be explained, in part, by the presence of a maladaptive interaction of factors, such as excessive caloric intake/decreased activity and associated insulin resistance, chronic activation of the renin–angiotensin–aldosterone system , the sympathetic nervous system and abnormalities of innate immunity, inflammation, and oxidative stress (30, 35, 36). The epidemic of obesity and sedentary lifestyle, and the aging of populations worldwide have contributed to the current high

prevalence of DM and hypertension. Resistant hypertension is defined as hypertension that remains above goal blood pressure in spite of concurrent use of three antihypertensive agents belonging to different antihypertensive classes. Guidelines for treating resistant hypertension have previously been published (37-39).

This study was aimed to characterize the profile of hypertension and diabetes mellitus as well as the different risk factors related to patient life-style, genetic and environmental.

Subjects and Methods

Patients: Subjects aged more than 30 years who provided informed consent were invited to participate in this study. This was performed in TMC on 200 hypertensive Libyan patients during the period of October 2013 and January 2014. Gender- and age-stratified random sample (30-40, 41-50 and > 50 years) of potentially eligible subjects. The study was performed to characterise the profile of two leading cardio-metabolic conditions, hypertension and diabetes in patients who having both diseases (109 pts, 54.5%). In addition, emphasis was placed on the magnitude of the associations between these cardio-metabolic conditions and modifiable risk factors in these circumstances.

Data collection: A questionnaire prepared by staff-members of Pharmacology and Clinical Pharmacy Department, Faculty of Pharmacy, University of Tripoli, Tripoli, 2013 was used. The questionnaire was about prevalence and risk factors related to hypertensive subjects which mainly contain three major parts with specific different variables related to the disease. Socio-demographic characteristics, personal, family history of medical problems and life style and medication profile and coronary risk factors.

Results

Data from 200 hypertensive participants, 49% male and 51% females (1 : 1) were analysed. Individuals who invited to participate were divided into four age sub-groups, the percentage of age groups were < 30 and 30-40 were 0.5% and 2%, respectively, whereas, for 41-50 group, was 13.5% and for > 50 was 84%. The ratio between Arab and others patients was 1.9: 0.1, and between white and black patients was 1.84 : 0.16. With regard to marital status for single, married, married polygamous, divorced and widowed status, the findings are 2, 60.5, 8.5, 1.5 and 27.5%, respectively. Regarding family size of the participants it can be seen that the largest number of patients of the study was in family size > 5 (n=88), with no big difference with patients of 3-5 family size (n=81) and the lowest number was in patients with < 3 family size (n=31).

With regard to education, socio-professional group, total family income/month, and residence state among the study patients. In table 1, most of the patients were illiterate (n=97), the other patients education level distributed between primary (n=52), secondary (n=18) and university graduate (n=33). There were 91 (45.5%) of the patients who are house-wives, and the other patients are 54.5% (n=109) were salary own distributed between retired which represents the largest number of patients (68.8%, n=75), with less number of patients was government employee (21.1%, n=23) and with almost no different patient number between self-employed (6.4%, n=7), private sector employee and un-employed (n=2 for each, 1.8%), where they represents the lowest number of patients.

Another parameter is total family income per month among patients. Thus, the distribution is between < 750 LD/month for the most of the

patients (n=142), 750-1200 LD/month for less patients number (n=41), and the income that > 1200 LD/month represents the smallest population (n=17). It is notable that the largest population of patients was found to live in urban areas (n=153) and the lowest population in rural areas (n=47).

Table 1: Demographics of the Libyan patients

Category		Frequency	Percent
Patients Age Subgroup	< 30	1	23
	30-40	4	36.50
	41-50	27	46.41
	➤ 50	168	68.96
Gender	Male	98	49%
	Female	102	51%
Ethnicity	Arab	190	95%
	Others	10	5%
Colour	White	184	92%
	Black	16	8%
Marital status	Single	4	2%
	Married	121	60.5%
	Married polygamous	17	8.5%
	Divorced	3	1.5%
	Widowed	55	27.5%
Family size	< 3	31	15.5%
	3-5	81	40.5%
	> 5	88	44%
Education level	Illiterate	97	48.5%
	Primary	52	26%
	Secondary	18	9%
	Uni graduate	33	16.5%
Total family income/month	< 750	142	71%
	750-1200	41	20.5%
	> 1200	17	8.5%
Socioprofessional group	House wife	91	45.5%
	Salary own	109	54.5%
Salary own (employement)	Government	23	21.1%
	Private sector	2	1.8%
	Self	7	6.4%
	Retired	75	68.8%
	Unemployed	2	1.8%
Residence	Rural	47	23.5%
	Urban	153	76.5
Tobacco smoking	Never	69	34.5%
	Former	44	22%
	Current	25	12.5%
	Passive	62	31%
Physical activity level (Level of exercise)	<= 2 Times/Wk	9	4.5%
	> 2 Times/Wk.	17	8.5%
	Missing	174	87%

Consumption of vegetables D/WK		No	5	2.5%
		<= 1	21	10.5%
		2-3	39	19.5%
		>= 4	135	67.5%
Consumption of fruits D/WK		No	2	1%
		<= 1	30	15%
		2-3	68	34%
		>= 4	100	50%
Consumption of animal protein D/WK		No	9	4.5%
		<= 1	35	17.5%
		2-3	34	17%
		>= 4	122	61%
Dietary salt intake		Low	85	42.5%
		Medium	105	52.5%
		High	10	5%
CNS stimulant liquid		No	10	5%
	Coffee	Yes	127	63.5%
		No	63	31.5%
	Tea	Yes	179	89.5%
		No	11	5.5%
	Soda	Yes	109	54.5%
		No	81	40.5%

In this study, it can also be seen that the patients history of smoking were distributed between 69 patients with no history of smoking (never) and 131 patients distributed between 44 patients with former history of smoking, 25 patients with current history of smoking and 62 patients with passive history of smoking. A large population patients were missing the physical activity (exercise) (n=174, 87%), 17 patients with > 2 times/wk of exercise (8.5%) and only 9 patients with physical activity of ≤ 2 times/wk (4.5%). Most of the patients consume vegetables 4 days or more per week (n=135), less patients consume vegetables 2-3 days/wk (n=39) or once a week (n=21) and only 5 patients that do not consume dietary vegetables. Also, most of the patients consume fruits 4 days or more per week (n=100), less patients consume fruits 2-3 days per week (n=68) or once a week (n=30) and only 2 patients that do not consume fruits at all. Furthermore, most of patients consume animal protein 4 days or more a week (n=122), fewer patients consume animal protein about 2-3 days per week (n=34), or once a week (n=35) and only 9 patients that do not consume animal protein. The highest number of the patients was their dietary salt intake medium (n=105) with almost no difference with

low salt intake (n=85) and the lowest number of patients was with high salt intake (n=10). Also, most of the patients consume coffee (n=127), tea (n=179) and soda (n=109) on almost daily basis, with only 10 patients that do not consume any liquids contain CNS stimulant. Descriptive information of the patient is shown in Table 1. Another aspect is the body mass index (BMI), WHO classification: group 1 under-weight (BMI < 19), normal weight (BMI: 19.9 - 24.9), over-weight (BMI: 26.9 - 29.9), obese (BMI: 29.9 - 39.9) and morbid obesity (BMI > 40). The BMI data for the patients of this is shown in Figure 1.
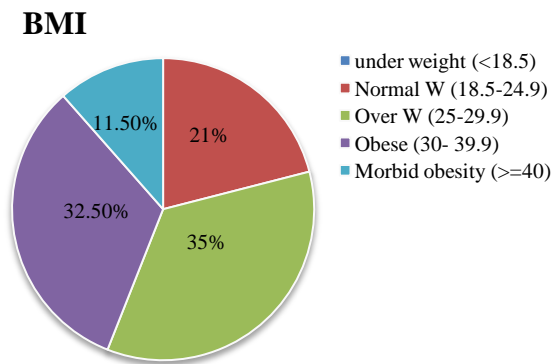

% Blood pressure measurement

	Low	Normal	Borderline	High
SBP	9%	54%	17.50%	19.50%
DBP	15.50%	66%	13.50%	5%

Figure 2: Systolic and diastolic blood pressure measurements of Libyan patients

BMI

- under weight (<18.5)
- Normal W (18.5-24.9)
- Over W (25-29.9)
- Obese (30- 39.9)
- Morbid obesity (>=40)

11.50% 21% 32.50% 35%

Figure 1: BMI of the Libyan patients

In Figure 1, there is no difference between the overweight and obese patients that represent the largest patients population 35% and 32.5% respectively. With less frequency of the patients considered their weigh in normal weight range (21%) and fewer patients (11.5%) were within morbid obesity range. Generally, there are some important blood measurements for the patient's blood pressure (systolic and diastolic as clarified in Figure 2).
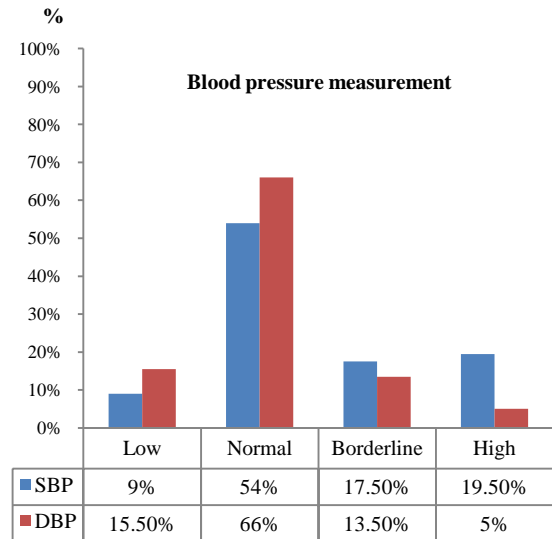
It can be illustrated that there is a difference between normal systolic and diastolic blood pressure measure (54% normal SBP, 66% normal DBP) and the remaining of the participants. Further, the SBP measures of other patients were distributed between low, borderline and high with 9, 17.5 and 19.5% and their DBP measure were 15.5, 13.5 and 5% respectively as shown above. It is fundamental to look for medication history of the patient that is associated with particular diseases. Table 2 illustrates this aspect. It is designed to show diseases and medication history for patients and distribution of history of hypertension in pregnancy, history of abortion, and number of deliver among the female patients. For the family history of hypertension, it can be seen that the number of patients with a family history of hypertension was 76 patients, history of maternal hypertension (n=67), paternal hypertension (n=36) and brother/sister was 79 patients.

Regarding the distribution of history of hypertension in pregnancy, history of abortion and number of deliver among the female patients, it can be seen that the number of patients that have family history of cardio-vascular diseases were 71 patients; family history of diabetes mellitus were 120 patients. Further, the number of female patient that has history of hypertension in pregnancy was 21 patients and history of abortion (n=39). The number of female patient that has a large number of delivery (> 5) was 79 patients, with less number of delivery (1-5) was 20 patients and only one patient with no delivery.

For disease state of the patients, the large number of patients were with history of cardio-vascular diseases (n=160), diabetes mellitus (n=109), less patient number with respiratory diseases (n=82), renal diseases (n=35), thyroid dysfunction (n=16) and 25 patients have other diseases. The largest population of patients were with no history of migraine (n=191) and 9 patients were with history of migraine distributed between 6 patients with former attack and 3 patients with current attack. Also, 183 patients were with no history of obstructive sleep apnea with 14 patients already have OSA and 3 patients with intermittent OSA. For paracetamol use, on almost daily basis ($\geq$ 4 days/wk.) was 15 patients with 34 patients using this drug 2- 3 days/week. and the largest patient number (n=151) using paracetamol once weekly, rarely, or never do. The patients who also use NSAIDs (aspirin, ibuprofen, etc) on almost daily basis ($\geq$ 4 days/wk.) was 101 patients with 27 patients using those drugs 2-3 days/wk and 72 patients using those drugs also once weekly, rarely, or never do.
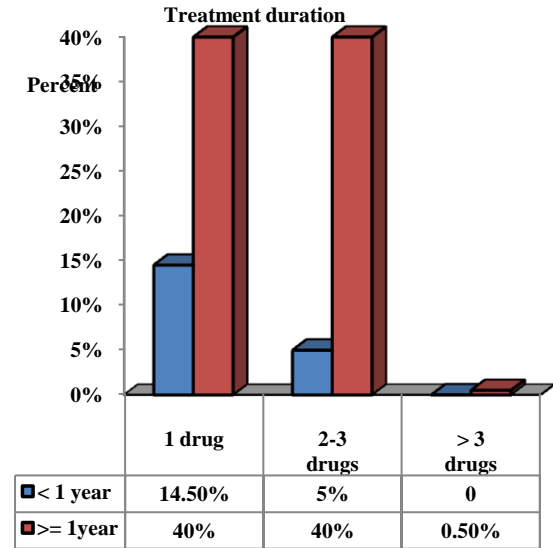
This study also looked for treatment duration of hypertension as illustrated in Figure 3. There is no big difference between number of patients who take 1 and 2-3 anti-hypertensive drugs with equal percent among patients that use their medication for a year or more (40%), but with small difference in treatment duration for less than 1 year (14.5% for 1 drug, 5% for 2-3 drugs). Otherwise, only 0.5% who take their anti-hypertensive for more than one year duration. In addition, the distribution of pulse pressure and pulse rate among study participants is presented. Also, TC, LDL, HDL, FBG range are mentioned in Table 3.

Table 2: Patient's family, medical and drug history of Libyan patients

Parameters		Frequency	%
Family history of Hypertension	YES	76	38
	No	88	44
	Don't know	36	18
History of maternal Hypertension	YES	67	33.5
	No	103	51.5
	Don't know	30	15
History of Paternal Hypertension	YES	36	18
	No	133	66.5
	Don't know	31	15.5
History of brother/sister Hypertension	YES	79	39.5%
	No	101	50.5%
	Don't know	20	10%
Family history of Cardio-Vascular diseases	YES	71	35.5%
	No	110	55%
	Don't know	19	9.5%
Family history of diabetes mellitus	YES	120	60%
	No	69	34.5%
	Don't know	11	5.5%
History of Hypertension in pregnancy	YES	21	21%
	No	66	66%
	Don't know	13	13%
History of abortion	YES	39	39%
	No	54	54%
	Don't know	7	7%
Number of deliver	0	1	1%

	1-5	20	20%
	> 5	79	79%
Renal diseases	YES	35	17.5%
	No	165	82.5%
Thyroid diseases	YES	16	8%
	No	184	92%
DM	YES	109	54.5%
	No	91	45.5%
Cardio-Vascular diseases	YES	160	80%
	No	40	20%
Respiratory diseases	YES	82	41%
	No	118	59%
Other diseases	YES	25	12.5%
	No	175	87.5%
History of migraine	Never	191	95.5%
	Former	6	3%
	Current	3	1.5%
History of OSA	YES	14	7%
	No	183	91.5%
	Often	3	1.5%
Frequency of paracetamol use D/W	<= 1	151	75.5%
	2-3	34	17%
	>= 4	15	7.5%
Frequency of NSAIDs (Aspirin/Ibuprofen) use D/W	<= 1	72	36%
	2-3	27	13.5%
	>= 4	101	50.5%

Treatment duration	1 drug	2-3 drugs	> 3 drugs
< 1 year	14.50%	5%	0
>= 1year	40%	40%	0.50%

Figure 3: The distribution of patient number and duration of hypertension treatment

Most of the patient's pulse pressure was widened (n=130), but only 3 patients was with narrowed pulse pressure and 67 patients with normal pulse pressure. Also, most study patients was with normal pulse rate (n=166) and only fewer patients was with abnormal pulse rate (8 with low abnormal pulse rate & 6 with high abnormal pulse rate). The TC level in most of study patients was in desirable range (n=117); with only 13 patients their cholesterol level was in borderline high range, and fewer patients (n=5) was in high risk range.

Also, TG level was in optimal range in 56 patients with no difference in patients number (42 pts), those were in normal triglycerides range; and almost no different in patients number between borderline high range (19 pts), and high risk range (17 pts). Also, the LDL level was in optimal range in 84 patients, in normal range in 30 patients, in borderline high range in 12 patients, and only 2 patients in very high risk LDL range. Otherwise, large number of study patients was in high risk HDL range (83 pts), where only 16 patients were in normal range and 10 patients were in desirable range; with the notification of HDL ranges difference between male and female patients. Most of study patients were with high blood glucose level (106 pts), with 29 patients with normal blood glucose level, and only 3 patients with low blood glucose level.

Table 3: Distribution of pulse pressure, pulse rate, TC, TG, LDL, HDL and FBG in Libyan patients

Pulse Pressure (PB)	Normal PB	67	33.5%	30-40
	Low or Narrowed PB	3	1.5%	< 30
	High or Widened PB	130	65%	> 40
Pulse Rate (PR)	Normal	166	83%	60-100
	Low abnormal	8	4%	< 60
	High abnormal	6	3%	> 100
	None	20	10%	None
Total Cholesterol	Desirable	117	58.5%	< 200 mg/dl
	Borderline high	13	6.5%	200-239 mg/dl
	High risk	5	2.5%	≥ 240 mg/dl
	None	65	32.5%	None
Triglycerides	Optimal	56	28%	< 100 mg/dl
	Normal	42	21%	100-149 mg/dl
	Borderline high	19	9.5%	150-199 mg/dl
	High risk	17	8.5%	200-499 mg/dl
	Very high risk	0	0%	≥ 500 mg/dl
	None	66	33%	None
LDL	Optimal	84	42%	< 100 mg/dl
	Normal	30	15%	100-129 mg/dl
	Borderline high	12	6%	130-159 mg/dl
	High risk	0	0%	160-189 mg/dl
	Very high risk	2	1%	≥ 190 mg/dl
	None	72	36%	None
HDL	High risk	83	41.5%	< 40 mg/dl for men, < 50 mg/dl for women
	Normal	16	8%	40-49 mg/dl for men,50-59 mg/dl for women
	Desirable	10	5%	≥ 60 mg/dl for both gender
	None	91	45.5%	None
Fasting blood glucose range	Hypo-glycemic	3	1.5%	< 70 mg/dl
	Normal blood sugar	29	14.5%	70-120 mg/dl
	Hyper-glycemic	106	53%	> 120 mg/dl
	None	62	31%	

Discussion

The present findings show risk factors of hypertension and type-2 diabetes prevalence within 200 hypertensive patients in Tripoli. This study with other previous studies indicate that most are elderly people (> 50 years), this of course because as human advances in age, as they will be at a greater risk of developing several diseases as diabetes and/or hypertension (Table 1). Although no particular evidence shows that younger patients suffer from primary hypertension; it has been found that one patient did suffer from secondary hypertension as the latest was suffering from renal artery stenosis. Furthermore; the incidence of females suffering from hypertension is more than males: the reason will be explained later, also Arabs were occupied the vast majority of the cases. In addition, the marital status has an important role as married folks were highly susceptible more than single or divorced and so on. Of course, it is concluded that as family sizes increases the risk of developing the disease also increase, this maybe be due to the increase of risk of developing gestational hypertension in females. On the other hand, increasing the financial demands in the family which is the males responsibility speaking in the mentality of a married person in our domestic population.

Although we did have a strong correlation between finance and chances of having hypertension and diabetes, it is found that the more the income the lesser the chance of developing the diseases. It is important to indicate that most of the cases were retired people, maybe be due to advanced age or to less physical activity. Family history of diabetes was also considered as a risk factor and as previously mentioned females that developed gestational hypertension are at risk of developing hypertension at least in Libyan study, as the increasing number of child delivery; the more the chance of developing

hypertension. Obesity is always a risk factor for many diseases, diabetes and hypertension are not an exception, we found that over-weight and obese patients were occupying the highest number. Other important risk factors for developing hypertension are diabetes mellitus, cardio-vascular disease, migraine and obstructive sleep apnea.

Taking paracetamol was common among the patients may be because it relieves the headache that arises during hypertension and also taking CNSs stimulants such as coffee, tea or energy drinks was also highly present among the individuals that participated in this study. The highest number of cases denied any history of smoking but the summation of passive, former and current smokers was about two-folds more than the non-smokers, whereas most of the cases were females, this does not mean that they are smoker but does not exclude that they were passive smokers. The consumption of fruits and vegetables according to WHO recommendations was low. Increased animal protein consumption is a major risk factor in developing hyper-lipidemia which is one of the hazards that leads to hypertension and diabetes mellitus.

Most cases included in this study had normal systolic and diastolic blood pressure with normal pulse rate because those patients were under treatment control. As for the lipid profile most patients had cholesterol, triglycerides and LDL levels of optimal range in those individuals due to treatment control; but few patients were not in desirable HDL range which might need some critical modification in their life style. Conversing the duration of treatment, most patients were taking medication for a long period which exceeds one year. There was no big difference between taking one medication and two or three drugs but we must put in mind that increase in number of drug administration

may lead to drug-drug interaction which might lead to other complication. Also, there was a correlation between the increase in number of drug administrated and the decrease in patient drug compliance.

In conclusion: this study show that in the local population of the sample not only old age and

male gender are potential threat for an early hypertensive disease but other variables like diabetes, cardiovascular diseases, dyslipidemia, migraine and obstractive apnea are also playing an essential role in hypertension disease. It is also concluded that Libyan population is more prone to hyperglycemia and high pulse pressure with hypertension in majority of population.

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