



Ingestion of lean beef meats in blood pressure and biochemical parameters in hypertensives patients"

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Abstract

The objective of the present research was to relate lean beef meat intake and blood pressure reduction in hypertensive subjects. Fifty-one participants more than 30 years-old were selected. Study participants were assigned to receive a diet with partial replacement of carbohydrates for proteins of lean beef meat. Follow-up of participants were made every four weeks for an eight-week period. There were indicated to consume lean beef meat once or twice daily depending of caloric expenses. Blood pressure was measured twice with a week difference. Blood samples were collected in all participants at beginning, at four and eight weeks to determine fasting glucose, insulin, glycosilated hemoglobin, cholesterol and triglycerides concentrations. Mean age was 43.5±7.1 years-old and a body mass index was 26.9±3.1 Kg/cm². There were not significant statically differences in concentrations of cardiovascular risk markers in study periods (p = ns). There was a significant reduction in mean values of systolic and diastolic blood pressure after four and eight weeks of intervention (p < 0.05). It is concluded that a lean red beef intake produces a reduction in blood pressure in hypertensive subjects, without effect on the biochemical parameters.

Keywords: Hypertension, Lean beef meat, Blood pressure, biochemistry parameter.

Introduction

Through history, beef meat consumption has maintained an important position, being considered one of the highly nutritious foods in human consumption because of its protein content that has a high biological value, fat, vitamins and minerals. It also provides calories that origin mainly from its lipidic content, but its most important contribution to diet are its proteins, essential fats, B complex vitamins, minerals like Fe, Zn, P. Beef meat also provides cholesterol and saturated fats that have been associated with cardiovascular problems^{1,2}. However, it's important to highlight that in Venezuela beef meat has a lower content of fat compared to the rest of Latin-American countries and United States³.

The relation between protein consumption and arterial pressure has been investigated at length in studies on populations³. The results of this studies support in a general way, are that the high consumption of proteins decrease arterial pressure. The total protein consumption estimate^{4,5} vegetable proteins⁶⁻⁸ and animal proteins⁹⁻¹² have been recessively related to arterial pressure. However, some studies have found that vegetable proteins are related with arterial pressure reduction^{7,8}. On the other hand, total carbohydrate consumption hasn't been consistently related with the increase or reduction of arterial pressure^{4,8}. Differences in types and origins of carbohydrate, consumed in diets can alter in a differential form the relation between the consumption of them and the arterial pressure¹³.

Several studies have determined the effects of protein consumption compared to carbohydrate consumption associated to arterial pressure while doing iso- energetic

diets¹⁴⁻¹⁷. Previous studies have shown that a supplement with 66 gr. Of soy protein a day produced a 5.9 mm of Hg decrease in systolic arterial pressure in only 24 hours in hypertensive patients that were evaluated ambulatory way¹⁴. Washburn and collaborators¹⁵ found a reduction of the arterial pressure in women that eat the supplement with 20 gr. Of soy protein a day compared with the women that eat 20 gr. Of complex carbohydrates. He y collaborators¹⁶ proved that an amount o people that eat the supplement with 26 gr. Of soy protein a day presented a decrease of systolic and diastolic arterial pressure compared to the first group tested. Appel and collaborators¹⁷ proved that the partial substitution of carbohydrate consumption with 55 gr. Of Protein from several origins a day produced a 1.4 mm of Hg decrease in systolic arterial pressure compared to the first diet.

Changes in arterial pressure among these studies can be caused by a reduction effect in proteins, or due to an amplification effect in carbohydrate consumption, or both. It must be clarified if the soy protein differs from other proteins in its effect on arterial pressure, because the isoflavines in soy have a potential vasodilator effect¹⁸. Control study results that compare soy protein consumption to other lactic origin proteins¹⁹⁻²² or to wheat protein consumption²³ have not clarified this situation. The roll that carbohydrate could have related to arterial pressure still has to be clarified. In most populations, an increase of protein consumption is probably the result of a reduction in carbohydrate consumption, emphasizing that in occidental countries most protein consumption animal origin, including lean beef meat.

The main objective of this investigation was to determine the influence of lean beef meat consumption in arterial pressure reduction and in biochemistry parameters in hypertensive patients.

Method and materials

Patient Selection

51 male and female patients over 30 years old were selected at random. After measuring systolic and diastolic arterial pressure twice in internal medicine practice and with one week difference, individuals with systolic arterial pressure over 130 mm of Hg and with diastolic pressure over 95 mm of Hg were selected. None of these patients having associated pathologies like diabetes, coronary symptomatic illnesses, no precedent of kidney or hepatic illnesses or cancer.

Nutritional intervention

All patients were assigned a diet with partial replacement of carbohydrates for lean beef meat proteins for 8 weeks. All participants maintained their diet and usual life style for a previous period of two weeks. Follow-up of participants was issued every 4 weeks for an 8 week period. Besides this, each patient was provide with instructions to achieve the necessary changes in the diet. They were in-

dicated lean beef meat consumption once or twice a day depending on their caloric expenditure. Participants that had low caloric expenditure received 180 gr. Of lean beef meat (36 gr. Of protein a day) and those who had a high caloric expenditure received 250 gr. Of lean beef meat (50 gr. Of protein a day). **All participants were indicated consumption of meat instead of enriched carbohydrate food (bread, pasta, rice, potatoes and cereals).** The objective was to achieve the consumption of 35 – 40 gr. Of protein a day (7-8% of total energy consumption).

Study Protocole

Arterial pressure was measured twice with one week difference with a standard sphygmomanometer, the main values for systolic and diastolic arterial pressure are the first and fifth Korotkoff sounds. All participants rested for a 10 minute period, sitting down. Arterial pressure was measured three times in 10 minute intervals in both arms. The average of the six measurements was used as final value. During this study, the use of hypertensive drugs continued and didn't change. The amount of time of anti-hypertensive medication use in relation to the arterial pressure measurements remained without changes. All participants were indicated to continue their normal daily activities and to avoid vigorous exercises.

Chemical Determinations

Blood samples were collected from all patients at the start of this study, on the 4th And 8th Week, after a 12 hour fasting period. Plasma was separated and stored at -70°C till the time of measurement. Cholesterol and triglycerides were enzymatically measured using a detection HUMAN kit. Plasmatic Insulin concentrations were measured with an Immunological radiation test kit.

Statistical Analysis

The obtained results were presented as a \pm standard deviation average with a very important $p < 0,05$ statistically. To compare statistical differences in clinical and lab studies Variance Analysis test was used with DUNNET post test using as main values information obtained at the start and at the end of each study.

Results

The studied sample was formed by 51 individuals (30 female patients and 21 male patients). The average age was $43,5 \pm 7,1$ and the body mass index average was $26,9 \pm 3,1$ Kg/cm². 21 individuals used hypertension drugs called Beta-blockers, 19 individuals used antihypertensive drugs called ACE inhibitors and ACE blockers, 8 individuals used Calcium channel blockers and 3 individuals used daily diuretics. The average of protein consumption between participants was $39,7 \pm 3,2$ gr./day.

The measurements of risk of cardiovascular indicators (hemoglobin and insulin during fasting periods, postprandial

hemoglobin, cholesterol and triglycerides) and the averages of values during the start and the follow up can be seen in table 1. No statistical differences were found in the determination of concentrations of each or these parameters after 4 and 8 weeks and after being compared to the initial values ($p = ns$).

Table 1. Biochemistry parameters in different study periods. Octubre 2007

Chemistry Determinations	Start	4th Week	8th Week
Glucose in fasting period, (mg/dl)	89,1±8,6	90,4±12,1	87,5±7,6
Insulin in fasting period, (mg/dl)	10,2±5,4	10,3±4,7	10,9±5,0
Cholesterol, (mg/dl)	191,6±8,4	189,4±7,8	188,9±7,5
Triglycerides, (mg/dl)	175,6±11,2	173,4±9,6	173,1±11,2

FI: Medical precedents from Central Hospital "Dr. Urquinaona".

An important decrease in systolic arterial pressure values was observed after 4 weeks of intervention when compared ($140,5 \pm 6,4$ mm de Hg; $p < 0,05$), to initial values ($144,5 \pm 7,8$ mm de Hg) on the 8th week the decrease continued and was considered very relevant. ($138,9 \pm 7,5$; $p < 0,05$; figure 1). In relation to the diastolic arterial pressure, it was also observed an important decrease after 4 weeks of treatment ($95,4 \pm 7,5$ mm of Hg compared to $91,3 \pm 6,5$ mm of Hg after 4 weeks). After 8 weeks decrease continued till reaching $90,2 \pm 5,9$ mm of Hg, this was considered very important statistically ($p < 0,05$; figure 2). View table 2

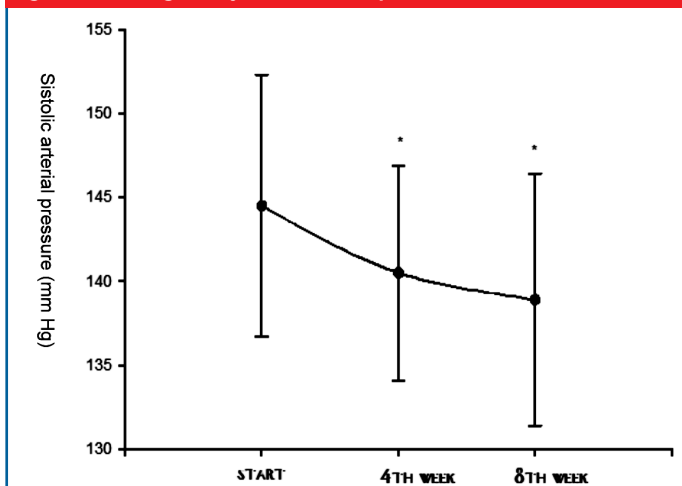
No significant changes in the average of heart frequency values were observed (table 2) during the different study periods ($p = ns$; figure 3).

Table 2. Arterial pressure and heart frequency in different study periods. Octubre 2007

Measurements	start	4th week	8th week
Systolic Arterial Pressure, (mm of Hg)	144,5±7,8	140,5±6,4	138,9±7,5
Diastolic Arterial Pressure, (mm of Hg)	95,4±7,5	91,3±6,5	90,2±5,9
Heart Frequency, (Heart beats per minute)	78,4±5,4	77,5±11,3	76,9±10,9

FI: Medical precedents from Central Hospital "Dr. Urquinaona".

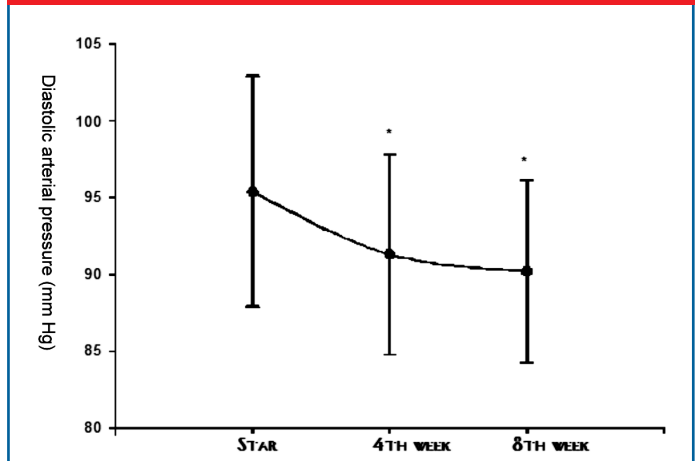
Figure 1. Average of systolic arterial pressure values



*P < 0,05

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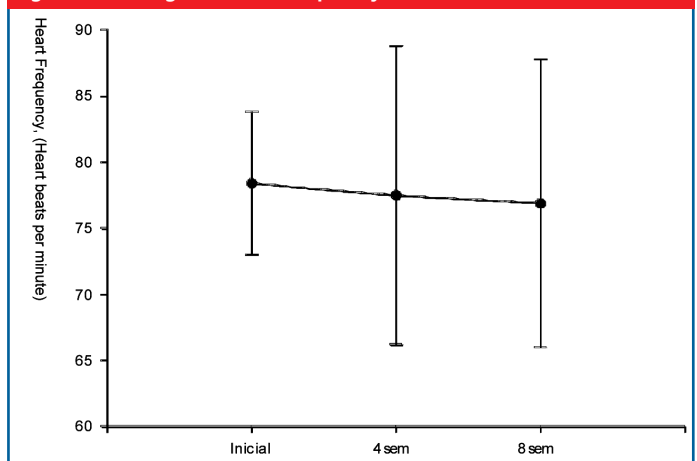
Figure 2. Average of diastolic arterial pressure values



*p < 0,05

FI: Medical precedents from Central Hospital "Dr. Urquinaona".

Figure 3. Average of heart frequency values



*P < 0,05

FI: Medical precedents from Central Hospital "Dr. Urquinaona".

Discussion

Hypertension has been identified as the main factor of risk of mortality around the world. It currently affects a vast majority of the global population and it's estimated to affect more than 75% of the global population in the next 25 years²⁶. Currently two thirds of the hypertensive populations live in developed countries that have low protein consumption and high carbohydrate consumption. Most increase of hypertension incidence in developed countries is due to changes related to diet and life style. A change in diets and life styles is also the best way to prevent hypertension. Results in intervention and population studies^{1-12,14-17} suggest that higher protein consumption can decrease arterial pressure.

It has been proposed that animal protein, and high consumption of total proteins, in a general way, can increase arterial pressure. This idea evolved from studies that prove

that vegetarian diets, that are low in total proteins and do not have meat proteins, can decrease arterial pressure²⁴⁻²⁸. However, similar arterial pressure decreases have been found with fruits, vegetable, fish, nuts, and low fat lactic products consumption and with the diminution of saturated fat, and sugar consumption^{29,30}. Absence of meat protein does not explain a decrease in arterial pressure observed in vegetarian diets^{31,32}. Increase of non digestive carbohydrate consumption (dietetic fiber, for example) can decrease arterial pressure, specially in hypertensive individuals^{33,34}. Some researchers support the proposal that says that foods like enriched fiber beans with a low glycemic index can help to decrease arterial pressure³⁵⁻³⁷. The effects of high glycemic index foods related to arterial pressure in human are still unknown.

To research the effects of the increasing consumption of proteins related to arterial pressure, it's necessary to balance changes in the carbohydrate consumption as well in fat consumption or both. It's necessary to avoid confusion factors due to the energy expenditure and body mass changes. With normal diets it can be harder to reduce fat consumption than to reduce carbohydrate consumption. Carbohydrate consumption is the easiest part of the diet that can be modified; this allows protein consumption to reach an Iso-energetic diet. The effects of the animal protein consumption increase because of carbohydrate consumption, related to arterial pressure, haven't been previously reported. In this research, the effect of lean beef meat consumption related to the decrease of arterial pressure in hypertensive people was determined. It was observed that protein consumption produces important effects related to arterial systolic and diastolic pressure.

In population studies, vegetable protein consumption is consistently associated to arterial pressure¹⁻³. Founding's in random controlled studies proved lower arterial pressure after consumption of vegetable proteins (Soy) than carbohydrate consumption¹⁴⁻¹⁶. The relation between animal protein consumption and arterial pressure in population studies are less consistent. Various studies results suggest an inverse association⁹⁻¹², while other studies suggest no association at all^{6,7} or a positive association⁸. However, in some populations animal protein consumption and lean beef meat products that can contribute with animal protein consumption can be related with diet patterns and life style factors that can contribute to a arterial pressure increase^{38,39}. Anyhow, more random studies are needed to determine the effects of animal protein related to arterial pressure.

In this research it was found that animal protein consumption produces a decrease in arterial systolic and diastolic pressure. Previous to this, different studies proved that the supplement with 66 gr. a day¹⁴, 20 gr. A day¹⁵ and 26 gr. A day of vegetable proteins (soy) produced a decrease in systolic arterial pressure between 2 and 6 mm of Hg. Besides, after further investigation it was determined that there is perhaps evidence of a further increase of energetic consumption of proteins (more than 55 gr. A day), de-

rived from various sources and from carbohydrate replacements, having as result a further decrease of systolic arterial pressure (14 mm of Hg) compared to controls¹⁷. The effects of the decrease of arterial pressure of diet protein, compared to the effects in carbohydrates, are very evident in hypertensive individuals^{16,17}. In the second group of hypertensive individuals that was studied, He and collaborators¹⁶ found evidence of a decrease in systolic and diastolic arterial pressure of 8 and 5 mm of Hg respectively, in people that consumed supplement of soy protein compared to those who consumed carbohydrates, Appel y collaborators¹⁷ found evidence of a systolic and diastolic arterial pressure decrease of 3,5 and 2,4 mm of Hg, respectively, in people who partially replaced carbohydrate consumption for proteins. International Salt and arterial pressure studies indicate that an increase of 37 gr. Of protein a day would cause a 3 mm of Hg decrease in systolic arterial pressure averages⁵. This study would be consistent to other estimated effects in intervention studies. A decrease in systolic arterial pressure of this magnitude would substantially reduce prevalence of cardiovascular illnesses in population.

There is various ways to explain differences in arterial pressure. The amino acid consumption, including arginine and taurine, could be important in arterial pressure variations. Lean beef meat is an important source of arginine and taurine. Arginine, is an oxide nitric, that can improve vasodilation, endotelial functions⁴⁰ and can also decrease arterial pressure⁴¹. Taurine relates inversely to arterial pressure in population studies¹⁰ and can decrease arterial pressure in rats and hypertensive humans⁴². A diuretic not specified effect that can be related to amino acid dosages can also contribute to arterial pressure reduction⁴³.

Another possible explication is that arterial pressure is related to carbohydrate consumption. In this investigation and others¹⁴⁻¹⁷, differences in arterial pressure could be affected by protein and carbohydrate consumption. A previous investigation proved that the partial substitution of carbohydrate consumption for proteins or monounsaturated fats produced a arterial pressure decrease of the same magnitude¹⁷. Even so, there is very small evidence of refined carbohydrate consumption related to arterial pressure in human studies, results in animals support these facts^{44,45}. Results of different investigations suggest a small decrease in sodium consumption in individuals that consume proteins. These differences can be explained because of the diminution of bread and cereals consumption in the study group. Information from INTERSALT study⁴⁶ and DASH-sodium⁴⁷ suggest that a change in sodium consumption of great magnitude can represent a variation of more than 2 mm of Hg in arterial pressure.

Another interesting founding in this investigation was the absence of modifications in plasma glucose concentrations in the study group. The physiological relevance of these changes is unknown, due that plasmatic glucose concentrations stay in normal rang. However, this change is in opposite direction to those proposed by diet changes. A

reduction in carbohydrate consumption replaced by proteins would produce a decrease in the answer of plas-matic glucose due to the diminution of glycemic levels in the diet⁴⁸⁻⁴⁹. Changes sustained in glycemic levels in the diet, would bring long term benefits to glucose and insulin metabolism⁵¹. A previous study that analyzed weight loss in overweight women investigated the effects of high protein content compared to high carbohydrate content related to glycemic control and no differences were found between diets⁵².

Lean beef meat consumption produces a decrease in systolic and diastolic arterial pressure, in hypertensive patients, without causing changes in biochemical param-eters. Proving that an absolute or severe reduction of lean beef meat consumption in hypertensive patients diets is not necessary.

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