

تأثير تقليل استهلاك الأطعمة الكربوهيدراتية على مستوى ضغط الدم
المرتفع لدى الأشخاص المصابين بالسمنة و ضغط الدم

The effect of reducing consumption of carbohydrate foods on the high blood pressure level for people with obesity and hypertension

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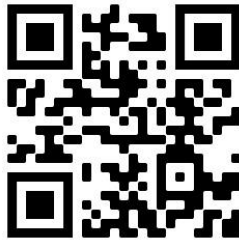
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Abstract

Blood pressure is a silent killer and is common in obese patients. The pattern of food intake especially carbohydrates, physical activity, obesity and body mass index are the effective factors in cardiovascular diseases. This article reviews the effect of reducing the consumption of carbohydrate on blood pressure in people with obesity and high blood pressure. Thirty adult from men, ages 43-48 years, with a weight between 107 and 109 kg, a BMI of 35 kg/m² and a blood pressure of 160 and 110 mm/Hg, not suffering from heart, kidney, liver or diabetic diseases. Tests FT4 and TSH were normal at 14.48±0.5 and 3.36±0.1, as was the electro cardiogram. Blood glucose, total cholesterol, HDL and LDL cholesterol, triglyceride, hemoglobin, uric acid, creatinine, crystal, ALT,AST, hemoglobin, calcium, phosphorus, potassium, sodium levels were recorded to have a significant increase 134.5±108, 202.3±3, 37.6±0.5, 56.78±1.0, 219.9±1.2 (mg/dl), 13.3±1.0 g/dl, 8.3±0.1 mg/dl, 0.8±0.11 mg, 0.79±0.1 mg/dl, 23.6±1.1, 16.5±0.8 (u/l), 1.29±2.0 mmol/l, 3.05±1.7 mg/dl, 3.64±1.9 and 152.1±0.1(mmol/l) respectively compared to the normal results 120, 200-240, more than 65, less than 129,200, 12-18, 3.4-7.0, 0.7-1.2, 0.5-1.4, up to 40, 40, 1.05-1.13, 2.5-4.5, 3.4-5.1 and 136-145. The patients were followed healthy diet without carbohydrates, they depended on vegetables with proteins for three months, the results were recorded 107±2.5, 140±2.0, 55±5.0, 39.51±0.6, 137±1.0, 16.0±0.5, 3.2±0.5, 0.67±0.1, non-Crystal, 8.5±0.2, 11.5±0.1, 1.12±0.1, 4.3±0.8, 4.96±1.0 and 135.1±0.7. **Conclusion:** Reducing carbohydrates consumption or avoiding it, eating vegetables, plant and animal proteins are reducing the overweight and considered a healthy diet for blood pressure patients.

Key words: Blood pressure, carbohydrate, sugar, overweight, body mass index.

Introduction:

Hypertension is a risk factor for myocardial infarction, cardiovascular disease, renal impairment and impaired public health. The pattern of food intake, poor dietary habits and physical activity are factors effective in reducing its incidence (**Muntner et al, 2015 ; Whelton, et al, 2018 ;Toni, 2019 ; Hossein et al, 2020**), blood pressure (BP) level when is ≥ 130 and/or ≥ 80 mm Hg high about normal level 120/80 mm Hg recommended eat drugs especially individuals with stroke, diabetes, chronic kidney, cardiovascular diseases and them age 65 (**John and Beml, 2020**). Lifestyle changes, increasing physical activity, fitness, BMI and sodium low consumption lead to lower BP and cardiovascular disease for those who do not suffer from chronic diseases such as diabetic disease, kidney and liver disease (**Manzoor et al, 2015 ; Arasb et al, 2018**). Also, fruits and vegetables consumption, low-fat dairy, whole grains, nuts, fish and red meat, saturated fats, sweets and sweetened drinks in moderation reduce high BP (**Siervo et al, 2015**). According (**Hawkins et al, 2016**) explained that different dietary interventions have effects on BP. In obese subjects with elevated cardiovascular risk, systolic blood pressure (SBP) and diastolic blood pressure (DBP) decreased by 3, 2 mm Hg after $\geq 5\%$ weight loss (**Jensen et al, 2013**). (**Helene et al, 2014**) mentioned the relationship between nutrition and blood pressure (BP), BMI is the responsible for increasing BP level, also decrease the salt, fat diets, eating vegetable, fruits, playing sports and physical activity, especially walking and changes life style, weight loss led to decrease BP during rest and exercise. According to (**Fatma et al, 2011**) explained that type, amount and quality of carbohydrates especially when replacing bread, rice and pasta with starchy vegetables affected lowering BP on arterial pulse pressure in Cuban Americans with and without type 2 diabetes. In my opinion starchy vegetables such as potatoes, carrots, green peas, green beans and green okra and a diet low in carbohydrate improve arterial BP, because eating a lot of carbohydrates and sugars increases blood glucose level and insulin level in the body, and affects the kidneys, and thus the cells' response to insulin decreases, which increases the stiffness of blood vessels and leads to the inability of it to expand, thus increasing blood pressure. The

elasticity of blood vessels is necessary to maintain a normal blood pressure. Carbohydrates also increase weight, lead to obesity, which it is a factor in blood pressure. Therefore, the aim of this study was to study the effect of the new trend in nutrition especially the consumption of carbohydrates on BP patients suffering from high weight and obesity.

Material and methods

Patient selection and Characteristics

This study was conducted on 30 adults aged 43-48 years from Cairo, Egypt and were selected randomly from the educated class, age, hypertension and lifestyle, food intake, salt amount, water, physical activity, weight, education level, sugar and sweets intake. No one suffered from chronic diseases according to the laboratory analysis. This study lasted 3 months with recording measurements of the SBP and DBP pressure. BP was measured three times by each person using the setezen blood pressure at home, hypertension of about 140/90 was recommended using medication. Data analysis was done by SPSS software, to examine the relationship between anthropometric status, age and hypertension, t-test were used. (WHO, 2016) explained the relationship between increasing BMI, waist, hip ratio, body fat, obesity and BP, diabetes, and dyslipidemia. A NOVA was used to test for statistical differences between subgroups. In addition, Meta regression analyses were conducted to examine the impact of weight reduction on the net BP effect, as weight loss has been independently correlated with blood pressure change. The Scientific Research Ethics Letter No. EC 2301 was obtained from the Scientific Research Ethics Committee at Fayoum University.

Table 1: Average of baseline characteristics for hypertension patients

Data in **Table 1** showed the recording of baseline characteristics of hypertension patients like age, sex, high, actual weight, perfect weight, BMI and DBP and SBP for three months. There was a significant improvement in Body weight (BW), BMI and BP level

for three months (85 ± 1.0 , 29 ± 1 and $113 \pm 3/90 \pm 1$) compared to pre-treatment (107 ± 1 , 35 ± 1 and $160 \pm 5/120 \pm 5$) respectively. These results agreed with **Jensen et al. (2013)** who mentioned that in obese subjects with elevated cardiovascular risk, systolic BP and diastolic BP decreased by 3, 2 mm Hg after $\geq 5\%$ weight loss. Also there is a relationship between nutrition and blood pressure, body mass index is responsible for increasing blood pressure level, also decreasing salt and fat diets, eating vegetables, fruits, playing sports and physical activity, especially walking and changing lifestyles, weight loss led to a decrease in blood pressure during rest and exercise (**Helene et al, 2014**).

Table 1: Average of baseline characteristics for hypertension patients

Baseline characteristics of patients	Results				
	0	1	2	3	4
Age/ years	43 ± 5	43 ± 5	43 ± 5	43 ± 5	—
Sex	Men	Men	Men	Men	—
High/ Cm	171 ± 2	171 ± 2	171 ± 2	171 ± 2	171 ± 2
AW/Kg	107 ± 1	99 ± 0.5	91 ± 0.7	85 ± 1.0	73 ± 1
BW/Kg	73 ± 1	73 ± 1	73 ± 1	73 ± 1	73 ± 1
BMI/ Kg/m ²	35 ± 1	33 ± 1	31 ± 1.5	29 ± 1	24
SBP / mm/Hg	160 ± 5	143 ± 5	130 ± 1	113 ± 3	120
DBP / mm/Hg	120 ± 5	100 ± 5	90 ± 1	73 ± 2	80

0: Before the treatment

1: the first month

2: the second month

3: the third month

4: Normal Value

AW: Actual weight

PW: perfect weight

BMI: Body mass index

DBP: Diastolic blood pressure

SBP: Systolic blood pressure

pressure

Values are expressed as mean \pm SD.

There was a relationship

weight, body mass index and diastolic blood pressure (quantitative) ($P < 0.5$)

Table (2): Electro cardiogram

The data in **Table 2** explained that electrocardiogram was normal, and the conclusion showed that the regular sinus rhythm was 74 bpm with no acute ischemic signs.

Table (2): Electro cardiogram

Rate	74 bpm
Rhytham	Regular sinus
Axis	Normal
P.R,	Less than 0.2 s
QRS complex	Less than 0.1 s

Statistical analysis

Data analysis was done by SPSS software, To examine the relationship between anthropometric status and age and hypertension, a t-test was used. There is relation between BP and obesity according to (WHO, 2016) they mentioned that increasing BMI and waist hip ratio led to increasing blood pressure, diabetes, and dyslipidemia. A NOVA was used to test for statistical differences between subgroups, In addition, meta-regression analyses were conducted to examine the impact of weight reduction on BP, Weight loss has been independently correlated with BP change.

Results and discussion

Table (3): Foods and drinks for hypertension patients for three month/ daily

Data in **Table 3** showed the foods and drinks for hypertension patients. They depended on healthy foods without salt and fats, such as boiled and grilled chicken, grilled chicken burger, vegetable soup, grilled vegetable, fish, and vegetables such as lettuce, cucumber, watercress, onion, radish, and red radish and fruits such as orange, banana, guava and romaine, avoiding preserved foods such as canned beans and peas, and tuna. According to (Alonso et al, 2004) mentioned that a food pattern including types of foods, eating a varied and balanced diet, and consuming vegetables and fruits rich in potassium and magnesium help reduce blood pressure, antioxidants (Liu et al, 2001) and fiber (Whelton et al, 2005). Also calcium and magnesium have high content in dairy products and casein has a blood pressure

lowering effect (**Jauhiainen and Korpela, 2007**). Red meat consumption is associated with increased uric acid, hypertension, hyperlipidaemia, cardiovascular risk and mortality (**Ester et al, 2020**). Yoghurt consumption decreases blood pressure despite its high saturated fat content (**Paul, 2019**). Fried food consumption is associated with hypertension in women and increases the risk of coronary artery disease, heart failure and diabetes (**Sherlyn et al, 2020**). Sweet, fatty, baked, spicy, seasoned and salted consumption increases the incidence of hypertension (**Herlina et al, 2017**). Processed meat consumption raises rate of hypertension, obesity and cardiovascular disease the risk because of the high sodium content responsible for hypertension (**Pan American Health Organization, 2015 ; Raquel et al, 2016**). Oily fish consumption reduces SBP because it is rich in omega 3 (**Gabriele et al, 2023**). Overall, food could prevent the development of hypertension, as eating of salt, garlic, fish oil, chocolate and vitamin D makes changes in the vascular smooth muscle cells and aids in the prevention of hypertension (**Kofi et al, 2017**). Vitamins D, calcium, potassium, phosphorous, bioactive small peptides, low fat dairy and its products may be improve BP and decrease its risk and a high dairy diet compared to a low dairy diet results in a reduction of SBP and DBP, as well as low sodium, high protein and bioactive lactotriptides protective against hypertension (**Susan et al, 2019 ; Massimo et al, 2019**). (**Rosa et al, 2020**) The effects of hesperidin in orange juice reduce BP after sustained consumption in mildly hypertensive individuals because of high content of flavonoids, pectin, and essential oils. According to (**Stockton et al, 2017 ; Golbon et al, 2018**) Pomegranate extract may reduce SBP and DBP and lipid profile in patients with type 2 diabetes because of its high polyphenols content. (**Renfan et al, 2020**) prove that green tea significantly reduces SBP and DBP due to its high antioxidants content. (**Shu et al, 2016**) mentioned that lemon juice consumption reduces overweight responsible for cardiovascular and renal diseases, hypertension, hyperglycemia, inflammation, dyslipidemia and atherosclerosis because it is rich in vitamin C.

Table (3): Foods and drinks for hypertension patients for three month/ daily

Foods	Drinks without sugar
No salt	Water free sodium
Boiled chicken	Green tea
Grilled chicken	Limon juice
Grilled chicken burger	Caracadia
No processing meat or canned foods.	Grapefruit
No bread	Low fat milk
Vegetable soup	Orange juice
Grilled vegetable	pomegranate juice
Fishes	—————
Low fat yogurt	—————
Vegetables as lettuce, cucumber, watercress, onion, radish and red radish.	—————
Boiled and grilled cauliflower, Grilled eggplant.	—————
Fruits as orange, banana, guava and Pomegranate.	—————
Avoid canned beans, peas and tuna.	—————
Avoid fried foods	—————

There was a relationship between food intake and diastolic blood pressure (quantitative) ($P < 0.5\%$).

Table (4): Blood glucose, lipid profile and thyroid tests

The data in **Table 4** shows blood glucose and total fats analysis included total cholesterol (TC), high density lipoprotein (HDL), low density lipoprotein (LDL), triglyceride cholesterol (TG), hemoglobin (HGB) and thyroid tests. The results were recorded improvement as a result of reducing carbohydrate consumption with depending on vegetables, plant and animal proteins in the third month ($107 \pm 2.5 \text{mg/dl}$, $5.0 \pm 0.1 \text{mg/dl}$, $140 \pm 2.0 \text{mg/dl}$, $55 \pm 5.0 \text{mg/dl}$, $39.51 \pm 0.6 \text{mg/dl}$, $137 \pm 1.0 \text{mg/dl}$ and $16.0 \pm 0.5 \text{g/dl}$) respectively, compared to the first month ($115 \pm 1 \text{mg/dl}$, $5.2 \pm 0.14 \text{mg/dl}$, $182 \pm 1.4 \text{mg/dl}$, $45 \pm 2.0 \text{mg/dl}$, $51.23 \pm 0.3 \text{mg/dl}$, $161 \pm 1.1 \text{dl}$ and 13.7 ± 1.0). These results agreed with **(Paul J. Nestel, 2019)** studied that a low-fat diet lowered blood pressure level. Recent studies suggest that sugar intake increases blood pressure, daily intake reduction of added sugar and increased fruit consumption are recommended to promote overall cardiovascular health in older adults **(Safiyah et al, 2019 ; Seriki, 2017)**.

Table (4): Blood glucose, lipid profile and thyroid tests

Analysis mg/dl	0	1	2	3	4
Blood glucose	134.5±1.8	115±1.0	110±2.0	107±2.5	120/80
Fasting glucose	5.4±0.1	5.2±0.14	5.0±0.5	5.0±0.1	less than 5.7
TG	202.4±3.0	182±1.4	155±1.0	140±2.0	200-240
HDL-C	37.6±0.5	45±2.0	49±3.0	55±5.0	More than 65
LDL -C	56.78±1.0	51.23±0.3	43.41±0.7	39.51±0.6	Less than 129
TC	219.9±1.2	161±1.1	158±0.4	137±1.0	200
HGB, g/dl	13.3±1.0	13.7±1.0	14.2±2.0	16.0±0.5	12-18
FT4, Pmol/L	14.48±0.5	_____	_____	_____	9.0-20.0
TSH, uIU/ml	3.36±0.1	_____	_____	_____	0.15-7.0

TG: Total Glycerides

HDL: High Density Lipoprotein

LDL:

Low Density Lipoprotein

TC: Total Cholesterol

HGB: Hemoglobin

FT4: Free thyroxine

TSH: thyroid stimulating hormone

Values are expressed as mean ±

SD. There was a relationship between blood glucose and total fats and diastolic blood pressure (quantitative) ($P < 0.5\%$).**Table (5): Liver and kidney function analysis**

Data in **table 5** showed liver and kidney function analysis. The results recorded significant improvement in uric acid, creatinine, crystal, Alanine transaminase (ALT) and aspartate aminotransferase (AST) levels during the third month as follows: (3.2±0.5 mg/dl, 0.67±0.1 mg, Non mg/dl, 8.5±0.2 U/L and 11.5±0.1 U/L) compared to the first month (4.7±0.6 mg/dl, 1.0±0.003 mg, Uric: Few mg/dl, 24±0.5 U/L and 24±1.5 U/L). (**Huldani et al, 2020**) investigated the influence of uric acid on hypertension, foods containing fat, carbohydrates and protein consumption can be the risk factors for hyperuricemia that increase SBP and DBP. According to (**Eun et al, 2020**) said that rise in the levels of bilirubin, AST and ALT could reflect a potential cardiovascular risk and hypertension. DBP affects renal function when it is lower than 75 mm/Hg with a significant alteration in serum creatinine level (**Didier et al, 2018; Wang et al, 2019**).

Table (5): Liver and kidney function analysis

Analysis mg/dl	0	1	2	3	4
Uric acid	8.3±0.1	4.7±0.6	4.15±0.1	3.2±0.5	3.4-7.0
Creatinine	0.8±0.11	1.0±0.003	1.0±0.007	0.67±0.1	0.7-1.2
Crystal	0.79±0.1	Uric: Few	Uric: Few	Non	0.5-1.4
ALT, U/L	23.6±1.1	24±0.5	14±0.6	8.5±0.2	Up to – 40
AST, U/L	16.5±0.8	24±1.5	14±2.1	11.5±0.1	40

Values are expressed as mean ± SD.

There was a relationship between liver and kidney function and diastolic blood pressure (quantitative) ($P < 0.5\%$).

Table (6): Minerals Analysis

Table (6): Showed minerals analysis and its role in controlling hypertension, calcium, phosphorus, potassium and sodium levels were improved in the third month (1.12±0.1 mmol/l, 4.3±0.8 mg/dl, V mmol/l and 135.1±0.7 mmol/l), compared to the first month (1.18±0.3 mmol/l, 3.28±1.1 mg/dl, 3.91±1.5 mmol/l and 147.6±1.2 mmol/l). These results agree with (**Mariam et al, 2019**) studied the role of calcium in controlling hypertension, in addition to foods rich in potassium manages hypertension and helps to ease tension in your blood vessel walls, which helps lower blood pressure because the more potassium you eat, the more sodium you lose through urine (**Alexander , 2018**). According to (**Scott et al, 2019**) mentioned that no consistent association between phosphorus intake and blood pressure in adults, and iron deficiency may contribute to the pathogenesis of pulmonary hypertension because of the positive association between hemoglobin and ferritin with SBP and DBP (**Yasaman et al, 2018 ; Obeagu, 2020**).

Table (6): Analysis of minerals

Analysis Mmol/L	0	1	2	3	4
Ca	1.29±2.0	1.18±0.3	1.15±0.5	1.12±0.1	1.05-1.13
P mg/dl	3.05±1.7	3.28±1.1	3.89±0.2	4.3±0.8	2.5-4.5
K	3.64±1.9	3.91±1.5	4.21±1.9	4.96±1.0	3.4-5.1
Na	152.1±0.1	147.6±1.2	144±2.0	135.1±0.7	136-145

Values are expressed as mean ± SD.

There was a relationship between the level of minerals and diastolic blood pressure (quantitative) ($P < 0.5\%$).

Conclusion

Arterial pulse pressure and diet are risk factors for cardiovascular disease, they are strongly linked to food intake patterns; for example, carbohydrate intake can increase blood pressure, but fruits, vegetables, fish, and dairy products can decrease blood pressure. Also, increased red meat consumption, fatty foods and salty foods cause high blood pressure levels. In this research low carbohydrate intake and depending on plant and animal proteins helped lower hypertension; eating a lot of carbohydrates and sugars increases blood glucose level and insulin level in the body, and affects the kidneys, and thus the cells' response to insulin decreases, which increases the stiffness of blood vessels and leads to the inability of it to expand, thus increasing blood pressure. The elasticity of blood vessels is necessary to maintain a normal blood pressure. Carbohydrates also increase weight, lead to obesity, which it is a factor in blood pressure.

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تأثير تقليل استهلاك الأطعمة الكربوهيدراتية على مستوى ضغط الدم المرتفع لدى

الأشخاص المصابين بالسمنة و ضغط الدم

The effect of reducing consumption of carbohydrate foods on the high blood pressure level for people with obesity and hypertension

ملخص البحث

ضغط الدم هو القاتل الصامت و الشائع لدى مرضى السمنة. يعد نمط استهلاك الطعام كالأطعمة الكربوهيدراتية،النشاط البدني،السمنة،مؤشر كتلة الجسم عوامل فعالة لإنتشارأمراض القلب والأوعية الدموية، تستعرض هذه الدراسة تأثير تقليل استهلاك الأطعمة الكربوهيدراتية على مستوى ضغط الدم لدى الأشخاص المصابين بالسمنة و ارتفاع ضغط الدم. تم مشاركة ثلاثون رجلا بالغًا، أعمارهم 43-48 سنة، أوزانهم 107-109 كجم، مؤشر كتلة الجسم 35 كجم/ م 2، مستوى ضغط الدم 110/160 مم/ زئبق، لا يعانون من أمراض القلب، الكلى، الكبد والسكري. اختبارات FT4 و TSH و مخطط القلب كانت طبيعية وسجلت 0.5 ± 14.48 و 0.1 ± 3.36 . أوضحت نتائج جلوكوز الدم، الكوليسترول، الليبوبروتين مرتفع و منخفض الكثافة، الدهون الثلاثية، الهيموجلوبين، حمض اليوريك، الكرياتينين،الكريستال، ALT، AST، الكالسيوم، الفوسفور، البوتاسيوم، الصوديوم زيادة معنوية قبل العلاج 134.5 ± 202.3 ، 3 ± 108 ، 0.5 ± 37.6 ، 1.0 ± 56.78 ، 1.2 ± 219.9 (مجم / ديسيلتر)، 1.0 ± 13.3 جم / ديسيلتر، 8.3 ± 0.1 مجم / ديسيلتر، 0.8 ± 0.11 مجم، 0.1 ± 0.79 مجم/ ديسيلتر، 1.1 ± 23.6 ، 16.5 ± 0.8 (u / لتر)، 2.0 ± 1.29 ملي مول/ لتر، 3.05 ± 1.7 مجم / ديسيلتر، 1.9 ± 3.64 ، 152.1 ± 0.1 (ملي مول/ لتر) مقارنة بالقيم الطبيعية لنفس المقاييس. تم اتباع نظام غذائي بدون كربوهيدرات و تناول الخضراوات مع البروتين ثلاثة أشهر، سجلت النتائج 107 ± 2.5 ، 140 ± 2.0 ، 55 ± 5.0 ، 39.51 ± 0.6 ، 137 ± 1.0 ، 16.0 ± 0.5 ، 3.2 ± 0.5 ، 0.67 ± 0.1 ، لا توجد أملاح كريستالية، 8.5 ± 0.2 ، 11.5 ± 0.1 ، 1.12 ± 0.1 ، 4.3 ± 0.8 ، 4.96 ± 1.0 و 135.1 ± 0.7 على التوالي. الخلاصة: التقليل من استهلاك الكربوهيدرات أو تجنبها و تناول الخضراوات و البروتينات النباتية و الحيوانية يعد حماية صحية لمرضى ضغط الدم و يقلل من الوزن الزائد.

الكلمات المفتاحية: ضغط الدم ، الكربوهيدرات ، السكر ، الوزن الزائد ، مؤشر كتلة الجسم