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Petunjuk Penulisan

Format penyusunan manuskrip
Manuskrip diketik pada kertas berukuran A4 (210 x 297 mm) dengan batas tepi 254 mm (*margin Normal)*, huruf diketik dengan tipe huruf (*font) Times New Roman*, besar huruf (*font size*) 12 point dengan menggunakan spasi rangkap 2 (*double space*). Setiap bagian dari manuskrip dimulai pada halaman baru dengan urutan sebagai berikut: halaman judul, abstrak dan kata kunci (*keywords*), teks keseluruhan, ucapan terima kasih, daftar pustaka, tabel dan gambar (setiap tabel dan gambar pada halaman terpisah). Nomor halaman dicantumkan secara berurutan dimulai dari halaman judul pada sudut sebelah kanan bawah. Manuskrip sebaiknya ditulis maksimal 16 halaman.

Halaman judul
Halaman judul mencakup: a) judul manuskrip yang dibuat sesingkat mungkin, spesifik informatif dan ringkasan judul tidak lebih dari 40 karakter (hitung huruf dan spasi) yang dicantumkan dibawah judul, b) nama penulis disusun berurutan dengan nama mahasiswa sebagai pengarang pertama, diikuti oleh Pembimbing sebagai pengarang kedua. Nama penulis ditulis lengkap tanpa gelar dan dicantumkan seperti aslinya, tidak dibalik seperti pada daftar pustaka dan sitasi, c) alamat setiap penulis, nama departemen dan lembaga afiliasi penulis, d) nama dan alamat penulis untuk korespondensi serta nomor telepon, nomor faksimili, alamat email. Judul penelitian dibuat jelas, singkat, spesifik, informatif, dan sesuai dengan topik manuskrip. Jumlah kata tidak lebih dari 12 kata agar mudah dan cepat dipahami pembaca.

Abstrak dan kata kunci
Abstrak berjumlah 200-250 kata ditulis dalam bahasa Indonesia dan Inggris. Abstrak berisikan latar belakang termasuk tujuan penelitian, metode, hasil, dan kesimpulan. Kata kunci dicantumkan di bawah abstrak pada halaman yang sama sebanyak 4-6 kata. Bagian abstrak merupakan ringkasan dari isi makalah yang dibuat secara singkat, informatif, dengan menekankan pada aspek baru dan penting dari penelitian.

Teks
Teks makalah manuskrip dibagi dalam beberapa bagian dengan judul sebagai berikut: ***Pendahuluan, Metode, Hasil, Pembahasan, Kesimpulan dan saran.***

Pendahuluan
a. Latar belakang merupakan bagian yang menjelaskan alasan mengapa masalah ini penting untuk diteliti. Bagian ini memuat penjelasan mengapa masalah itu dipandang menarik, penting, dan perlu diteliti untuk mencari pemecahannya. Penjelasan dapat diperoleh dari penelusuran pustaka yang berkaitan erat dengan masalah yang diteliti.
b. Keaslian penelitian dikemukakan dengan menunjukkan bahwa masalah yang dihadapi belum pernah dipecahkan oleh peneliti terdahulu atau dinyatakan dengan tegas perbedaan penelitian ini dengan penelitian terdahulu.
c. Tujuan penelitian yang menjelaskan hasil yang akan dicapai.

Metode
Metode penelitian berisi uraian terpadu dan sistematis mengenai bagaimana penelitian akan dilaksanakan. Metode terdiri dari :
a. Desain
b. Populasi / sampel (subjek) penelitian
Diuraikan kriteria inklusi dan eksklusi subjek penelitian, cara pemilihan sampel (subjek penelitian) secara random atau non-random, serta besar sampel yang akan di pilih. Teknik pemilihan sampel harus dijelaskan secara rinci. Bila perlu dibuat alur pemilihan sampel.
c. Bahan dan alat serta pengukuran
Bahan dan alat yang harus disajikan pada laporan terbatas pada bahan (materi) dan alat utama yang diperlukan untuk penelitian dan harus disebutkan spesifikasinya. Prosedur pengukuran perlu dijelaskan sesuai dengan tahapan yang dilakukan.
d. Alur kerja penelitian
Jalannya penelitian perlu dijelaskan mengenai jenis pendekatan yang dipakai untuk
mendapatkan data, melalui pendekatan laboratorium, klinik, komunitas, observasi, dll.
e. Analisis data
Perlu dijelaskan jenis teknik statistik yang digunakan untuk menjawab masalah dan mencapat tujuan penelitian. Data yang diperoleh dapat dianalisis menggunakan teknik statistik secara parametrik dan non-parametrik.

Hasil
Suatu hasil penelitian hendaknya disajikan dengan jelas, logis, runut, sehingga mudah untuk dimengerti. Hasil penelitian sebaiknya ditampilkan selain dalam bentuk narasi dapat pula berupa gambar, tabel, foto, dan grafik sehingga memudahkan untuk dipahami. Hasil dan interpretasi analisis statistik dituliskan secara jelas dalam uraian hasil penelitian.
Pada tahap awal disajikan distribusi karakteristik subjek penelitian, yang biasanya dibuat pada sebuah tabel. Kemudian disajikan temuan penting yang diperoleh, kalau cukup banyak sebaiknya pada sebuah tabel. Bila terbatas misalkan hanya satu atau dua temuan cukup dalam bentuk narasi/teks.
Tabel, bagan/gambar, grafik dibuat dengan jelas, diberi nomor urut serta keterangan yang jelas. Keterangan

tabel diletakan di atas tabel dan keterangan gambar diletakkan di bawah gambar. Maksimal tabel dan gambar 5. Semua tabel, grafik dan gambar diberi nomor dan keterangan yang jelas. Setiap tabel dianalisis dan diinterpretasi secara sistematik, dan hasilnya ditulis di bawah tabel tersebut. Perhitungan statistik detail tidak perlu ditulis dalam bagian hasil ini. Bila perhitungan statistik dianggap perlu ditulis, maka sebaiknya diletakkan dalam lampiran saja.

Pembahasan

Langkah awal harus diuraikan temuan penting yang diperoleh dari penelitian sesuai dengan tujuan penelitian. Kemudian bandingkan hasil penelitian yang diperoleh dengan hasil-hasil penelitian sebelumnya. Perlu dijelaskan kesesuaian dan ketidaksesuaian hasil penelitian yang didapat terhadap kerangka teori atau hasil penelitian lain yang telah dilakukan sebelumnya. Selanjutnya menggunakan teori-teori yang ada uraikan mekanisme terjadinya hasil penelitian tersebut. Bagian pembahasan juga menjelaskan mengenai kelemahan dan kelebihan penelitian yang telah dilakukan. Uraikan implikasi dari hasil penelitian yang diperoleh.

Kesimpulan

Kesimpulan hendaknya dibuat dalam bentuk narasi dan menguraikan secara singkat, jelas, padat menurut urutan yang sistematis. Bagian ini memuat tentang hasil penelitian yang telah diperoleh untuk menjawab tujuan penelitian. Saran menguraikan perlunya dilakukan penelitian lebih lanjut untuk memperbaiki kelemahan/ keterbatasan dari penelitian yang telah dilakukan.

Ucapan terima kasih

Ditujukan kepada pihak-pihak yang memberikan bantuan dana dan dukungan antara lain dukungan dari bagian dan lembaga, para professional yang memberikan kontribusi dalam penyusunan makalah, dan untuk penguji I maupun penguji II. Pembimbing tidak perlu dicantumkan pada Ucapan Terima Kasih karena sudah dicantumkan sebagai penulis.

Daftar Referensi

Daftar referensi/rujukan hanya mencatumkan rujukan yang telah digunakan dan ditulis menurut sistem Vancouver.

Online Submission

Penulis dapat mengirim naskah manuskrip melalui *online submission* di *website* Jurnal Biomedika dan Kesehatan.

Langkah online submission:

1. Pastikan naskah yang akan diunggah sudah mengikuti semua petunjuk penulisan
2. Lakukan pendaftaran author di : https://jbiomedkes.org/index.php/jbk/user/register
3. Setelah terdaftar silakan unggah naskah manuskrip dan isi form yang terdapat di dalam website, dan ikuti langkah selanjutnya.

Daftar Cek Pengiriman Naskah Manuskrip

□ Naskah manuskrip belum pernah dipublikasikan sebelumnya, juga tidak dalam pengajuan ke jurnal lain.
□ File manuskrip harus berformat OpenOffice, Ms. Word atau RTF dokumen, *font* 12, *Times New Roman, double spacing.*
□ Halaman judul harus memuat jelas judul, nama lengkap penulis tanpa gelar, departemen penulis, universitas, alamat lengkap, nomor telepon dan email.
□ Pelaporan data manuskrip dari penelitian yang melibatkan manusia dan hewan memerlukan persetujuan formal (kaji etik) oleh dewan peninjau atau komisi etik institusi yang bersangkutan.
□ Daftar rujukan memuat semua rujukan yang terdapat di dalam manuskrip dan ditulis sesuai urutan pengutipannya menggunakan sistem Vancouver.

Daftar Isi

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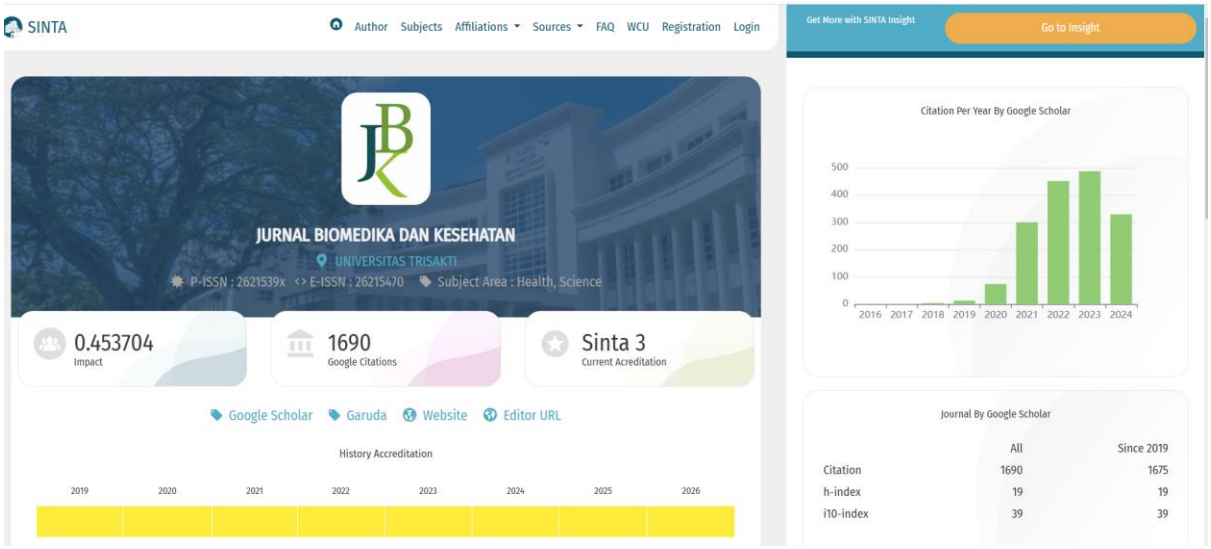

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ORIGINAL ARTICLE

The Correlation between Laboratory Metabolic Profile and Blood Pressure

Korelasi antara Profil Metabolik Laboratorium dan Tekanan Darah

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ABSTRACT

Background

High blood glucose and cholesterol are risk factors for hypertension. This study aims to determine the correlation between blood glucose and cholesterol levels with blood pressure in the normal blood pressure (NBP), controlled hypertension (CHT), and uncontrolled hypertension groups (UHT).

Methods

The study used a cross-sectional design with analytic observations on subjects aged 36 years or older. Ninety-five subjects were divided into three groups: NBP, CHT, and UHT. Subjects were men and women, without chronic heart failure or chronic renal failure. Samples were taken by consecutive random sampling. Blood pressure, body mass index, random BG, and lipid profile (triglycerides, HDL, LDL, total cholesterol) were measured. Statistical test using Spearman correlation test with p-value <0.05 significantly.

Results

There were 95 subjects with a range age of 36-81 years old. There were 30 NBP subjects, 34 CHT subjects, and 31 UHT subjects. There was a weak positive correlation between HDL level and diastolic BP in the NBP group (r=0.391;p=0.032). There was no correlation between blood glucose and other lipid profiles with BP in the three groups.

Conclusions

The increase in HDL is accompanied by an increase in diastolic blood pressure in NT but not with random blood sugar and other lipid profiles in all three blood pressure groups.

Keywords: blood glucose; cholesterol; blood pressure; hipertensi, korelasi

ABSTRAK

Latar Belakang

Kadar gula darah (GD) dan kolesterol (K) yang tinggi merupakan faktor risiko untuk hipertensi. Penelitian kali ini untuk menentukan korelasi antara kadar KG dan K dengan tekanan darah (TD) pada kelompok tekanan darah normal (TDN), hipertensi terkontro (HTK), dan hipertensi tidak terkontrol (HTT).

Metode

Penelitian ini menggunakan disasin potong lintang dengan observasi analitik pada subyek berusia 36 tahun atau lebih. Sebanyak 95 subyek dibagi menadi tiga kelompok: TDN, HTK, HTT. Subyek terdiri dari laki-laki dan perempuan dan tidak mengalami gagal jantung atau gagal ginjal. Pengambilan sampel berdasarkan consecutive renadom sampling. Dilakukan pengukuran terhadap tekanan darah, indeks masa tubuh, gula darah acak, profil lipid (trigliserida), HDL, LDL, total kolesterol). Dilakukan uji korelasi Spearman dengan nilai p signifikan <0.05.

Hasil

Terdapat sebanyak 95 subyek dengan rentang usia 36-81 tahun. Terdapat 30 subyek tekanan darah normal, 34 subyek hipertensi terkontrol, 31 subyek hipertensi tidak terkontrol. Terdapat korelasi positif lemah antara HDL dengan tekanan darah diastolik pada kelompok tekanan darah normal (r=0.391 ;p=0.032). Tidak terdapat korelasi antara gula darah dan profil lipid lainnya pada ketiga kelompok tekanan darah.

Kesimpulan

The increase in HDL is accompanied by an increase in diastolic blood pressure in NBP but not with random blood sugar and other lipid profiles in all three blood pressure groups.

Kata Kunci: gula darah; kolesterol; tekanan darah; hipertensi; korelasi

INTRODUCTION

Hypertension is a persistent increase in systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg, which is a global health problem worldwide.[1] It occurs in the age group of 31-44 years old (31.6%), 45-54 years old (45.3%), and 55-64 years old (55.2%).[2] Hypertension is a silent killer disease whose symptoms are rarely seen in the early stages, until complications arise such as coronary heart disease, heart failure, myocardial infarction, atrial fibrillation, peripheral vascular disease, stroke, chronic kidney disease, cognitive impairment, which can lead to death and disability in the worldwide.[3, 4] Most people are not aware that their blood pressure is increasing, so it is necessary to do a screening examination by measuring blood pressure. Although most hypertensive patients (HP) are asymptomatic, some HP report symptoms of headache, dizziness, vertigo, visual disturbances, or fainting.[3] Among several factors that cause hypertension as mentioned above, high blood glucose (BG) and cholesterol (C) are factors that are often found. Regarding the relationship between BG and hypertension, a study conducted by Yan et al found that higher BG levels, although still within the normal range, were significantly associated with a higher prevalence of hypertension in both men and women.[5] Midha et al also found a significant relationship between fasting BG and systolic blood pressure.[6] Likewise, Dwi et al found there was a significant correlation between BG and hypertension where the higher the BG, the higher the blood pressure.[7]

A study conducted by Umar and Mariana found a positive correlation between total cholesterol (TC) and systolic blood pressure (r=0.509, p=0.000).[8] A study conducted on Chinese adult men found that the incidence of hypertension was associated with an increase in TC, low-density lipoprotein (LDL), and non-high-density lipoprotein (HDL), but not with triglycerides (TG).[9] However, the research of Saputra et al did not find a significant correlation between TC levels and hypertension.[10]

In addition to the differences in the results above, the data obtained are still researching, in general, the relationship between BG and C with hypertension, but no specific research has been found to know the differences in the correlation between BG and C levels with blood pressure in normotension, controlled hypertension, and uncontrolled hypertension, especially in patients aged 36 years or older. This study aims to know the correlation between random blood glucose (BG) and lipid profile (LP) levels with blood pressure (normotension, controlled and uncontrolled hypertension) in patients 36 years old or older.

METHODS

Subjects

This study used a cross-sectional design with analytical observations on HP. Sampling is based on consecutive non-random sampling. The subjects were 36 years old or older, male and female, who came for treatment at a hospital in Jakarta and were willing to participate in this study by signing an informed consent. Exclusion criteria in this study were patients with a history of chronic heart failure and chronic kidney failure.

Collecting Data

Blood pressure measurements were taken using a validated Erkameter Flex digital sphygmomanometer. The device is regularly checked and calibrated for accuracy and safety quarterly by the technical and maintenance division and annually by a third-party company. Blood pressure values were taken in a sitting position after 2-5 minutes of resting. Two sequential measurements were taken at each arm. The first measurements were scrapped. The respondent's blood pressure was the second measurement of the left or right arm, whichever was higher. Blood pressure category according to JNC-7. Blood pressure (BP) in this study was divided into three groups, namely normal blood pressure (NBP), controlled hypertension (CHT), and uncontrolled hypertension (UHT). NBP patients are patients with normal blood pressure when measured and have no history of hypertension. CHT patients are patients who have been diagnosed with hypertension and are undergoing therapy with antihypertension drugs and normal blood pressure when measured on-site. UHT patients are patients who have been diagnosed with hypertension have been treated with or without antihypertension drugs and have high blood pressure when measured on site. Height was measured by microtoise and body weight was measured using a GEA brand digital weight scale. Measurement of sugar levels and lipid profiles taken from blood serum.

Statistical analysis

If the data distribution is not normal, then the univariate data is displayed with the median, minimum, and maximum values; while the bivariate analysis used the Spearman correlation test, with p-value <0.05 significantly. This research has obtained a research ethics permit from the Faculty of Medicine, Universitas Trisakti with the number 177/KER/FK/VIII/2022.

RESULTS

The subjects studied were 95 people, 30 NBP subjects, 34 CHT subjects, and 31 UHT subjects. Table 1 shows that NBP subjects have an age range of 36-81 years old, 36-80 years old for CHT subjects, and 38-76 years old for UHT subjects. It appears that UHT patients have a higher median BMI (27.02) compared to NBP (24.06) and CHT (24.5). Likewise systolic blood pressure (SBP) and diastolic blood pressure (DBP). The range of BG levels in NT is 74-432 mg/dL, CHT is 69-256 mg/dL, and UHT is 72-275 mg/dL. Furthermore, the values of TC, LDL, HDL, and TG can be seen in Table 1.

Table 1. Characteristics and clinical data of subjects

Variables	Median NBP/CHT/UHT	Minimum NBP/CHT/UHT	Maximum NBP/CHT/UCT
Age (years)	52.5/59.5/62	37/42/36	81/80/73
BMI	24.06/24.38/28.06	16.66/17.91/18.31	29.21/47.65/38.21
SBP (mmHg)	120/131.75/157	100.5/111.5/140	139/139.5/202
DBP (mmHg)	67.75/70/86	55.5/51.50/54	82/69.5/130
BG (mg/dL)	97/109/102	74/69/72	432/256/365
TC (mg/dL)	204.5/186.5/195	113/130/123	273/318/275
LDL (mg/dL)	133.5/118/124	43/50/64	198/204/193
HDL (mg/dL)	49.5/49/48	29/33/29	75/86/89
TG (mg/dl)	157.5/173/188	57/70/61	434/518/412

NBP: normal blood pressure; CHT:controlled hypertension; UHT: uncontrolled hypertension; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure: BG: blood glucose; TC:total cholesterol; LDL: low density lipoprotein; HDL: high density lipoprotein; TG: triglyceride

The correlation analysis in Table 2 shows that there was a weak positive correlation between DBP and HDL in the NBP group (r=0.391; p=0.032).

Table 2. Correlation between blood glucose and cholesterol with blood pressure in normal, controlled hypertension, and uncontrolled hypertension subjects.

Variables	Normal blood pressure (NBP)(n=30)		Controlled hypertension (CHT) (n=34)		Uncontrolled (UHT) (n=31) hypertension	
	r	p	r	p	r	p-value‡
BG-SBP	0.015	0.938	0.095	0.593	-0.057	0.761
TC-SBP	-0.207	0.273	0.008	0.966	-0.002	0.992
LDL-SBP	-0.180	0.341	0.167	0.344	0.042	0.821
HDL-SBP	0.172	0.364	-0.100	0.055	-0.242	0.190
TG-SBP	-0.291	0.119	-0.208	0.237	0.031	0.869
BG-DBP	-0.070	0.713	-0.137	0.441	-0.246	0.184
TC-DBP	0.217	0.250	0.127	0.475	0.013	0.945
LDL-DBP	0.117	0.537	0.156	0.379	-0.006	0.974
HDL-DBP	0.391	**0.032***	-0.229	0.192	-0.127	0.498
TG-DBP	-0.194	0.305	0.322	0.063	-0.038	0.841

SBP, systolic blood pressure; DBP, diastolic blood pressure; BG, blood glucose; TC, total cholesterol; LDL, low-density lipoprotein; HDL, high-density lipoprotein; TG, triglyceride

‡ Spearman correlation test; significant p-value < 0.05

In this current study, it was also found that there was a negative correlation between HDL and TG levels in NBP, CHT, and UHT, namely when HDL decreased, TG increased, and vice versa (Figure 1).

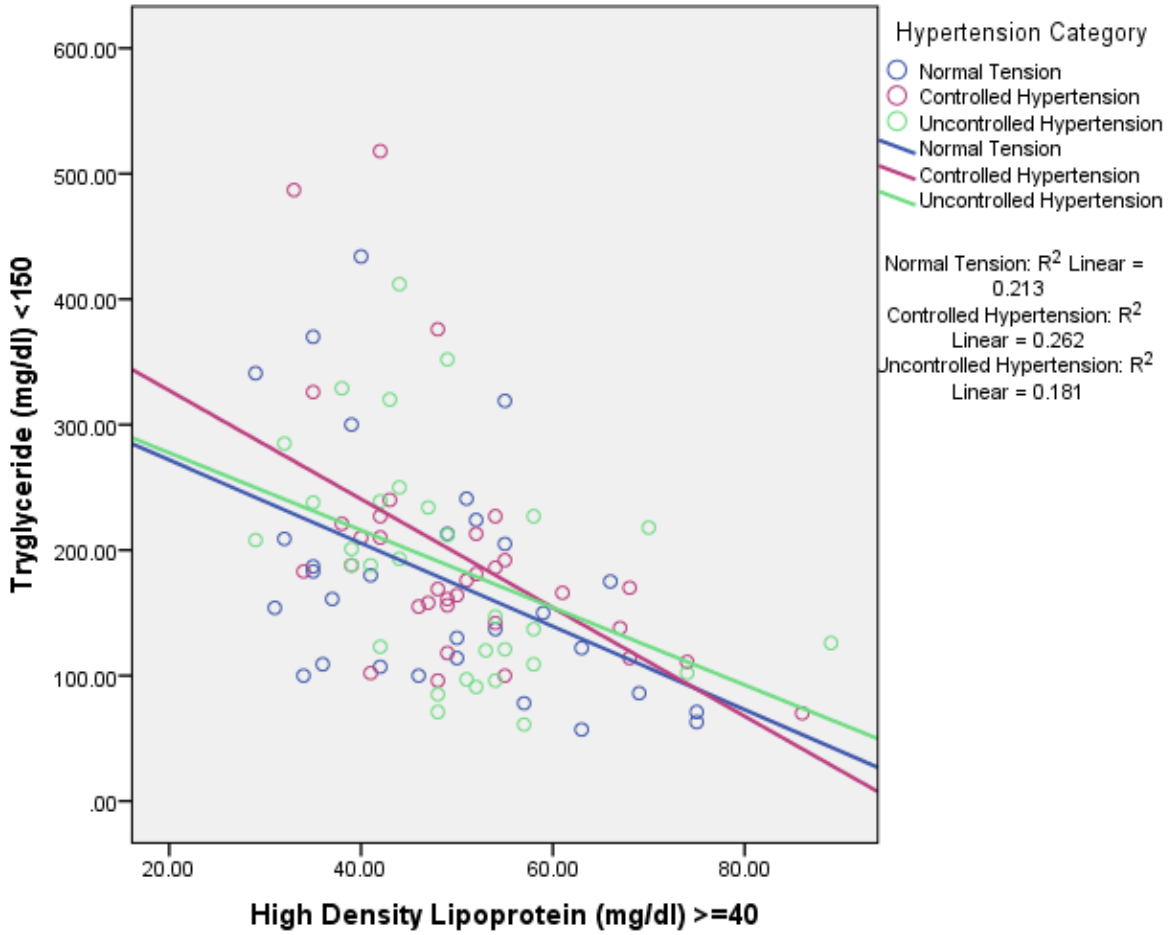

Figure 1. Distribution of negative correlation between HDL and TG in normal blood pressure (r=-0.466; p=0.009), controlled hypertension (r=-0.503; p=0.003), and uncontrolled hypertension (r=-0.457; p=0.007). Significant p-value <0.05.

DISCUSSION

Characteristics Subjects

A total of 95 subjects were involved in this study. The age of the research subjects ranged from 36 years to 81 years. The data (Tabel 1) shows that the median of SBP of NBP is 120 mmHg, CHT is 131.75 mmHg, and UHT is 157 mmHg, while the median of DBP of NBP is 67.75 mmHg, CHT is 70 mmHg, and UHT is 86 mmHg. It is known that BP measurements are influenced by body condition. Research conducted by Wulandari and Samara found that SBP in the evening was higher than in the morning, while there was no difference in DBP between the evening and morning.[11] The study conducted by Wielemborek et al shows that systolic blood pressure increases with dynamic workload as a result of increasing stroke volume, diastolic blood pressure usually does not change or decrease but not significantly.[12] This study carried out blood pressure measurements according to the time the patient arrived for treatment at the polyclinic in the morning until noon, therefore the range of BP could vary.

Correlation between Blood Glucose and Blood Pressure

In the present study, no correlation was found between SBP and BG or between DBP and BG, in the NBP, CHT, and UHT groups. Meanwhile, Midha et al in their research found no correlation between SBP and fasting BG, but there was a significant correlation between DBP and fasting BG.[6]

The difference between Midha et al's research and this current research is that Midha et al's research was conducted on subjects aged 17-19 years while the current study was on subjects aged 36 years old and over.

Yan et al in their study found that both hyperglycemia and high fasting BG was associated with a high prevalence in patients with hypertension independent of cardiovascular disease risk factors among the Chinese elderly. On the other hand, patients with hypertension, even patients with normal high BP, are also associated with a higher prevalence in patients with hyperglycemia.[5]

One of the causes of hypertension in patients with high BG is the presence of vascular endothelial dysfunction and increased activation of the renin-angiotensin-aldosterone system. Changes in the elasticity of the lumen of blood vessels that affect blood flow through the arteries. The occurrence of a minimal reduction in luminal diameter can result in an exponential increase in blood flow resistance. Adverse structural and functional changes in the lumen of the small arteries and arterioles are frequently found in HP. The occurrence of vascular remodeling, low-grade inflammation, fibrosis, and vascular stiffness found in HP with diabetes can cause blood pressure to increase.[13] Although hypertension appears due to an increase in body fluid volume, there is also a role for progressive vascular remodeling and peripheral resistance which generally occurs in diabetic patients and causes an increase in blood pressure.[14] In the present study, no correlation was found between BG and BP, this was because based on BG test, only 22 patients (23.16%) had BG above 140 mg/dL.

Correlation between Cholesterol and Blood Pressure

In this study, it was found that there was a low positive correlation between DBP and HDL in the NBP group, which means that an increase in DBP is followed by an increase in HDL, and vice versa. This is different from the results obtained by Aziz who found that HDL has an inverse correlation with SBP and DBP in non-HP. [15] However, Shimizu et al found a positive association between HDL and hypertension in patients with high circulating CD34-positive cells.[16] Looking at the research results obtained and related to this study, it is necessary to carry out further research related to HDL levels and blood pressure based on CD34 levels.

In this study, it was found that there was no correlation between DBP and TG in each group of blood pressure. However, Anika et al found a correlation between DBP and TG (r=0.457; p=0.003).[17] Increased levels of TG in the blood cause blood viscosity to increase resulting in impaired blood flow. The heart works harder to pump blood, causing blood pressure to increase. Hypercholesterolemia can also cause a build-up of C in the lumen of the arteries, causing atherosclerosis and resulting in narrowing, hardening, and stiffness of the arteries. This causes increased peripheral vascular resistance and increased blood pressure.[18] TG in plasma is carried by chylomicrons and VLDL, collectively referred to as triglyceride-rich lipoproteins (TGRL). High TG ranges from mild to very severe based on differences in TGRL composition and metabolism.[19] Although chylomicrons and VLDL particles are generally too large to cross the endothelium, TG can affect some specific aspects of the development of atherosclerotic lesions.[20] Serum TG is a biomarker for TGRL, and some evidence suggests that TGRL and cholesterol-enriched residual particles are associated with atherogenesis.[20] This atherogenesis disrupts blood flow in the blood vessels, causing blood pressure to increase as described above. The same thing was found by Raposeiras-Roubin et al who found that high TG was associated with subclinical atherosclerosis, and vascular inflammation, even with normal LDL levels.[21] Meanwhile, a study conducted by Aberra et al in subjects aged 40-65 years found that increasing TG increased the risk of developing cardiovascular disease.[22]

In this study, it was also found that there was no correlation between TC and SBP or DBP. However, in a study conducted by Umar and Mariana in adult HP, they found a significant correlation between TC and SBP.[8] Sakurai et al also found a positive correlation between dietary C

and SBP, in which women had a stronger relationship than men.[23] Research conducted by Znyk et al found subjects with high blood pressure had a 2.3 times risk of finding high C levels when examined.[24] Research conducted by Satoh et al found a relationship between increased C and increased SBP. High BP and high TC synergistically increase the risk of death in Asian populations.[25] A study conducted by Yeasmin et al in women aged 30-50 years found that fasting serum TG and fasting serum TC levels were significantly higher in hypertension subjects than controls. There is a positive correlation in hypertension subjects between fasting serum TG and fasting serum TC with SBP and DBP.[26]

It is known that the significance of TC and SBP is based on the accumulation of lipids that cause structural changes in blood vessels. This is related to reduced elasticity of the large arteries, which is generally known as the main pathology of changes in arterial hypertension in the elderly. In addition, dyslipidemia is also responsible for changes in vasomotor activity mediated by nitric oxide, and hyperinsulinemia (increasing circulating catecholamines) which causes hypertension.[8,26]

While the results of a study conducted by Patel et al found an exponential association between high TG and the risk of acute and chronic pancreatitis, new diabetes, and mortality, especially at the age of 40 years or younger, however, the incidence of MCI was only at greater risk in subjects with moderate-high TG.[27] Severe TG is defined as a plasma TG concentration of >10 mmol/L (>885 mg/dL) but is less common, with a prevalence range from 0.10 to 0.20%. Very severe hypertriglyceridemia (HTG) >2- mmol/L (>1770 mg/dL is rare (prevalence 0.014%).[27,28]

Genome-wide association studies (GWAS) found a causal relationship between increased TG and CVD, but the function of many GWAS-identified genetic variants is still unknown.[29] Epidemiological and genetic studies have shown that TGRL and their remnants are an important contribution to atherosclerotic cardiovascular disease (ASCVD). In addition, HTG is the most common cause of pancreatitis.[30]

In terms of the relationship between TG and HDL and CHD risk, a study conducted by Lee et al found that subjects with high fasting TG levels (≥150 mg/dL) and low fasting HDL levels (<40 mg/dL for men and <50 mg/dL for women) had a 1.32 times greater hazard ratio (95% CI 1.06-1.64) for the occurrence of CHD than subjects with normal TG and HDL levels. Meanwhile, subjects with LDL levels ≥130 mg/dL can increase the risk of stroke.[31] Research conducted by Joshi et al found that the 14-triglyceride-containing sub-fraction was negatively correlated with HDL, while the presence of 13 fractions (and the strongest was VLDL) could increase the risk of developing CHD (OR 1.12-1.22).[32]

Decreased HDL will cause an increase in TG as found in this current study. This means that if HDL increases, TG will decrease, and vice versa, both in the NT, CHT, and UHT groups. Therefore it is necessary to pay attention to lifestyles that can increase HDL so that TG does not increase. If it cannot be overcome with a lifestyle, then management of lowering blood TG is needed with drugs such as statins.

Limitation

The limitation of this study was BG and C tests in this study were not carried out on fasting subjects. This study also did not clarify the treatment of diabetes mellitus and cholesterolemia in detail. To get more accurate data, for further future studies, it is needed to ask patients to fast for 8-10 hours before BG and C are taken. In addition, it is necessary to have complete data collection about the treatment currently being carried out by the patient which consists of the type of drug, the rules for use, and medication adherence.

CONCLUSION

There is a correlation between HDL and blood pressure in the normotension group. However, there is no correlation between blood glucose and other lipid profiles (TG, LDL, TC) with blood pressure in normotension, controlled hypertension, and uncontrolled hypertension groups. An increase in TG is followed by a decrease in HDL both in normal blood pressure and in hypertension, both in controlled and uncontrolled hypertension groups. There needs to be attention to dietary regulation so that it can reduce the risk of hypercholesterolemia which causes metabolic syndrome and hypertension. The research between laboratory metabolic profile and blood pressure needs to be studied more deeply.

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AUTHORS CONTRIBUTION

TDS plays a role in preparing research designs, data collection, data analysis, and data interpretation, and is responsible for data collection in the field, and preparing manuscripts; MW plays a role in drafting concepts, data analysis, data interpretation, preparing manuscripts, revising the final manuscript for publication; AK plays a role in data collection in the field, data interpretation, and revising the final manuscript for publication

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CONFLICT OF INTEREST

There are no conflicts of interest

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Correlation Lab and BP

by Tjam Diana Samara FK

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ORIGINAL ARTICLE

The Correlation between Laboratory Metabolic Profile and Blood Pressure

Korelasi antara Profil Metabolik Laboratorium dan Tekanan Darah

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ABSTRACT

Background

High blood glucose and cholesterol are risk factors for hypertension. This study aims to determine the correlation between blood glucose and cholesterol levels with blood pressure in the normal blood pressure (NBP), controlled hypertension (CHT), and uncontrolled hypertension groups (UHT).

Methods

The study used a cross-sectional design with analytic observations on subjects aged 36 years or older. Ninety-five subjects were divided into three groups: NBP, CHT, and UHT. Subjects were men and women, without chronic heart failure or chronic renal failure. Samples were taken by consecutive random sampling. Blood pressure, body mass index, random BG, and lipid profile (triglycerides, HDL, LDL, total cholesterol) were measured. Statistical test using Spearman correlation test with p-value <0.05 significantly.

Results

There were 95 subjects with a range age of 36-81 years old. There were 30 NBP subjects, 34 CHT subjects, and 31 UHT subjects. There was a weak positive correlation between HDL level and diastolic BP in the NBP group (r=0.391;p=0.032). There was no correlation between blood glucose and other lipid profiles with BP in the three groups.

Conclusions

The increase in HDL is accompanied by an increase in diastolic blood pressure in NT but not with random blood sugar and other lipid profiles in all three blood pressure groups.

Keywords: blood glucose; cholesterol; blood pressure; hipertensi, korelasi

ABSTRAK

Latar Belakang

Kadar gula darah (GD) dan kolesterol (K) yang tinggi merupakan faktor risiko untuk hipertensi. Penelitian kali ini untuk menentukan korelasi antara kadar KG dan K dengan tekanan darah (TD) pada kelompok tekanan darah normal (TDN), hipertensi terkontro (HTK), dan hipertensi tidak terkontrol (HTT).

Metode

Penelitian ini menggunakan disasin potong lintang dengan observasi analitik pada subyek berusia 36 tahun atau lebih. Sebanyak 95 subyek dibagi menadi tiga kelompok: TDN, HTK, HTT. Subyek terdiri dari laki-laki dan perempuan dan tidak mengalami gagal jantung atau gagal ginjal. Pengambilan sampel berdasarkan consecutive renadom sampling. Dilakukan pengukuran terhadap tekanan darah, indeks masa tubuh, gula darah acak, profil lipid (trigliserida), HDL, LDL, total kolesterol). Dilakukan uji korelasi Spearman dengan nilai p signifikan <0.05.

Hasil

Terdapat sebanyak 95 subyek dengan rentang usia 36-81 tahun. Terdapat 30 subyek tekanan darah normal, 34 subyek hipertensi terkontrol, 31 subyek hipertensi tidak terkontrol. Terdapat korelasi positif lemah antara HDL dengan tekanan darah diastolik pada kelompok tekanan darah normal (r=0.391 ;p=0.032). Tidak terdapat korelasi antara gula darah dan profil lipid lainnya pada ketiga kelompok tekanan darah.

Kesimpulan

The increase in HDL is accompanied by an increase in diastolic blood pressure in NBP but not with random blood sugar and other lipid profiles in all three blood pressure groups.

Kata Kunci: gula darah; kolesterol; tekanan darah; hipertensi; korelasi

INTRODUCTION

Hypertension is a persistent increase in systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg, which is a global health problem worldwide.[1] It occurs in the age group of 31-44 years old (31.6%), 45-54 years old (45.3%), and 55-64 years old (55.2%).[2] Hypertension is a silent killer disease whose symptoms are rarely seen in the early stages, until complications arise such as coronary heart disease, heart failure, myocardial infarction, atrial fibrillation, peripheral vascular disease, stroke, chronic kidney disease, cognitive impairment, which can lead to death and disability in the worldwide.[3, 4] Most people are not aware that their blood pressure is increasing, so it is necessary to do a screening examination by measuring blood pressure. Although most hypertensive patients (HP) are asymptomatic, some HP report symptoms of headache, dizziness, vertigo, visual disturbances, or fainting.[3] Among several factors that cause hypertension as mentioned above, high blood glucose (BG) and cholesterol (C) are factors that are often found. Regarding the relationship between BG and hypertension, a study conducted by Yan et al found that higher BG levels, although still within the normal range, were significantly associated with a higher prevalence of hypertension in both men and women.[5] Midha et al also found a significant relationship between fasting BG and systolic blood pressure.[6] Likewise, Dwi et al found there was a significant correlation between BG and hypertension where the higher the BG, the higher the blood pressure.[7]

A study conducted by Umar and Mariana found a positive correlation between total cholesterol (TC) and systolic blood pressure (r=0.509, p=0.000).[8] A study conducted on Chinese adult men found that the incidence of hypertension was associated with an increase in TC, low-density lipoprotein (LDL), and non-high-density lipoprotein (HDL), but not with triglycerides (TG).[9] However, the research of Saputra et al did not find a significant correlation between TC levels and hypertension.[10]

In addition to the differences in the results above, the data obtained are still researching, in general, the relationship between BG and C with hypertension, but no specific research has been found to know the differences in the correlation between BG and C levels with blood pressure in normotension, controlled hypertension, and uncontrolled hypertension, especially in patients aged 36 years or older. This study aims to know the correlation between random blood glucose (BG) and lipid profile (LP) levels with blood pressure (normotension, controlled and uncontrolled hypertension) in patients 36 years old or older.

METHODS

Subjects

This study used a cross-sectional design with analytical observations on HP. Sampling is based on consecutive non-random sampling. The subjects were 36 years old or older, male and female, who came for treatment at a hospital in Jakarta and were willing to participate in this study by signing an informed consent. Exclusion criteria in this study were patients with a history of chronic heart failure and chronic kidney failure.

Collecting Data

Blood pressure measurements were taken using a validated Erkameter Flex digital sphygmomanometer. The device is regularly checked and calibrated for accuracy and safety quarterly by the technical and maintenance division and annually by a third-party company. Blood pressure values were taken in a sitting position after 2-5 minutes of resting. Two sequential measurements were taken at each arm. The first measurements were scrapped. The respondent's blood pressure was the second measurement of the left or right arm, whichever was higher. Blood pressure category according to JNC-7. Blood pressure (BP) in this study was divided into three groups, namely normal blood pressure (NBP), controlled hypertension (CHT), and uncontrolled hypertension (UHT). NBP patients are patients with normal blood pressure when measured and have no history of hypertension. CHT patients are patients who have been diagnosed with hypertension and are undergoing therapy with antihypertension drugs and normal blood pressure when measured on-site. UHT patients are patients who have been diagnosed with hypertension have been treated with or without antihypertension drugs and have high blood pressure when measured on site. Height was measured by microtoise and body weight was measured using a GEA brand digital weight scale. Measurement of sugar levels and lipid profiles taken from blood serum.

Statistical analysis

If the data distribution is not normal, then the univariate data is displayed with the median, minimum, and maximum values; while the bivariate analysis used the Spearman correlation test, with p-value <0.05 significantly. This research has obtained a research ethics permit from the Faculty of Medicine, Universitas Trisakti with the number 177/KER/FK/VIII/2022.

RESULTS

The subjects studied were 95 people, 30 NBP subjects, 34 CHT subjects, and 31 UHT subjects. Table 1 shows that NBP subjects have an age range of 36-81 years old, 36-80 years old for CHT subjects, and 38-76 years old for UHT subjects. It appears that UHT patients have a higher median BMI (27.02) compared to NBP (24.06) and CHT (24.5). Likewise systolic blood pressure (SBP) and diastolic blood pressure (DBP). The range of BG levels in NT is 74-432 mg/dL, CHT is 69-256 mg/dL, and UHT is 72-275 mg/dL. Furthermore, the values of TC, LDL, HDL, and TG can be seen in Table 1.

Table 1. Characteristics and clinical data of subjects

Variables	Median NBP/CHT/UHT	Minimum NBP/CHT/UHT	Maximum NBP/CHT/UCT
Age (years)	52.5/59.5/62	37/42/36	81/80/73
BMI	24.06/24.38/28.06	16.66/17.91/18.31	29.21/47.65/38.21
SBP (mmHg)	120/131.75/157	100.5/111.5/140	139/139.5/202
DBP (mmHg)	67.75/70/86	55.5/51.50/54	82/69.5/130
BG (mg/dL)	97/109/102	74/69/72	432/256/365
TC (mg/dL)	204.5/186.5/195	113/130/123	273/318/275
LDL (mg/dL)	133.5/118/124	43/50/64	198/204/193
HDL (mg/dL)	49.5/49/48	29/33/29	75/86/89
TG (mg/dl)	157.5/173/188	57/70/61	434/518/412

NBP: normal blood pressure; CHT:controlled hypertension; UHT: uncontrolled hypertension; BMI: body mass index; SBP: systolic blood pressure; DBP: diastolic blood pressure: BG: blood glucose; TC:total cholesterol; LDL: low density lipoprotein; HDL: high density lipoprotein; TG: triglyceride

The correlation analysis in Table 2 shows that there was a weak positive correlation between DBP and HDL in the NBP group (r=0.391; p=0.032).

Table 2. Correlation between blood glucose and cholesterol with blood pressure in normal, controlled hypertension, and uncontrolled hypertension subjects.

Variables	Normal blood pressure (NBP)(n=30)		Controlled hypertension (CHT) (n=34)		Uncontrolled hypertension (UHT) (n=31)	
	r	p	r	p	r	p-value‡
BG-SBP	0.015	0.938	0.095	0.593	-0.057	0.761
TC-SBP	-0.207	0.273	0.008	0.966	-0.002	0.992
LDL-SBP	-0.180	0.341	0.167	0.344	0.042	0.821
HDL-SBP	0.172	0.364	-0.100	0.055	-0.242	0.190
TG-SBP	-0.291	0.119	-0.208	0.237	0.031	0.869
BG-DBP	-0.070	0.713	-0.137	0.441	-0.246	0.184
TC-DBP	0.217	0.250	0.127	0.475	0.013	0.945
LDL-DBP	0.117	0.537	0.156	0.379	-0.006	0.974
HDL-DBP	0.391	**0.032***	-0.229	0.192	-0.127	0.498
TG-DBP	-0.194	0.305	0.322	0.063	-0.038	0.841

SBP, systolic blood pressure; DBP, diastolic blood pressure; BG, blood glucose; TC, total cholesterol; LDL, low-density lipoprotein; HDL, high-density lipoprotein; TG, triglyceride

‡ Spearman correlation test; significant p-value < 0.05

In this current study, it was also found that there was a negative correlation between HDL and TG levels in NBP, CHT, and UHT, namely when HDL decreased, TG increased, and vice versa (Figure 1).

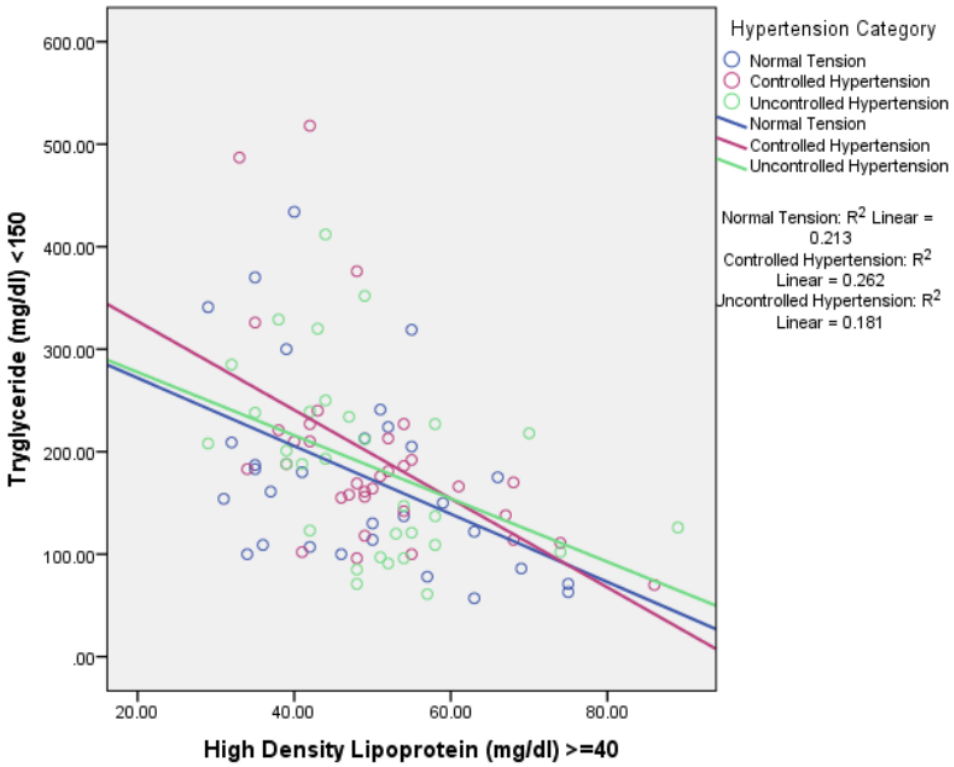

Figure 1. Distribution of negative correlation between HDL and TG in normal blood pressure (r=-0.466; p=0.009), controlled hypertension (r=-0.503; p=0.003), and uncontrolled hypertension (r=-0.457; p=0.007). Significant p-value <0.05.

DISCUSSION

Characteristics Subjects

A total of 95 subjects were involved in this study. The age of the research subjects ranged from 36 years to 81 years. The data (Tabel 1) shows that the median of SBP of NBP is 120 mmHg, CHT is 131.75 mmHg, and UHT is 157 mmHg, while the median of DBP of NBP is 67.75 mmHg, CHT is 70 mmHg, and UHT is 86 mmHg. It is known that BP measurements are influenced by body condition. Research conducted by Wulandari and Samara found that SBP in the evening was higher than in the morning, while there was no difference in DBP between the evening and morning.[11] The study conducted by Wielemborek et al shows that systolic blood pressure increases with dynamic workload as a result of increasing stroke volume, diastolic blood pressure usually does not change or decrease but not significantly.[12] This study carried out blood pressure measurements according to the time the patient arrived for treatment at the polyclinic in the morning until noon, therefore the range of BP could vary.

Correlation between Blood Glucose and Blood Pressure

In the present study, no correlation was found between SBP and BG or between DBP and BG, in the NBP, CHT, and UHT groups. Meanwhile, Midha et al in their research found no correlation between SBP and fasting BG, but there was a significant correlation between DBP and fasting BG.[6]

The difference between Midha et al's research and this current research is that Midha et al's research was conducted on subjects aged 17-19 years while the current study was on subjects aged 36 years old and over.

Yan et al in their study found that both hyperglycemia and high fasting BG was associated with a high prevalence in patients with hypertension independent of cardiovascular disease risk factors among the Chinese elderly. On the other hand, patients with hypertension, even patients with normal high BP, are also associated with a higher prevalence in patients with hyperglycemia.[5]

One of the causes of hypertension in patients with high BG is the presence of vascular endothelial dysfunction and increased activation of the renin-angiotensin-aldosterone system. Changes in the elasticity of the lumen of blood vessels that affect blood flow through the arteries. The occurrence of a minimal reduction in luminal diameter can result in an exponential increase in blood flow resistance. Adverse structural and functional changes in the lumen of the small arteries and arterioles are frequently found in HP. The occurrence of vascular remodeling, low-grade inflammation, fibrosis, and vascular stiffness found in HP with diabetes can cause blood pressure to increase.[13] Although hypertension appears due to an increase in body fluid volume, there is also a role for progressive vascular remodeling and peripheral resistance which generally occurs in diabetic patients and causes an increase in blood pressure.[14] In the present study, no correlation was found between BG and BP, this was because based on BG test, only 22 patients (23.16%) had BG above 140 mg/dL.

Correlation between Cholesterol and Blood Pressure

In this study, it was found that there was a low positive correlation between DBP and HDL in the NBP group, which means that an increase in DBP is followed by an increase in HDL, and vice versa. This is different from the results obtained by Aziz who found that HDL has an inverse correlation with SBP and DBP in non-HP. [15] However, Shimizu et al found a positive association between HDL and hypertension in patients with high circulating CD34-positive cells.[16] Looking at the research results obtained and related to this study, it is necessary to carry out further research related to HDL levels and blood pressure based on CD34 levels.

In this study, it was found that there was no correlation between DBP and TG in each group of blood pressure. However, Anika et al found a correlation between DBP and TG (r=0.457; p=0.003).[17] Increased levels of TG in the blood cause blood viscosity to increase resulting in impaired blood flow. The heart works harder to pump blood, causing blood pressure to increase. Hypercholesterolemia can also cause a build-up of C in the lumen of the arteries, causing atherosclerosis and resulting in narrowing, hardening, and stiffness of the arteries. This causes increased peripheral vascular resistance and increased blood pressure.[18] TG in plasma is carried by chylomicrons and VLDL, collectively referred to as triglyceride-rich lipoproteins (TGRL). High TG ranges from mild to very severe based on differences in TGRL composition and metabolism.[19] Although chylomicrons and VLDL particles are generally too large to cross the endothelium, TG can affect some specific aspects of the development of atherosclerotic lesions.[20] Serum TG is a biomarker for TGRL, and some evidence suggests that TGRL and cholesterol-enriched residual particles are associated with atherogenesis.[20] This atherogenesis disrupts blood flow in the blood vessels, causing blood pressure to increase as described above. The same thing was found by Raposeiras-Roubin et al who found that high TG was associated with subclinical atherosclerosis, and vascular inflammation, even with normal LDL levels.[21] Meanwhile, a study conducted by Aberra et al in subjects aged 40-65 years found that increasing TG increased the risk of developing cardiovascular disease.[22]

In this study, it was also found that there was no correlation between TC and SBP or DBP. However, in a study conducted by Umar and Mariana in adult HP, they found a significant correlation between TC and SBP.[8] Sakurai et al also found a positive correlation between dietary C

and SBP, in which women had a stronger relationship than men.[23] Research conducted by Znyk et al found subjects with high blood pressure had a 2.3 times risk of finding high C levels when examined.[24] Research conducted by Satoh et al found a relationship between increased C and increased SBP. High BP and high TC synergistically increase the risk of death in Asian populations.[25] A study conducted by Yeasmin et al in women aged 30-50 years found that fasting serum TG and fasting serum TC levels were significantly higher in hypertension subjects than controls. There is a positive correlation in hypertension subjects between fasting serum TG and fasting serum TC with SBP and DBP.[26]

It is known that the significance of TC and SBP is based on the accumulation of lipids that cause structural changes in blood vessels. This is related to reduced elasticity of the large arteries, which is generally known as the main pathology of changes in arterial hypertension in the elderly. In addition, dyslipidemia is also responsible for changes in vasomotor activity mediated by nitric oxide, and hyperinsulinemia (increasing circulating catecholamines) which causes hypertension.[8,26]

While the results of a study conducted by Patel et al found an exponential association between high TG and the risk of acute and chronic pancreatitis, new diabetes, and mortality, especially at the age of 40 years or younger, however, the incidence of MCI was only at greater risk in subjects with moderate-high TG.[27] Severe TG is defined as a plasma TG concentration of >10 mmol/L (>885 mg/dL) but is less common with a prevalence range from 0.10 to 0.20%. Very severe hypertriglyceridemia (HTG) >2- mmol/L (>1770 mg/dL is rare (prevalence 0.014%).[27,28]

Genome-wide association studies (GWAS) found a causal relationship between increased TG and CVD, but the function of many GWAS-identified genetic variants is still unknown.[29] Epidemiological and genetic studies have shown that TGRL and their remnants are an important contribution to atherosclerotic cardiovascular disease (ASCVD). In addition, HTG is the most common cause of pancreatitis.[30]

In terms of the relationship between TG and HDL and CHD risk, a study conducted by Lee et al found that subjects with high fasting TG levels (≥150 mg/dL) and low fasting HDL levels (<40 mg/dL for men and <50 mg/dL for women) had a 1.32 times greater hazard ratio (95% CI 1.06-1.64) for the occurrence of CHD than subjects with normal TG and HDL levels. Meanwhile, subjects with LDL levels ≥130 mg/dL can increase the risk of stroke.[31] Research conducted by Joshi et al found that the 14-triglyceride-containing sub-fraction was negatively correlated with HDL, while the presence of 13 fractions (and the strongest was VLDL) could increase the risk of developing CHD (OR 1.12-1.22).[32]

Decreased HDL will cause an increase in TG as found in this current study. This means that if HDL increases, TG will decrease, and vice versa, both in the NT, CHT, and UHT groups. Therefore it is necessary to pay attention to lifestyles that can increase HDL so that TG does not increase. If it cannot be overcome with a lifestyle, then management of lowering blood TG is needed with drugs such as statins.

Limitation

The limitation of this study was BG and C tests in this study were not carried out on fasting subjects. This study also did not clarify the treatment of diabetes mellitus and cholesterolemia in detail. To get more accurate data, for further future studies, it is needed to ask patients to fast for 8-10 hours before BG and C are taken. In addition, it is necessary to have complete data collection about the treatment currently being carried out by the patient which consists of the type of drug, the rules for use, and medication adherence.

CONCLUSION

There is a correlation between HDL and blood pressure in the normotension group. However, there is no correlation between blood glucose and other lipid profiles (TG, LDL, TC) with blood pressure in normotension, controlled hypertension, and uncontrolled hypertension groups. An increase in TG is followed by a decrease in HDL both in normal blood pressure and in hypertension, both in controlled and uncontrolled hypertension groups. There needs to be attention to dietary regulation so that it can reduce the risk of hypercholesterolemia which causes metabolic syndrome and hypertension. The research between laboratory metabolic profile and blood pressure needs to be studied more deeply.

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AUTHORS CONTRIBUTION

TDS plays a role in preparing research designs, data collection, data analysis, and data interpretation, and is responsible for data collection in the field, and preparing manuscripts; MW plays a role in drafting concepts, data analysis, data interpretation, preparing manuscripts, revising the final manuscript for publication; AK plays a role in data collection in the field, data interpretation, and revising the final manuscript for publication

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CONFLICT OF INTEREST

There are no conflicts of interest

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