

Nutrition Review

# WHICH DIET BEST REDUCES CARDIOVASCULAR DISEASE RISK?

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Appel L, Sacks F, Carey V, Obarzanek E, Swain J, Miller E et al. Effects of protein, monounsaturated fat and carbohydrate intake on blood pressure and serum lipids. *Journal of the American Medical Association* 2005;294(19):2455—2464.

## Introduction

It is widely acknowledged that a diet low in saturated fat reduces cardiovascular disease (CVD) risk. The question remains however as to which macronutrient should be given preference as a replacement for saturated fat in low saturated fat diets?

The carbohydrate rich Dietary Approaches to Stop Hypertension (DASH) diet is regularly advocated as an appropriate diet to lower CVD risk, and this diet does lower blood pressure and low density lipoprotein (LDL) cholesterol. The DASH diet however also lowers high density lipoprotein (HDL) cholesterol, and HDL cholesterol levels are inversely associated with CVD risk. It is known that diets high in monounsaturated fats will generally lower triglycerides and raise HDL cholesterol, however their effect on blood pressure is less clear. Meanwhile, although diets rich in plant sourced protein are thought to lower blood pressure and lipids, the supporting evidence is not conclusive.

Therefore this study was designed to compare the effects of three healthy diets on blood pressure and serum lipids.

## The Diets

The healthy diets comprised a carbohydrate rich diet similar to the DASH diet, a protein rich diet where about half the protein was obtained from plant sources, and a diet rich in unsaturated fat, primarily monounsaturated fats.

In the carbohydrate rich diet, carbohydrates provided 58% of kilocalorie (kcal), protein 15% of kcal and fats 27% of kcal.

With the protein rich diet the participants obtained 48% of kcal from carbohydrates, 25% of kcal from protein (of which 48% was from plant sources and 52% was from meat and dairy) and 27% of kcal from fats.

The unsaturated fat rich diet was designed so that 48% of kcal was provided from carbohydrates, 15% of kcal was provided from protein and 37% was provided from fats (of which 57% was monounsaturated, 27% polyunsaturated and 16% saturated.)

Of the total 15% kcal protein for both the carbohydrate rich diet and the unsaturated fat rich diet, some 37% kcal came from plant sources and 63% kcal from meat and dairy. Of the total 27% kcal fat for both the carbohydrate rich diet and the protein rich diet, 48% kcal was monounsaturated, 30% kcal polyunsaturated and 22% saturated.

The diets were also all designed to be low in total saturated fat (6% of total kcal), cholesterol (less than 150 mg/d) and sodium (2,300 mg/d). Additionally the diets were high in fibre (more than 30 g/d), potassium (4,700 mg/d) and in fruit and vegetables.

Other nutrients were provided at recommended levels including magnesium (500 mg/d) and calcium (1,200 mg/d). Finally the glycaemic index of the three diets were moderate and similar (68 in the carbohydrate diet, 71 in the protein diet and 75 in the unsaturated fat diet.)

## The Trial

The trial started with 191 participants. The participants were generally healthy with a blood pressure range of 120—159 mm Hg systolic and 80—99 mm Hg diastolic. This range allowed subjects who were diagnostically pre-hypertensive or had stage 1 hypertension to be included.

The participants were all aged more than 30, with a mean age of 53.6 years. Seventy-three percent were women of whom 73% were post-menopausal. Thirty-four percent of all participants were overweight and 45% were obese.

The participants were randomly assigned to follow one of 6 diet sequences (eg the carbohydrate rich diet followed by the protein rich diet followed by the unsaturated fat rich diet; or the unsaturated fat rich diet followed by the carbohydrate rich diet followed by the protein rich diet).

Each diet was eaten for 6 weeks (the 'feeding period'). Each feeding period was followed by a wash out period of 2—4 weeks where the participants ate their normal diet, after which the participants commenced the next diet in their sequence.

During each week day of the 6 week feeding period, the main meal was eaten at the study site. Participants kept a diary to record their compliance or non-compliance with the diet. The diets were designed at 5 caloric levels, and the participants weight was measured each week day with a goal that their weight be kept within 2% of their baseline weight.

Blood pressure was taken frequently before and throughout the feeding periods. Blood samples were taken before the feeding periods and at weeks 4 and 6 of each feeding period. These samples were taken following an 8—12 hour fast. Twenty-four hour urine samples were collected at baseline, and once during each feeding period.

## The Results

A total of 164 participants completed at least 2 feeding periods and were included in the primary analysis. One hundred and fifty-nine participants completed all three feeding periods. Participant self-reporting showed a high degree of adherence to the diets.

All three diets reduced systolic and diastolic blood pressure as well as LDL cholesterol levels. HDL cholesterol levels decreased in both the carbohydrate rich diet and the protein rich diet, but were essentially maintained in the unsaturated fat rich diet. Triglyceride levels reduced in the protein and unsaturated fat rich diets, but not the carbohydrate rich diet.

The researchers interest though was the contrasts between each of the protein rich diet and unsaturated fat rich diet with the carbohydrate rich diet. Compared to the carbohydrate rich diet, both the protein and unsaturated fat rich diets significantly lowered systolic and diastolic blood pressure when all the participants were analysed as a single group, and also for the hypertensive subgroup when analysed in isolation.

The unsaturated fat rich diet was marginally superior to the protein rich diet in improving the blood pressure of the hypertensive subjects, with both those diets clearly out-performing the carbohydrate rich diet. For the pre-hypertensive subjects, only the protein rich diet significantly lowered blood pressure when compared to the carbohydrate rich diet.

The protein rich diet, but not the unsaturated fat rich diet, significantly lowered LDL cholesterol levels compared to the carbohydrate rich diet. However, the protein rich diet significantly lowered HDL cholesterol levels compared to the carbohydrate and unsaturated fat rich diets. Only the unsaturated fat rich diet managed to maintain HDL levels.

Both the protein and unsaturated fat rich diets significantly lowered triglyceride and total cholesterol levels when compared to the carbohydrate rich diet. This reduction was greatest in the protein rich diet.

### CVD 10 Year Risk Reductions

The Framingham Equation is a CVD risk assessment tool that considers 6 variables: age, systolic blood pressure, total cholesterol, HDL cholesterol, hypertension medication use and smoking. This Equation revealed CVD 10 year risk reductions compared to baseline of 16.1%, 21% and 19.6% for the carbohydrate, protein and unsaturated fat rich diets respectively.

Another CVD risk assessment tool, the PROCAM equation, was applied. This tool includes triglyceride levels, but may only be applied to men. This tool showed even greater 10 year risk reductions of 20%, 30.7% and 29.4% for the carbohydrate, protein and unsaturated fat rich diets respectively.

### Clinical Comments

As many therapists will attest, the ratio of the macronutrients in a healthy diet is a most vexed question. It is often difficult to distinguish those diets which are sound from those which are unhealthy fads. Thus it is re-assuring to be able to consider such a well designed trail, with little significant limitations.

So what does this trial show? Firstly, that all three diets considerably lowered the 10 year risk for CVD. Thus all three diets were healthy, especially for the cardiovascular system. All three diets had adequate fibre, high fruit and vegetables, low salt and low saturated fat, and the importance of these factors cannot be overestimated. Thus the first message here is 'do not throw the baby out with the bath water'!

The second message is that the high carbohydrate DASH diet, though still effective, might be improved by partially replacing carbohydrates with either protein (preferably plant sourced) or unsaturated fat. Why this is so is not certain. As noted by the authors, some animal studies and small human trials have produced results that suggest increased sugar consumption raises blood pressure. This factor, when considered with the fact that both the protein and unsaturated fat rich diets lowered blood pressure by a similar extent, leads to the possibility 'that a reduced intake of carbohydrate, rather than an increased intake of protein or unsaturated fat, is the dietary factor that lowers blood pressure'.

Additional research is also required to explore the effects that different types of carbohydrates might have on blood pressure. Thus at this stage it seems that simply supplementing a patient's diet with protein or unsaturated fat may not necessarily further reduce CVD risk. Indeed, without a commensurate reduction in carbohydrate kilojoules, the potential weight gain might cause an increase in CVD risk.

So what is the best diet? The answer is clear that the best diet remains unclear. What is needed is to find the healthy diet that is right for each individual patient. If he or she will not follow dietary suggestions then, quite bluntly, it will not be a healthy diet for that patient. The answer is to be flexible and to be equipped with appropriate alternative suggestions.

Many factors will influence a patient's choices and ability to adhere to a healthy diet, and what may be suitable for one patient may be an abhorrence to another patient. Some of these complications were considered in the study. For example, poor appetite was reported by 10% of the people while eating the protein rich diet, compared to just 4% and 3% of those when eating the carbohydrate and unsaturated fat rich diets. Twelve percent experienced bloating/fullness while eating the protein rich diet, compared to just 6% for both the carbohydrate and unsaturated fat rich diets.

This study provides guidance as to how to achieve the required flexibility in providing dietary advice to different patients. It points the way towards how some dietary components may be appropriately varied, while highlighting other nutrients that should not be significantly varied. It suggests that appropriate and flexible dietary advice may be provided upon a foundation of carbohydrates providing about 48—58% of daily kilojoules, protein (being about 48% sourced from plants, 36% from meat and 16% from dairy) providing around 15—25% of daily kilojoules, with fats (being at least 84% unsaturated fats) providing some 27—37% of daily kilojoules. All ranges are healthy for the cardiovascular system, but best results might be achieved by combining the lower carbohydrate proportions with the higher protein or unsaturated fats proportions. ❖

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