

# Dietary support in persons with mild to moderate hypertension without overweight

## A pilot study in a general practice

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**Abstract** In a general practice the feasibility and effects of a sodium restricted and potassium enriched diet in patients with mild and moderate hypertension were studied for a period of 18 months. All participants were counselled by a dietician for a period of one year. Of the original 35 participants, 28 finished the experiment. After 12 and 18 months small decreases of 24-hour urinary sodium excretion occurred (20 mmol sodium = 1.2 g of NaCl). Urinary potassium excretion did not change. Independent from weight reduction diastolic blood pressure decreased 3-4 mm Hg. Despite the help of a dietician the goal of 85-100 mmol sodium/day (5-6 g of NaCl) was not reached. In a follow-up study it might be more appropriate to design intervention on a broader scale (with advice for weight reduction, alcohol reduction and more physical exercise, if necessary) and to focus on older subjects with higher initial blood pressures, without employing the use of antihypertensives as an exclusion criterion.

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### Introduction

Randomized intervention studies in the sixties and early seventies have demonstrated that drug treatment decreases cardiovascular complications in patients with severe hypertension.<sup>1,2</sup> Benefits were less obvious for patients with mild to moderate hypertension. More recent studies indicate that lowering blood pressure pharmacotherapeutically in this category of patients is less effective than had been hoped for initially.<sup>3,4</sup> This was especially true for the occurrence of the major cause of death in cardiovascular disease, being myocardial infarction. It was suggested that the favourable effect of blood pressure reduction by means of antihypertensives might be annulled by an unfavourable effect of the drugs used on lipid metabolism.<sup>5</sup> This probably accounts for the renewed interest in the relationship between blood pressure and diet in the eighties.<sup>6</sup>

Epidemiological studies and animal experiments have demonstrated that various dietary measures can reduce blood pressure. The antihypertensive effect of reduced salt intake was already known and has been reconfirmed in recent trials.<sup>7-9</sup> There are also publications on the role of other dietary factors in hypertension, such as potassium,<sup>10</sup> calcium,<sup>11</sup> and magnesium,<sup>12</sup> and also dietary fibres<sup>13</sup> and polyunsaturated fatty acids.<sup>14</sup> Potassium (especially the molar sodium/potassium ratio in the diet) appeared to be of great significance.<sup>10</sup> These developments have led to recommendations to advise dietary measures in the treatment of hypertension not just as a supplement to drug treatment, but especially as first choice.<sup>15,16</sup>

The first question we formulated was whether a diet with the following target values would be feasible:

- sodium <100 mmol (about 6 grammes of salt)/24 hours;
- potassium >75 mmol (about 3 to 4 grammes of potassium)/24 hours;
- sodium/potassium ratio <1.

Our second question concerned the maximum blood pressure response that was to be expected.

### Methods

In order to answer these two questions, a pilot study with some 7,500 patients was devised in a group practice. During office hours, blood pressure was measured in subjects aged 30-64 (after their permission). Subjects whose average diastolic phase V blood pressure was in the range 90-109 mmHg on three separate occasions (with at least two-week intervals), in the absence of renal disease, overweight (body mass index 27 kg/m), diabetes mellitus, coronary artery disease, use of oral contraceptives or antihypertensives (at least six weeks prior to the start of the study), were invited to participate.

The following exclusion criteria were used: diastolic blood pressure 110 mmHg on all three occasions, weight changes 5 per cent, signs and/or symptoms of a cardiovascular disease. After the GP performed anamnesis and examination to exclude secondary hypertension, suitable persons were admitted to the study and the following contacts were made:

- a Visits to a dietician for dietary advice (once a month) and for a 24-hour recall (once every two months).
- b Monthly visit to the GP for blood pressure measurement: systolic and diastolic phase 5 after 5 minutes rest in sitting position with the arm at heart level, with a Hawksley random-zero sphygmomanometer. Measurements were always performed by the investigator. The participant was informed of the value during the session. In order to correct for incidental fluctuations, the average of three measurements, taken at three separate occasions, was taken as value at t<sub>0</sub>, at t<sub>12</sub>, and at t<sub>18</sub>.
- c Monthly visit to the practice nurse to deliver the 24-hour urine for sodium, potassium and creatinine determinations.

Participants received dietary advice for a period of one year. Six months after the termination of intervention, the variables stated under a, b and c were determined again. The 24-hour diet recall was administered as follows: participants were asked to state all foodstuffs and beverages they

had taken from the moment they woke up on the previous day up to the moment they woke up on the day of the interview. Dishes, plates and glasses were used to describe the amounts of food taken as accurately as possible. Furthermore, the mode of preparation and the article brand-names were written down. Upon completion of the recall, the entire list was read back to the patients and, if necessary, corrections were made. The diet lists were coded for computer analysis.<sup>17</sup> On the basis of the results of this dietary analysis, an individual dietary advice was given.

On the day prior to the recall session, 24-hour urine was collected. Participants received both oral and written instructions for urine collection. Checks for completeness of collection were done by means of determination of the amount of creatinine excreted. The sodium and potassium excretion values were corrected on the basis of creatinine excretion.<sup>18</sup>

## Results

### Study group

There were 35 subjects (known with hypertension for eight years on average) included in this study – 16 males, 19 females; mean age 44.7. Ten of these people took antihypertensives; they were requested to discontinue six weeks prior to the start of the intervention. In the first three months, five out of these ten subjects dropped out for various reasons: two for pain in the chest, one for lack of motivation to continue with diet alone when blood pressure did not respond and two for repeated diastolic blood pressures  $\geq 110$  mmHg.

Between the 12th and the 18th month two more subjects (who did not use antihypertensives before the study) dropped out: one for lack of motivation, the other due to the development of a cerebrovascular accident. Thus 28 subjects completed the study.

Average base-line blood pressure of the drop-outs (n=7) was 154/103 mmHg. The first five drop-outs were completely excluded from analysis; the two participants who dropped out in the period between 12

**Table 1** Average blood pressure, body weight, intake of sodium (Nai) and potassium (Ki) according to the 24-hour recall method, excretion in 24-hour urine of sodium (Nau) and potassium (Ku), and the sodium/potassium ratio at various times during the study

	t0 n = 30	t12 n=30	t18 n=28
Systolic blood pressure (mm Hg)	144.5	142.9	140.3
Diastolic blood pressure (mm Hg)	95.4	91.8	90.9
Weight (kg)	75.9	76.5	77.5
Nai (mmol/24h)	129.9	101.5	99.7
Nau (mmol/24h)	153.3	132.4	131.1
Ki (mmol/24h)	110.7	102.5	105.9
Ku (mmol/24h)	76.9	79.5	71.3
NA/K ratio	2.09	1.77	1.96

t0 start; t12 after 12 months; t18 after 18 months.

**Table 2** Number of subjects with an excretion <100 mmol of sodium and >75 mmol of potassium in 24-hour urine, and the number of subjects with a molar Na/K ratio in the urine <1 on t0, t12 and t18.

	t0 n = 30	t12 n = 30	t18 n = 28
<100 mmol Na/24h	4	9	6
>75 mmol K/24h	10	13	9
Na/K ratio <1	0	5	1

and 18 months were excluded from analysis on t18 only.

### Changes after 12 and 18 months

Table 1 shows the study results of the total group for the various parameters: blood pressure, body weight, electrolytes (excretion in urine and intake calculated on the basis of 24-hour recall), and the Na/K ratio in the urine at t0, t12 and t18 (t0: start; t12: after 12 months; t18: after 18 months).

After 12 and 18 months a slight reduction in both systolic and diastolic blood pressures occurred. Mean urinary sodium excretion decreased by a mean 20 mmol/24 hours (1.2 gramme of NaCl), both on t12 and t18. Calculated sodium intake on the basis of recall decreased by

some 30 mmol/24 hours (1.7 gramme of NaCl) on t12 and t18. The Na/K ratio was decreased on t12, but somewhat increased again on t18. A slight body weight increase occurred on t12, which continued on t18.

Table 2 shows the number of subjects with an excretion in the 24-hour urine of less than 100 mmol of sodium and more than 75 mmol of potassium (corrected for creatinine excretion) at several intervals.

## Discussion

As it turned out, seven subjects (20 per cent) dropped out of the trial; five of them dropped out during the first three months. These five people had been using antihypertensives and had been requested to

stop taking them prior to the study. In two patients, chest pain did not appear to be related to angina pectoris upon examination by the cardiologist. Just like the elevated blood pressures in two other participants, their complaint could have been related to fear in connection with the discontinuation of drug treatment. In follow-up studies, significant drop-out among this category of participants must be anticipated. Perhaps it is advisable to stop employing the use of antihypertensives during the study as an exclusion criterion.

Reduced sodium intake appeared to be the major result of the dietary support. However, with sodium excretion as the most objective measure of sodium intake, most participants did not reach the target value of <100 mmol sodium per 24 hours. This might be explained by the fact that in the 24-hour recall, upon which each individual dietary advice was based, the sodium intake (calculated on the basis of excretion) was underestimated on all occasions; in other words, the amount of salt in the food might have been underestimated by the participants and the dietary advice was not strictly adhered to. From a survey that was conducted after the study, it thus appeared that all participants had had most problems with salt intake restrictions. Cooking separately for family members and eating out were mentioned as additional problems. This confirms that realizing a low-sodium diet is not easy, even in a group of well-motivated participants and despite intensive support. Therefore, the question could be asked whether it is not too idealistic to adhere to the WHO target value of no more than 100 mmol of sodium (about 6 grammes of salt) while daily (industrially prepared) food still contains so much sodium chloride.<sup>19</sup>

There were hardly any changes in the average potassium intake pattern. Also, there was a discrepancy between calculated potassium intake and urinary excretion. Thus, there was a considerable recall overestimation of the amount of potassium excreted in the urine. This electrolyte however is only excreted renally for some 80-85 per cent.<sup>20</sup>

After conversion potassium intake came up to a mean of more than 75 mmol.

The average initial Na/K ratio, calculated on the basis of the mean excretion values in the urine, was 2.09. This ratio also remained higher than one after 12 and after 18 months (<1 is favourable). During screening in Brielle, an average of 2.2 was found in male and female participants. That study demonstrated that the high Na/K ratio was mainly caused by a high sodium excretion.<sup>20</sup>

Due to the absence of a control group, it cannot be determined accurately whether reduction of diastolic blood pressure was a result of our diet intervention. Other factors, such as placebo and the 'regression to the mean' effects, may also have contributed. Thus, a mean reduction of 3-4 mmHg diastolic appeared to be the maximum attainable result. However, further reduction was not to be expected on the basis of sodium restriction.

In this study we wanted to focus on subjects between 30 and 65 years old with mild to moderate, uncomplicated hypertension, as the use of drugs in this category is controversial. In view of the relatively minor result, however, one may wonder whether this was a good choice. Indeed, the antihypertensive effect of sodium intake restriction increases with age and higher initial blood pressure values.<sup>21</sup> Furthermore, the question arises whether (from a GP's point of view) it might be more effective to design intervention on a broader scale, with advice for weight reduction, alcohol restriction and more physical exercise, if necessary.

### Conclusion

This pilot study demonstrates the feasibility of permanent (up to six months after support) affecting the dietary pattern in mildly to moderately hypertensive subjects with the support of a dietician. Sodium intake restriction was the main factor and did not depend on weight reduction. Despite intensive support, the WHO maximum target value of 100 mmol of sodium (6 grammes of NaCl) was not attained. Thus, only a minor diastolic blood pressure reduction of 3 to 4 mmHg occurred.

For reasons of efficiency, it would appear more useful to design intervention in a follow-up study on a broader basis (for example, by including weight loss, alcohol restriction and more physical exercise), and to focus on subjects with higher initial blood pressures and higher ages, without employing the use of antihypertensives as an exclusion criterion.

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### Samenvatting

In een huisartspraktijk werden de uitvoerbaarheid en het effect van een natriumbepoort en kaliumverrijkt dieet bij een groep patiënten met licht tot matige hypertensie gedurende een periode van 18 maanden bestudeerd. Alle deelnemers werden 1 jaar begeleid door een diëtiste. Van de oorspronkelijk 35 geselecteerde patiënten hebben er uiteindelijk 28 de studie afge maakt. Na 12 en 18 maanden was er een geringe daling opgetreden in de 24-uurs natriumuitscheiding (20 mmol natrium = 1,2 gram keukenzout). De kaliumuitscheiding veranderde niet. De diastolische bloeddruk daalde (onafhankelijk van gewichtsvermindering) met 3-4 mmHg. Ondanks de inbreng van een diëtiste werd het streefniveau van 85-100 mmol natriuminname (5-6 gram keukenzout) per dag niet gehaald. Het lijkt doelmatiger om in een vervolgstudie de interventie breder op te zetten (bijvoorbeeld tevens gewichtsvermindering, alcoholmatiging en meer lichaamsbeweging) en deze te richten op personen met een hogere initiële bloeddruk en hogere leeftijd, zonder dat daarbij het gebruik van antihypertensiva als uitsluitcriterium wordt gebruikt.