

# The DASH Diet

Susan Buckley, RDN

## DASH Diet

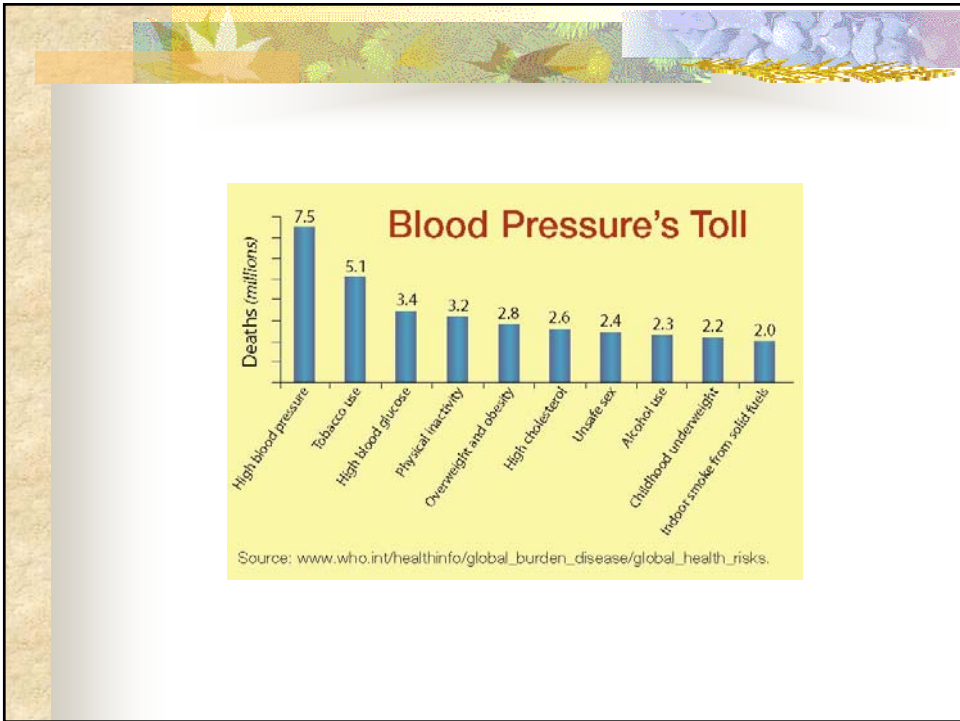
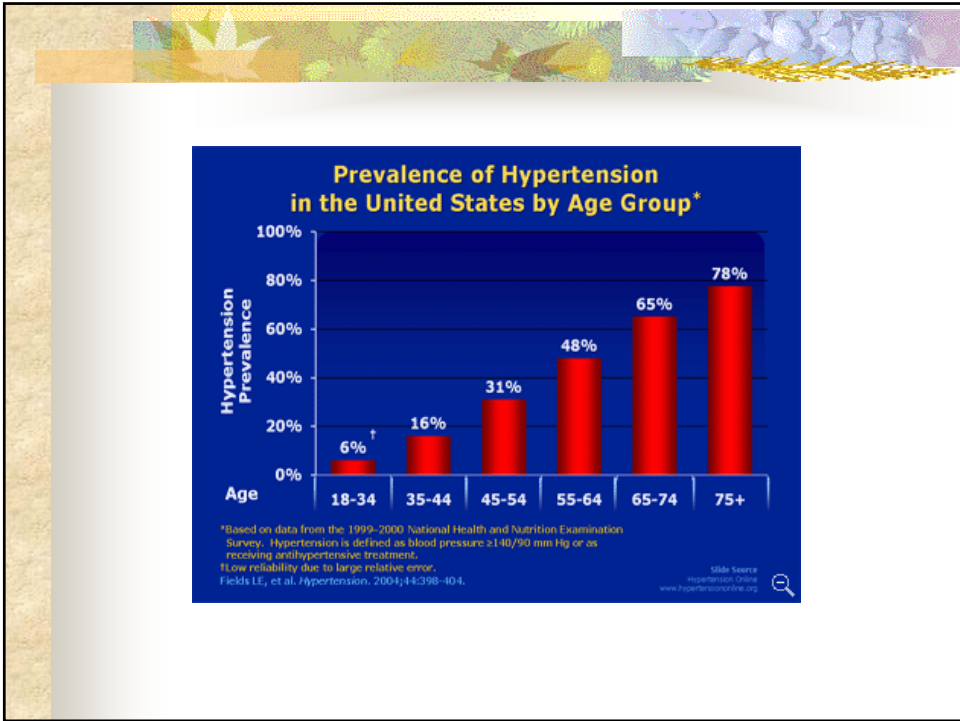
- D: Dietary
- A: Approaches to
- S: Stop
- H: Hypertension (High Blood Pressure)

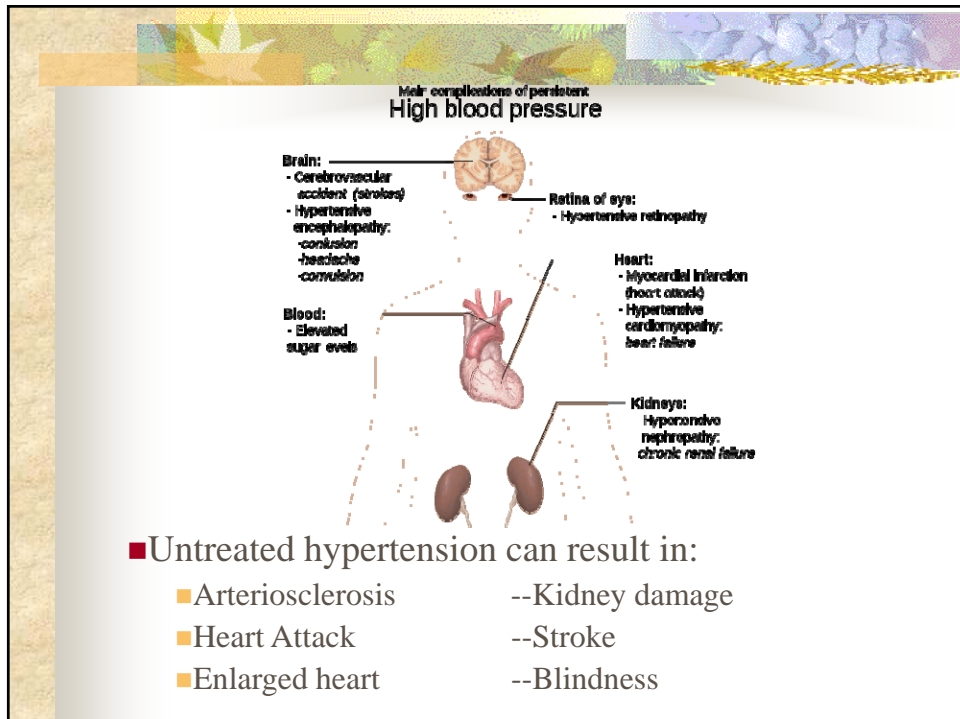
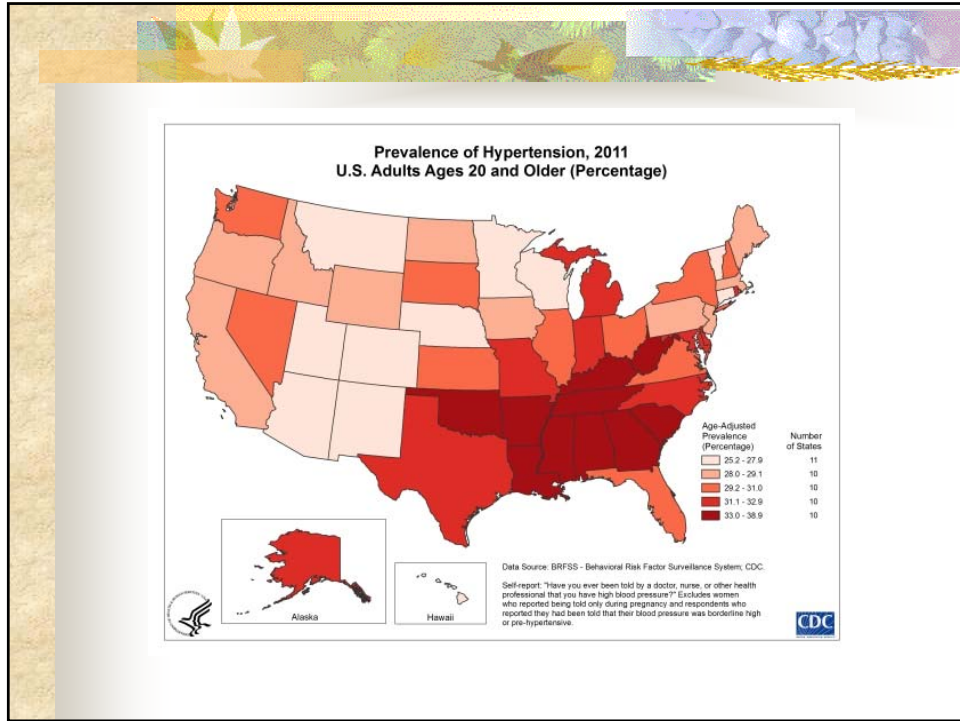
## Hypertension (HTN) Prevalence

- 50 million hypertensive US adults – about 1 in 4 adults
- One-third unaware
- *Less than half of American adults* have optimal blood pressure

## Hypertension

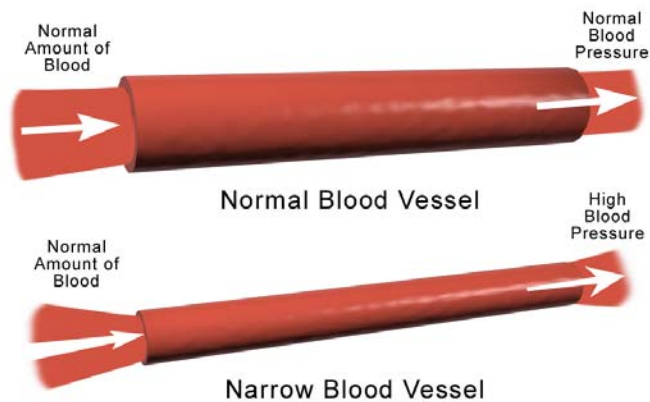
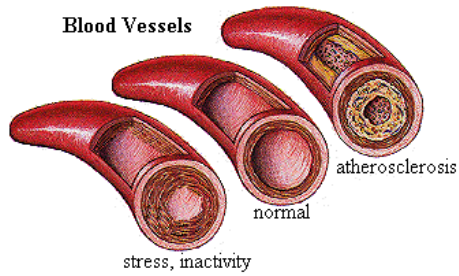
- As many as 2.8 million children also have high blood pressure.
- The prevalence of hypertension increases *with age*.



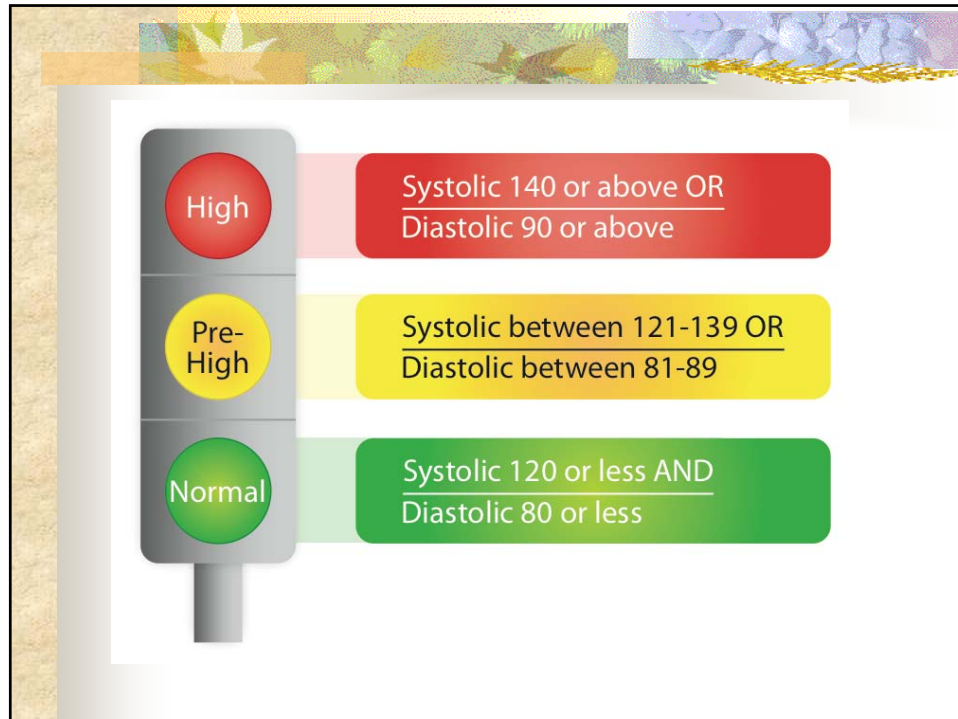


## Hypertension – High Blood Pressure

- HTN means increased pressure in blood vessels: less space for blood to travel through



### Blood Pressure Blood Flow



## Hypertension

- When the normal regulatory mechanisms fail, hypertension develops.
- Hypertension is so dangerous because it gives off no warning signs or symptoms.
- The “silent” disease





## Factors Influencing the Development of Hypertension

- High-normal blood pressure
- Family history of hypertension
- African-American ancestry
- Lifestyle factors:  
*overweight/inactivity/diet/sodium/  
alcohol/smoking*



## Factors Influencing the Development of Hypertension

- Excess Consumption of Salt
- Certain segments of the population are '**salt sensitive**' because their blood pressure is greatly affected by salt consumption

## Salt vs Sodium

- **Salt** is sodium + chloride
- Both are minerals
- Salt is made up of 40% sodium and 60% chloride
- It's that 40% sodium that causes so much concern

## Sodium

- The *Dietary Guidelines for Americans* recommend limiting sodium to **less than 2,300 mg per day**.
- **1,500 mg if you know you suffer from high blood pressure, kidney disease, or diabetes.**
- The average daily sodium intake for Americans aged 2 years and older is **more than 3,400 milligrams (mg)**
- Reducing average population sodium consumption by 400 mg has been projected by the Centers for Disease Control to prevent up to 28,000 deaths from any cause and save \$7 billion in health care expenditures annually



## Who is Salt Sensitive?

- Experts disagree as to the exact definition and cause of salt sensitivity but the chief symptom is blood pressure that is unusually sensitive to salt or sodium intake.
- Salt sensitivity is especially common among older people, African-Americans, and people with hypertension, kidney disease or diabetes.
- Overall, 26% of Americans with normal blood pressure and 58% of those with hypertension are salt sensitive
- So far there's no easy way to test for salt sensitivity—or its absence (though researchers seem to be narrowing in on a “salt gene”

## What about Iodine?

- Recent research suggests that iodine deficiency isn't as rare as it once was.
- Adults need 150 micrograms a day, which we used to get easily from our diet from iodized salt
- But in recent years, some of our main sources—restaurant and processed food—are less likely to contain iodized salt.
- We also get iodine from fish, shellfish, strawberries, yogurt, cow's milk, and eggs. Kelp contains the most, so sushi eaters get plenty.

- Iodized salt is the chief source of iodine in the industrialized world.
- Rates of *iodine deficiency* have reached epidemic levels, increasing fourfold over the past 40 years.
- Recent scientific analysis reveals that many commercial table salt brands now contain inadequate amounts of iodine.
- Iodine is critical to healthy thyroid function.
- Inadequate iodine intake causes weight gain, low energy, depression, cardiovascular disease, cognitive decline, and a variety of cancers.
- Iodine is vital to breast health in older women, with low intake correlated to increased risks for breast cancer and fibrocystic breast disease.

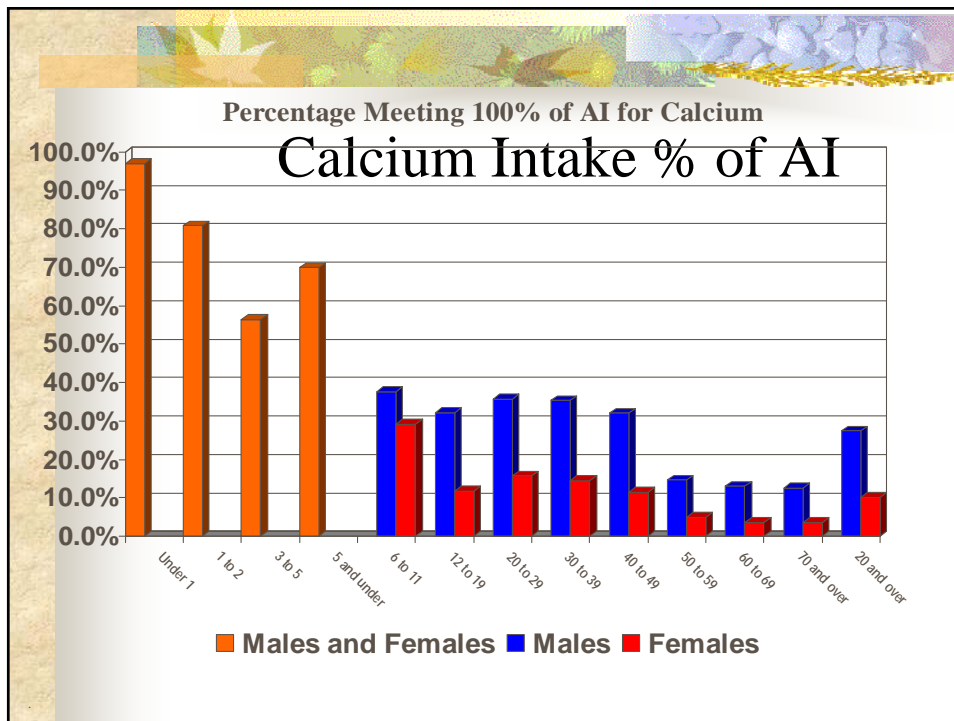
## Blood Pressure and Minerals

- It's not enough to just lower sodium.
- Too much sodium really does boost blood pressure, but high blood pressure really responds when you restore the natural **mineral balance** your body needs for healthy BP regulation.
- The perfect mineral ratio for most people:
  - 1,500 - 2,300 milligrams of **sodium**
  - 4,700 milligrams of **potassium**,
  - 1,200 milligrams of **calcium**
  - 420 milligrams of **magnesium**.

# Mineral Intake and Hypertension

## Calcium

- American Heart Association Statement:
  - Increasing calcium intake may preferentially lower blood pressure in salt-sensitive people
  - Benefits more evident with low initial calcium intakes (300-600 mg/day)



## Calcium

- But don't just pop a pill
- Evidence from research shows that getting calcium from food rather than a supplement is best for blood pressure control and a healthy heart

## Calcium: The most abundant mineral in the human body

- **Low intake of Calcium:** In the Nurse's Health Study, consuming the RDA for calcium (1200 mg/day) resulted in **lower risk of developing hypertension** than consuming lower levels (400 mg/day).
- **Good sources of Calcium:** yogurt, sardines, salmon, tofu, spinach, kale, milk

## Effects of increasing Calcium-Rich Food

- Increases urinary sodium excretion
- Decreases blood volume
- Decreases peripheral vascular resistance
- Decrease blood pressure

## Calcium

- A University of South Carolina review of the health histories of 17,030 Americans found that those who got more calcium from food had lower increases in systolic blood pressure, an indicator of artery health, as they aged.
- In contrast, relying on supplements might cause trouble.
- In a National Institutes of Health study that followed 388,229 women and men for 15 years, researchers found that men who took 1,000 mg or more of supplemental calcium daily had a 20% higher risk for fatal heart disease.
- However, calcium from food didn't raise risk.

## Calcium

- 99% of your body's calcium is stored in your skeleton and teeth, the remaining 1% circulates in your bloodstream and moves in and out of your cells on an important mission.
- Calcium helps blood vessels contract and expand; it also aids the transmission of signals in nerves and cells.
- These tasks are so important that if blood levels of calcium are low, your body will rob calcium from your bones to make sure they happen.

## Calcium

- When calcium intake is low, artery walls can tighten.
- Calcium also helps your body maintain a healthier sodium balance; low levels of calcium hamstring efforts to off-load sodium.



## Calcium

- When combined with low-sodium and high potassium, calcium's blood pressure punch is bigger.
- In the DASH study: "Dietary Approaches to Stop Hypertension," people who ate foods rich in both calcium and potassium (along with magnesium) saw bigger BP drops than those who skipped calcium-rich dairy products.
- At the end of the study, 70% of volunteers on the combination diet had lowered their blood pressure to healthy levels, compared to just 45% of those who ate loads of produce but didn't add daily calcium-rich dairy.

## Calcium

- Best calcium intake for bone and heart health:
- 1,200 milligrams a day, the amount recommended by the Institute of Medicine for people over age 50.

## Food Sources of Calcium

Food	Amount	Calcium (mg)
Yogurt, plain, low fat	8 oz	415
Collards, frozen, boiled	1 cup	357
Skim milk	1 cup	306
Black-eyed peas, boiled	1 cup	211
Canned salmon	3 oz	181
Calcium-set tofu	3 oz	163
Cottage cheese, 1% milk fat	1 cup	138
Almonds	1 oz	70
Blackstrap Molasses	1 Tbsp	172

## How Does Alcohol Affect Blood Pressure?

- Drinking too much alcohol can raise blood pressure to unhealthy levels.
- Having more than 3 drinks in one sitting temporarily increases your blood pressure, but repeated binge drinking can lead to long-term increases

## Alcohol

- If you have high blood pressure, avoid alcohol or drink alcohol only in moderation. **Moderate drinking** is generally considered to be:
  - Two drinks a day for men younger than age 65
  - One drink a day for men age 65 and older
  - One drink a day for women of any age
  - A drink is 12 ounces of beer, 5 ounces of wine or 1.5 ounces of 80-proof distilled spirits.

## Factors Influencing the Development of Hypertension

- **Lack of Exercise**
- Less active individuals are 30-50% more likely to develop hypertension.

## Sample Hypertension Program

	Cardio	Strength	Flexibility
Frequency	3-7x per week, To burn up to 2000 kcal/week	2-3x per week	3x per week
Intensity	40-70% VO2	16-20 repetitions, 60-70% 1RM	Point of tension
Duration	30-60 minutes	1-3 sets`	10 seconds
Mode	Any type they enjoy	Circuit training	Active, static, tai chi

## Factors Influencing the Development of Hypertension

- Other Dietary Factors
- **Low intake of Potassium:** In population studies, dietary potassium and blood pressure are inversely related.
- **High potassium intakes are associated with lower BP.**
- **Good sources of Potassium:** sweet potato, tomato paste, white beans, yogurt, soybeans, tuna, banana, spinach, low-sodium tomato juice

## Potassium

- Keeps sodium from raising blood pressure by making kidneys excrete more salt
- Potassium can lower blood pressure by 3-4 points
- Experts recommend **4,700 mg a day**
- Typical American gets roughly 2,300-3,000 mg day

## High Potassium Foods

- Potato 940 mg
- Low sodium V 8 juice (8 oz) 900 mg
- Sweet potato 540 mg
- Banana 490 mg
- Acorn squash 450 mg
- Spinach 420 mg
- Salmon 3 oz 390 mg
- Milk/Yogurt 1 cup 370 mg
- Pinto beans ½ cup 290 mg

## Potassium

- A low sodium diet will have greater impact on health if it is coupled with a diet rich in potassium!

## Magnesium

- Low intake of Magnesium:
- Magnesium is a potent inhibitor of vascular smooth muscle contraction and may play a role in blood pressure regulation as a vasodilator.
- **Good sources of Magnesium:** halibut, almonds, cashews, soybeans, spinach, oatmeal, yogurt



## Magnesium

- In two big Harvard School of Public Health studies of 70,000 doctors and nurses, those with the highest magnesium intakes had healthier diastolic and systolic blood pressure numbers.
- A University of Minnesota study of nearly 8,000 people found that risk for hypertension was **70% lower in women with the highest blood levels of magnesium and 18% lower in men with the highest levels.**

## Magnesium

- Up to 45% of us currently shortchange ourselves of this important mineral.
- If you take blood pressure drugs, you should know that some diuretics (water pills) can also cause magnesium deficiencies.
- Proton Pump Inhibitors (Prilosec, Nexium, etc) can drastically lower magnesium.
- Couldn't you just take a pill to make up the difference? Experts say the magnesium in food works better, in part because you get other pressure-lowering minerals at the same time.

- **Spinach** — 1 cup: 157 milligrams (40% DV)
- **Chard** — 1 cup: 154 milligrams (38% DV)
- **Pumpkin seeds** — 1/8 cup: 92 milligrams (23% DV)
- **Yogurt or Kefir** — 1 cup: 50 milligrams (13% DV)
- **Almonds** — 1 ounce: 80 milligrams (20% DV)
- **Black Beans** — 1/2 cup: 60 milligrams (15% DV)
- **Avocado** — 1 medium: 58 milligrams (15% DV)
- **Figs** — 1/2 cup: 50 milligrams (13% DV)
- **Dark Chocolate** — 1 square: 95 milligrams (24% DV)
- **Banana** — 1 medium: 32 milligrams (8% DV)

## The DASH Diet

- The **D**ietary **A**pproaches to **S**top **H**ypertension clinical trial (**DASH**)
- Diet rich in fruits, vegetables, and low-fat dairy foods, can **substantially lower blood pressure** in individuals with hypertension and high normal blood pressure.

## DASH is Unique

- Tested dietary patterns rather than single nutrients
- Experimental diets used common foods that can be incorporated into recommendations for the public
- Investigators planned the DASH diet to be fully compatible with dietary recommendations for reducing risk of CVD, osteoporosis and cancer

## U.S. News & World Report

- Overall Rating 4.2 stars out of 5
- DASH just barely edged out the **Mediterranean diet** for the **first place spot on U.S. News' list of ranked diets.**
- The DASH Diet is ranked **#1 in Best Diets Overall.**

## DASH Study Design

- 8-week randomization to one of three diets:
  - Control
  - ↑ Fruits and vegetables
  - Combination: ↑ fruits, vegetables and low fat dairy products
- Energy intake adjusted to ensure constant weight
- Sodium content of all three diets was approximately 3000 mg/daily (not low sodium)

## DASH Subject Characteristics

- Systolic bp < 160 mm Hg
  - Average was 132 mm Hg
- Diastolic bp 80-95 mm Hg
  - Average was 85 mm Hg
- 459 randomized
  - 133 hypertensive
  - 326 normotensive
- 22 years and older
- 50% women, 50% men
- 29% untreated hypertensive: not currently taking hypertensive meds

## DASH Study Test Diets

### Control diet

- Modeled after the typical American diet
- 37% fat, 15% protein, 48% carbs
- Calcium deficient – 443 mg/day
- Potassium – 1700 mg/day
- Magnesium – 165 mg/day

## DASH Study Test Diets

### Fruit and vegetable diet

- Similar to control diet in fat and protein content
- Included 8-10 servings fruits and vegetables
- Calcium – 534 mg/day
- Potassium – 4101 mg/day
- Magnesium – 423 mg/day

## DASH Study Test Diets

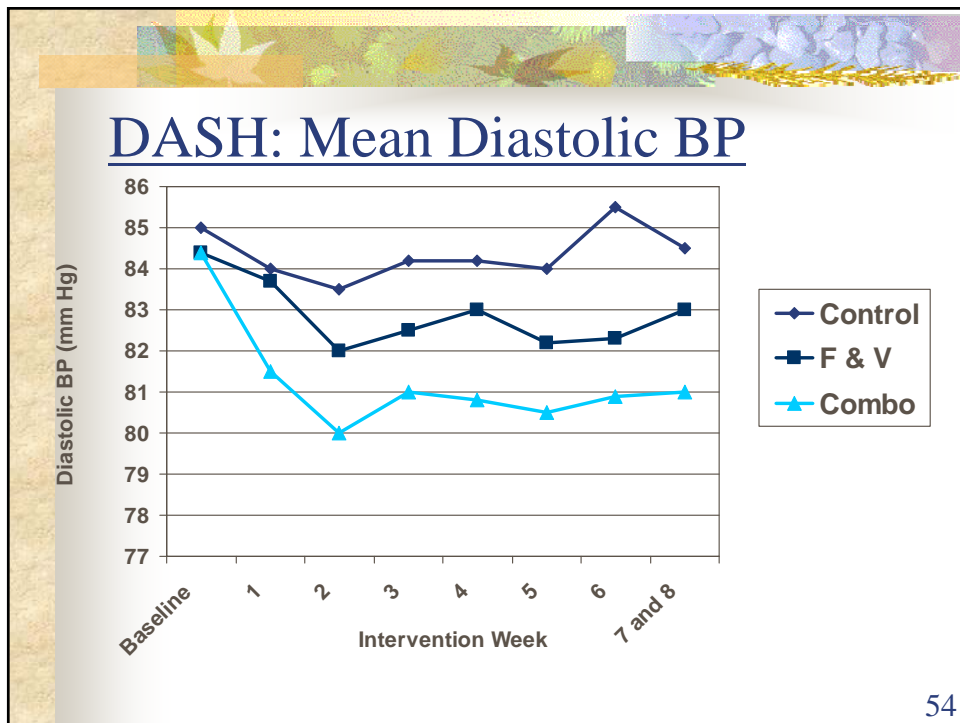
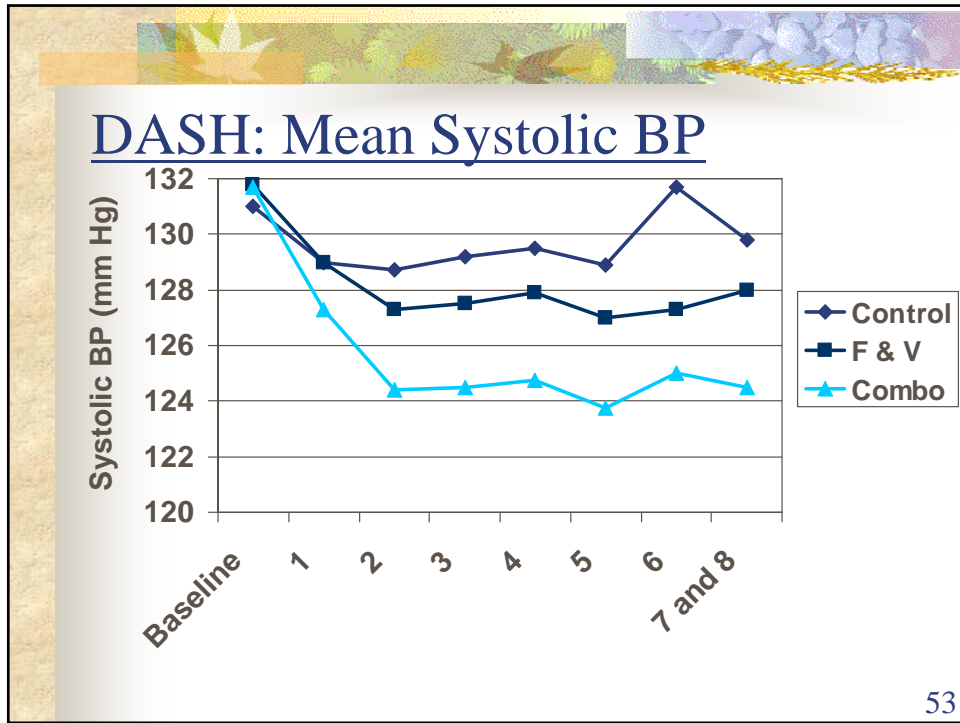
### Combination diet

- Similar to fruit and vegetable diet
- Low fat and cholesterol
- At least 3 servings of dairy foods
- Calcium – 1265 mg/day
- Potassium – 4415 mg/day
- Magnesium – 480 mg/day

## Controlled Feeding Trial

- 7-day menu cycle (21 meals)
- 4 calorie levels: 1600, 2100, 2600, 3100
- Lunch/dinner consumed on-site weekdays
- Weekend meals consumed off-site
- Adherence recorded





## DASH Author's Conclusions

- Blood pressure reduction is rapid
- Blood pressure reduction *comparable to drugs*
- BP effect can be generalized to all Americans
- Dietary Ca/F&V effect independent of
  - Sodium intake
  - Weight change
- DASH has public health implications
  - Preventive measure against hypertension
  - Reduce stroke by 27% and CHD by 15%

## DASH-Sodium

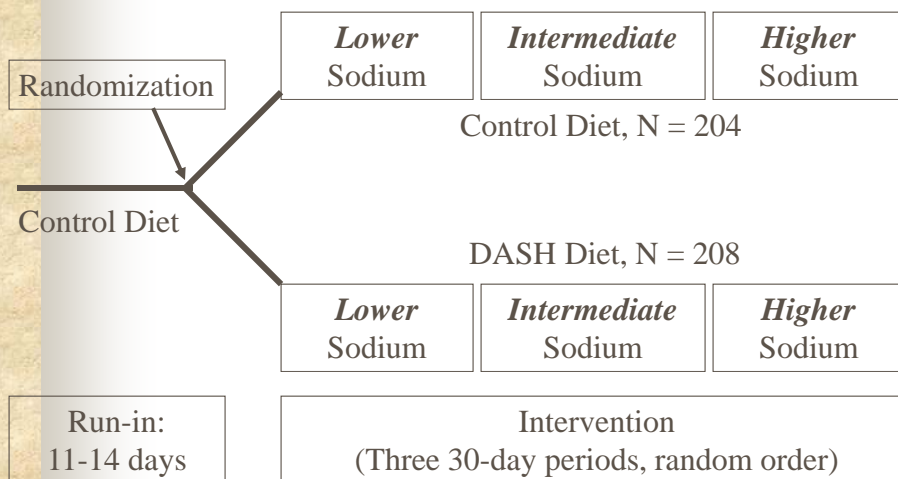
**Effects on Blood Pressure of Reduced Dietary Sodium and the Dietary Approaches to Stop Hypertension (DASH) Diet**

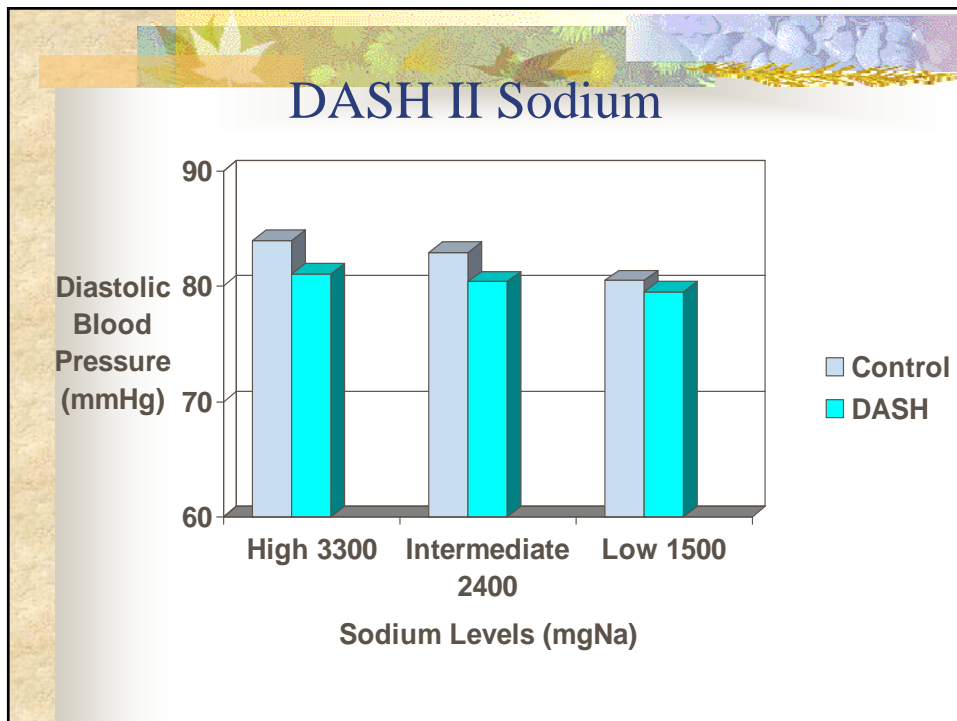
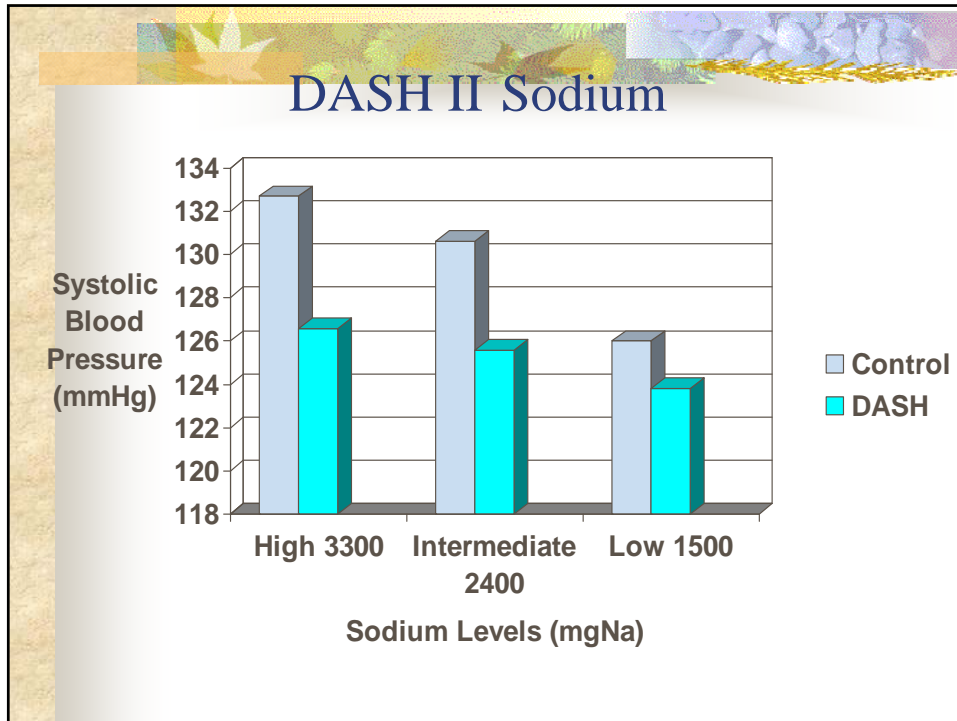
## DASH-Sodium: Subjects

- 412 randomized
- 57% women
- 57% ethnic minority
- Systolic BP of 120-159 mmHg
- Diastolic BP of 80-95 mmHg
- 41% hypertensive

## DASH-Sodium Trial: Study Design

Sodium levels: *Lower*: 1500 mg/day; *Intermediate*: 2400 mg/day; *Higher*: 3,300 mg/day





## DASH-Sodium: Results

- *At each of the three levels of sodium* intake, blood pressure was lower for those on the DASH diet than for those on the control diet.
- Reducing dietary sodium lowered blood pressure for both the control and DASH diets in all participants.
- Largest reductions in blood pressure were found with the DASH diet at the lowest sodium intake.

## Sodium



- ¼ teaspoon = 600 mg sodium
- ½ teaspoon = 1,200 mg sodium
- ¾ teaspoon = 1,800 mg sodium
- 1 teaspoon = 2,400 mg sodium
- 1 tsp baking soda = 1,000 mg sodium

## Sodium

- Nuts
- Potato chips
- Cheerios
- Bread

## Sodium

- Honey Nut Cheerios  $\frac{3}{4}$  cup = 190 mg
- Cheerios 1 cup = 160
- Cheerios 1  $\frac{1}{2}$  cup = 240
- Lay's potato chips 1 oz = 170 mg
- Arnold's Oatnut bread 2 slices = 300 mg
- Planter's Mixed nuts (lightly salted)  
1 oz = 45 mg

## Sodium

- Make your own salad dressing/marinades
- Make your own stock and gravy instead of using bouillon cubes or granules
- Mrs. Dash spices and marinades
- Low-sodium cookbooks and web sites
- Use herbs/spices vs salt

## Sodium

- When eating out, order foods that have been grilled, baked, steamed or poached instead of fried, battered or “smothered”
- Low-sodium canned soup (150 mg or less)
- Natural low-fat cheese vs processed cheese
- Unsalted popcorn, rice mixes, etc



## Sodium

- Dehydrated onion soup mix (1 packet):  
3,132 mg sodium
- Seasoned bread crumbs, 1 cup: 2,111 mg  
sodium
- Soy sauce, 1 tablespoon: 1,260 mg
- Beef Bouillon cube: 930 mg

## Sodium

- Subway tuna and cheese wrap: 1,310 mg sodium
- Wendy's roasted turkey and Swiss cheese sandwich:  
1,530 mg
- Panera Bread French onion soup: 1,790 mg
- Taco Bell Southwest Steak Border Bowl: 2,330 mg
- Starbucks' Turkey & Swiss Sandwich: 1,140 mg
- Subway's Spicy Italian: 3200 mg
- Wendy's Baja Salad 1,975 mg
- Chipotle Burrito (chicken, black bean, fajita vegetables,  
tomato salsa, cheese): 2450 mg
- Qudoba Naked Salad: 1185 mg







## Sodium vs Potassium Chloride

- Potassium chloride has no sodium
- Can buy No Salt (potassium chloride) or Low Salt (1/2 potassium chloride and 1/2 sodium chloride)

## DASH Reduces Homocysteine Levels

- Effect a result of diet high in vitamin B-rich milk and milk products, fruits and vegetables
- Homocysteine is a common amino acid (one of the building blocks that make up proteins) found in the blood and is acquired mostly from eating meat.
- High levels of homocysteine are related to the early development of heart and blood vessel disease - considered an independent risk factor for heart disease
- Lowering homocysteine with DASH may reduce CVD risk an additional 7%-9%

## DASH Reduces Cholesterol

- 

 Total cholesterol 13.7 mg/dl
- 

 LDL cholesterol 10.7 mg/dl
- 

 HDL cholesterol 3.7 mg/dl

## DASH Diet Pattern

based on a 2,000 calorie diet

<b>Food Group</b>	<b>Servings*</b>
Grains	7-8
Vegetables	4-5
Fruits	4-5
Low-fat or fat free dairy	2-3
Meats, poultry, fish	less than 2
Nuts, seeds, dry beans and peas	4-5/week
Fats and oils	2-3
Sweets	5/ week

\*servings varied from day to day,  
average intake over a week close to  
recommended

## Typical day of DASH Eating

### ■ Breakfast

- 1 cup fresh mixed fruits, such as melons, banana, apple and berries, topped with 1 cup fat-free, low-calorie vanilla-flavored yogurt and 1/3 cup walnuts
- 1 bran muffin
- 1 teaspoon trans-free margarine
- 1 cup fat-free milk
- Herbal tea

## Typical day of DASH Eating

### ■ Lunch

- Curried chicken wrap made with:
  - 1 medium whole-wheat tortilla
  - 2/3 cup cooked, chopped chicken, about 3 ounces
  - 1/2 cup chopped apple
  - 2 tablespoons light mayonnaise\*
  - 1/2 teaspoon curry powder
  - 1/2 cup, or about 8, raw baby carrots
- 1 cup fat-free milk

## Typical day of DASH Eating

- **Dinner**
- 1 cup cooked whole-wheat spaghetti with 1 cup marinara sauce, no added salt
- 2 cups mixed salad greens
- 1 tablespoon low-fat Caesar dressing
- 1 whole-wheat roll
- 1 teaspoon olive oil
- 1 nectarine
- Sparkling water

## Typical day of DASH Eating

- **Snack (anytime)**
- Trail mix made with:
  - 1/4 cup raisins
  - 1 ounce, or about 22, unsalted mini twist pretzels
  - 2 tablespoons sunflower seeds

<b>Calories:</b>	<b>2,193</b>	<b>Cholesterol:</b>	<b>99 mg</b>
<b>Total fat:</b>	<b>70 g</b>	<b>Sodium:</b>	<b>1,854 mg</b>
<b>Saturated fat:</b>	<b>11 g</b>	<b>Total carbohydrate:</b>	<b>324 g</b>
<b>Trans fat:</b>	<b>0 g</b>	<b>Dietary fiber:</b>	<b>38 mg</b>
<b>Monounsaturated fat:</b>	<b>16 g</b>	<b>Sugars:</b>	<b>135 g</b>
<b>Potassium:</b>	<b>4,219 mg</b>	<b>Protein:</b>	<b>95 g</b>
<b>Calcium:</b>	<b>1,370 mg</b>	<b>Magnesium:</b>	<b>495 mg</b>

## Killing many birds with one stone

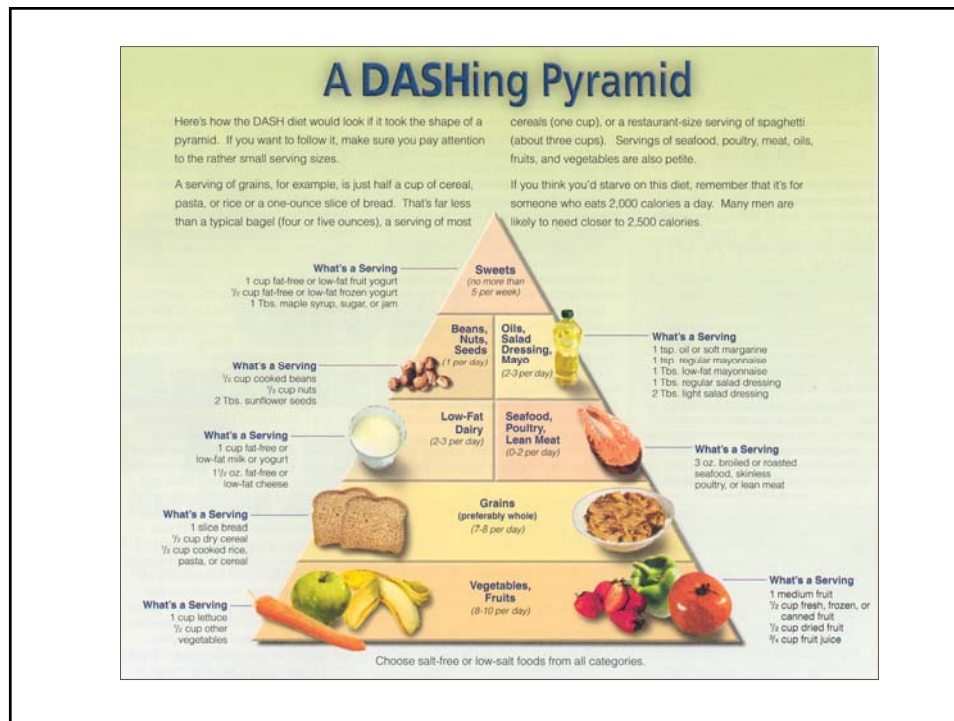
DASH meets multiple dietary recommendations

- NIH-NHLBI-ATP III
- AHA
- USDA Dietary Guidelines
- NCI and AICR
- Surgeon General



## Take Time for Some TLC

- Choose foods low in saturated fat
  - Whole grains
  - Fruits
  - Vegetables
  - Fat free or 1% dairy products
  - Lean meats, fish, skinless poultry
  - Dried peas/beans







## Sodium: Are You Getting Too Much?

- Main sources of sodium in the average U.S. diet:
  - 5% added while cooking
  - 6% added while eating
  - 12% from natural sources
  - 77% from processed and prepared foods



## Reducing Sodium in the Diet

- Use fresh poultry, fish and lean meat, rather than canned or processed.
- Buy fresh, plain frozen or canned with “no salt added” vegetables.
- Use herbs, spices and salt-free seasoning blends in cooking and at the table; decrease or eliminate use of table salt.
- Choose ‘convenience’ foods that are lower in sodium.

## Reducing Sodium in the Diet

- When available, buy low- or reduced-sodium or 'no-salt-added' versions of foods like:
  - Canned soup, canned vegetables, vegetable juices
  - Low-fat cheeses
  - Condiments like soy sauce
  - Crackers and snack foods like nuts
  - Processed lean meats



## Food Labels

Claim	Amount
Low Sodium	<140 mg/serving
Very Low Sodium	<35 mg/serving
Sodium Free	<5 mg/serving
Reduced Sodium	25% less than original

## Understanding Sodium Terms:

- Reduced Sodium      25% less



## Diuretics

- Diuretic drugs can deplete levels of:
- Calcium, Magnesium, Potassium
- Vitamins B1, B6, Vitamin C
- Low levels can lead to bone loss, muscle cramping and weakness, irregular heartbeat, high blood pressure and nausea
- Can cause confusion, memory loss, insomnia, fluid retention & fatigue

## Natural Diuretics

- Some foods act as natural diuretics:
- Asparagus, parsley, beets, grapes, green beans, leafy greens, pineapple, pumpkin, onion, leeks and garlic
- Should not replace diuretics but can help and may keep need for high doses of diuretics to a minimum

## Summary

- **Simple Changes: One at a Time**
  - Add one more vegetable per day
  - Snack on a piece of fruit instead of a cookie
  - Buy low fat/nonfat milk and/or yogurt
  - Use garbanzo beans on salads
  - Have a 1/4 cup nuts as a snack

## Summary

- Maintain normal body weight
- Reduce sodium intake to no more than 1500 mg/day
- Regular physical activity – at least 30 minutes most days of the week
- Limit alcohol consumption
- Maintain adequate potassium, calcium, magnesium intake
- Consume a diet rich in fruits, vegetables and low-fat dairy products
- Reduce saturated fat in diet

### Strategy

### Approx reduction in SBP

DASH Diet	8-14 mmHg
Sodium 1500 mg	2-8 mmHg
Reduce Weight	5-20 mmHg per 20#
Physical Activity (30 min day)	4-9 mmHg
Limit alcohol (no more than 2 drinks per day for men and 1 for women)	2-4 mmHg

## DASH website

- [www.dashdiet.org](http://www.dashdiet.org)
- Excellent website for information on Dietary Approaches to Stop Hypertension

## Resources

- [American Heart Association Low-Salt Cookbook, 3rd Edition: A Complete Guide to Reducing Sodium and Fat in Your Diet](#)





## Resources

- 500 Low Sodium Recipes: Lose the salt, not the flavor in meals the whole family will love by Dick Logue (Nov 1, 2007)



## Resources

- Website/blog: [www.sodiumgirl.com](http://www.sodiumgirl.com)
- Lots of low sodium info and recipes
- Low sodium expert has written for San Francisco Chronicle, Ladies Home Journal, Women's Day, Shape, Living Without, Arthritis Today, Alliance for Lupus Research and Stanford Hospital
- Cookbook: Sodium Girl's Limitless Low-Sodium Cookbook