



Module 3: Hypertension, Sodium, and Lifestyle

This program meets the accreditation criteria of The College of Family Physicians of Canada and has been accredited for up to 1 Mainpro-M1 credits.

Canadian Hypertension Education Program



1

Notes

This program meets the accreditation criteria of The College of Family Physicians of Canada and has been accredited for up to 1.5 Mainpro-M1 credits

Case Development & Disclosures

Case Author

Luc Trudeau , MD, FRCPC

- Assistant-Professor of Medicine
- Cardiovascular Prevention Centre, Jewish General Hospital, McGill University
- Specialty: Internal Medicine

Case Series Editor:

Sheldon W. Tobe, MD, MScCH
HPTE, FRCPC, FACP, FASH,

CHEP Continuing Education Committee

- Sol Stern, MD MCFP
- David Dannenbaum, MD CCFP
- John Hickey MD, CCFP
- Karen Mann, BN, MSc, PhD

Additional Reviewers

- Debra Reid, PhD, RD



2

Instructions

Read out the case authors and their disclosure information.

Conflict Disclosure Information

- Presenter 1:
 - Grants/Research Support: _____
 - Speakers Bureau/Honoraria: _____
 - Consulting Fees: _____
 - Other: _____



3

Instructions

Fill out prior to the meeting and disclose to the group any real or apparent conflict(s) of interest that may have a direct bearing on the subject matter of this CME program (based on the guidelines below).

Allow other participants to introduce themselves and give a brief outline of their practice and interests.

Guidelines for Disclosure:

To ensure balance, independence, objectivity and scientific rigor, please disclose to program participants any real or apparent conflict(s) of interest that may have a direct bearing on the subject matter of this CME program. This pertains to relationships with pharmaceutical companies, biomedical device manufacturers, or other corporations whose products or services are related to the subject matter of this program. The intent of this disclosure is not to prevent a facilitator with a potential conflict of interest from making a presentation. It is merely intended that any potential conflict would be identified openly so that the participants may form their own judgments about the program with the full disclosure of the facts. It remains for the audience to determine whether the facilitator's outside interests may reflect a possible bias in either the exposition or the conclusions presented.

Example

Grants/Research Support: PharmaCorp ABC

Speakers Bureau/Honoraria: XYZ Biopharmaceuticals Ltd.

Consulting Fees: MedX Group Inc.

Other: Employee of XXY Hospital Group

Outline of Today's Activity

- Introduction
- Case Presentation
- Key Learnings & Questions
- Wrap Up



4

Instructions

Review the agenda for today's activity.

For all slides, present the slide content and use the accompanying notes to describe them.

Module 3: Sodium and Lifestyle

Lavani

A 56 year old woman presents
to your office for worsening hypertension



5

Instructions

Indicate to the group that this patient will be the focus of today's case discussion.

Notes

Hypertension, alone or in combination with coronary heart disease, precedes the development of heart failure in the majority of both men and women.

Learning Objectives

Upon completing this activity, participants should be able to:

1. Apply the Canadian Hypertension Education Program (CHEP) recommendations for the management of hypertension in association with sodium and lifestyle
2. Explain the relationship between hypertension and sodium, how to prevent and manage hypertension with lifestyle modifications, and a multi-pronged approach
3. Recognize high sodium content food items and lower sodium options



6

Instructions

Review the learning objectives for today's activity.

Statement of Need

“My greatest challenge as a health care provider in the management of patients with hypertension is _____”



7

Instructions

Quickly go around the room and ask each participant to complete this statement. If there are members of the interprofessional team participating, tailor the statement accordingly.

Risk Factors for Hypertension

- High dietary sodium intake
- Obesity
- High alcohol intake
- Sedentary lifestyle
- Smoking
- Inadequate vegetable and fruit intake
- Inadequate milk product intake

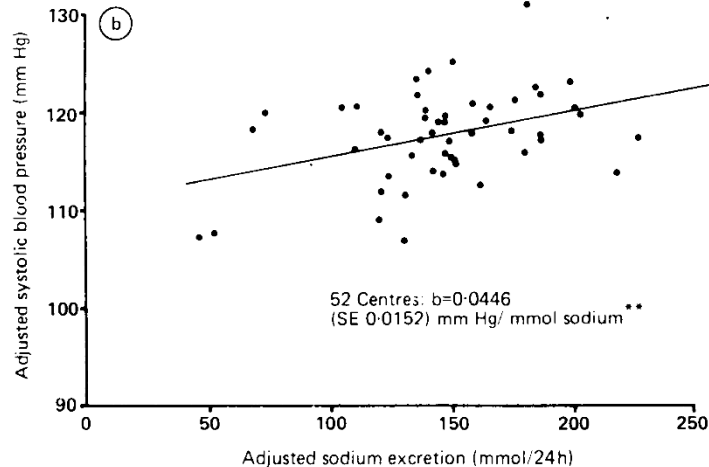


8

Key Points

This slide lists modifiable lifestyle risk factors that contribute to hypertension. High dietary sodium is the focus of this slide presentation.

Relationship Between Salt Intake and BP



CHEP

BMJ. 1988 July 30; 297(6644): 319-328



9

Notes:

Key Points

- Increased sodium intake is significantly associated with a corresponding increase in systolic blood pressure.

Reference: Intersalt Study

Intersalt Cooperative Research Group. Intersalt: an international study of electrolyte excretion and blood pressure: results for 24-hour urinary sodium and potassium excretion. Br Med J. 1988;297:319-328.

Abstract:

The relations between 24 hour urinary electrolyte excretion and blood pressure were studied in 10,079 men and women aged 20-59 sampled from 52 centres around the world based on a highly standardised protocol with central training of observers, a central laboratory, and extensive quality control. Relations between electrolyte excretion and blood pressure were studied in individual subjects within each centre and the results of these regression analyses pooled for all 52 centres. Relations between population median electrolyte values and population blood

Hypertension as a Risk Factor

- Hypertension is a significant risk factor for:
 - Cerebrovascular disease
 - Coronary artery disease
 - Congestive heart failure
 - Renal failure
 - Peripheral vascular disease
 - Dementia
 - Atrial fibrillation



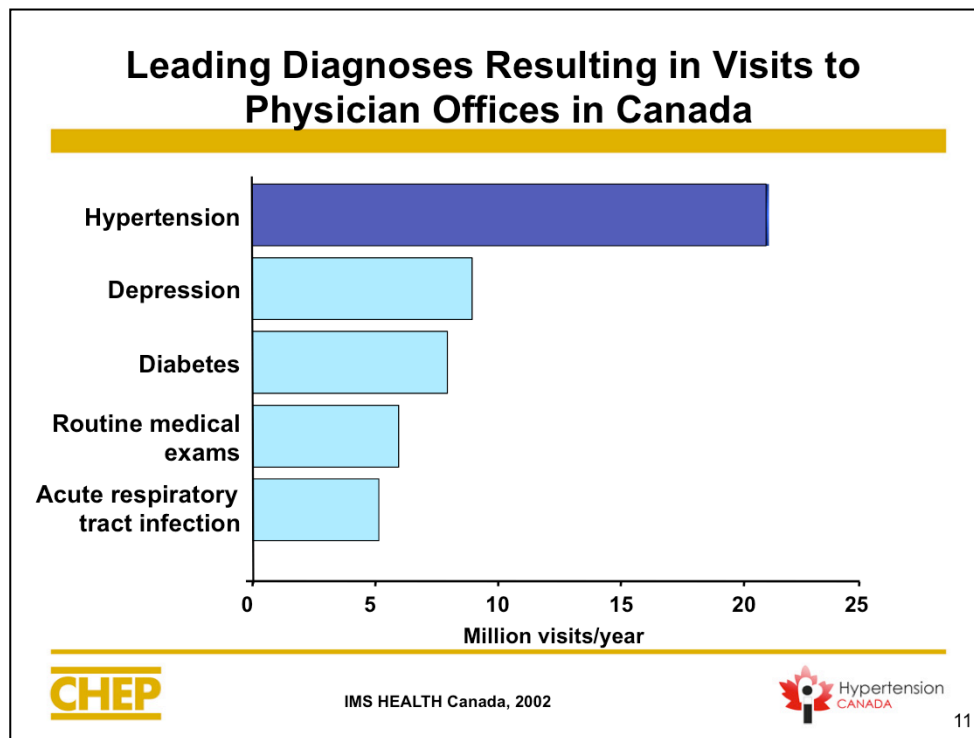
10

Key Points

- Hypertension confers significant risk for cerebrovascular and coronary artery disease. It is a major cause of heart failure. Hypertension also increases the risk of renal failure, peripheral vascular disease and dementia.
- Hypertension is likely the most common cause of atrial fibrillation and, in fact, atrial fibrillation may be the first presentation of untreated hypertension. Atrial fibrillation is a major risk factor for stroke.

References

- 1.Joffres MR, et al. Prevalence, control and awareness of high blood pressure among Canadian adults. Canadian Heart Health Surveys Research Group. *CMAJ* 1992;146:1997-2005.
- 2.Khan N, et al. Differences in need for antihypertensive drugs among those aware and unaware of their hypertensive status: a cross sectional survey. *BMC Cardiovascular Disord* 2005;5:4.
- 3.Lawes CM, et al. Global burden of blood-pressure-related disease, 2001. *Lancet* 2008;371:1513-8.



Key Points

- Patient visits to office-based physicians for hypertension totaled 18.9 million in 2002, a 10% increase from the previous year.
- Most visits were to GP/FMs (90%), and more than 81% of visits involved a drug recommendation.
- Community retail pharmacies dispensed an estimated 52.7 million prescriptions for antihypertensive agents in 2002, compared with 34 million in 1998.

Reference

1. IMS Canada. http://www1.imshealth.com/vgn/images/portal/cit_40000873/7/57/79014602Trends06_En_07CORR.pdf

History of Present Illness

- Lavani is a 56-year-old woman that presents to your office for worsening hypertension
- Born in India and now living in Canada for 8 years
- Housekeeper
- Married; 2 children
- Dresses and eats in a traditional fashion



12

Instructions

Review the case study slide with the group.

Questions are integrated in the case presentation – when these appear on screen, allow the group to discuss their possible answers and the rationale behind them before moving on to review feedback from the case authors.

History of Present Illness

- Patient concerned about higher BP readings at home (140-154/88-94 mmHg)
- Average office BP = 158/98 mmHg
- No symptoms (dyspnea, chest discomfort, orthopnea, change of vision, ankle edema)
- Denies snoring
- Still performs all daily activities
- Weight stable



13

Instructions

Review the case study slide with the group.

Past History

- Hypertension for the last 5 years
- Has taken the same medications ever since
- Does no specific physical activity, but has no symptoms after going up a flight of stairs
- Some lower back pain when standing up for a long time preparing meals
- Only surgery was a cholecystectomy



14

Instructions

Review the patient's past history.

Missing data are to be assumed NORMAL, to prevent prolonged discussions.

Family History

- Father
 - Hypertension, passed away from CHF at age 60
- Mother
 - Hypertension, suffered a fatal CVA at age 76
- No history of diabetes or hypercholesterolemia



15

Instructions

Review the patient's family history.

Missing data are to be assumed NORMAL, to prevent prolonged discussions.

Current Medications

- Ramipril 5 mg OD
- HCTZ 12.5 mg OD
- ASA 80 mg OD
- Ibuprofen 200 mg q 8 hours PRN
- Natural products imported from India: rock salt, Indian pickles, gooseberries



16

Notes

These are the medications that the patient is taking at presentation. They reflect an actual patient seen in clinic and are not intended to reflect current best practices.

Physical Examination

- Height: 158 cm
- Weight: 64 kg
- BMI: 25.6 kg/m²
- Waist circumference: 86 cm
- BP (left arm, seated):
 - 156/94 mm Hg using an automated device
- Pulse: 80/m regular
- Lungs: clear
- Heart: normal
- Abdomen: no bruit
- Vascular: strong pulses, no ankle edema



17

Instructions

Based on the patient's history and examination, discuss with the group possible next steps.

These findings are all from the current visit.

Notes

- The office automated device when used correctly, measures BP very accurately.
- After the device is initiated, the healthcare provider leaves the room, while it completes additional readings.
- The initial reading is discarded and the subsequent readings are then averaged.
- An office automated BP of 135/85 mm Hg is equivalent to the daytime automated ambulatory BP of 135/85 mm Hg or home BP monitoring.
- The reading recorded in the office with the automated device of 156/94 mm Hg can be considered a 'research quality' measurement.

Discussion Question 1

What is your treatment plan for this patient?



18

Instructions

Discuss the question with the group.

Reminder: Allow the group to discuss their possible answers and the rationale behind them before moving on to review feedback from the case authors.

Discussion Question 1) What is Your Treatment Plan?

- a) Increase dosage of ramipril
- b) Increase dosage of HCTZ
- c) Increase dosage of both ramipril & HCTZ
- d) Recommend improvements in lifestyle habits

Note: Discussion questions do not necessarily have only one correct answer



19

Instructions

Review the options and pause here to discuss with the group.

Discuss the potential merits of each answer.

There is not necessarily one right answer; the goal of the exercise is to have an open discussion.

When you have discussed each possible answer, proceed to see the feedback provided by the case authors.

a) Increase dosage of ramipril

- Increasing dosage of ramipril to 10 mg/day could further decrease BP



20

Instructions

Review this answer choice regarding a treatment plan for the patient.

Briefly discuss any rationale that participants may have for selecting this answer choice.

b) Increase dosage of HCTZ

- Increasing dosage of HCTZ to 25 mg/day could further decrease the BP



21

Instructions

Review this answer choice regarding a treatment plan for the patient.

Briefly discuss any rationale that participants may have for selecting this answer choice.

c) Increase dosage of both ramipril & HCTZ

- Increasing both medications to full dosage will decrease better the BP
- Both medications have complimentary mechanisms (better in one tablet)



Instructions

Review this answer choice regarding a treatment plan for the patient.

Briefly discuss any rationale that participants may have for selecting this answer choice.

d) Recommend improvements in lifestyle habits

- Understanding Lavani's lifestyle habits
 - Review the sodium content of traditional diet
 - Limiting sodium intake will decrease BP in itself and will render medications more effective.
 - Discuss the benefits of physical activity
 - Remind the patient to avoid NSAIDs or to use them only PRN at a low dose. Acetaminophen could be a better choice



23

Instructions

Review this answer choice regarding a treatment plan for the patient.

Briefly discuss any rationale that participants may have for selecting this answer choice.

Lifestyle Recommendations for *Prevention* and Treatment of Hypertension

To reduce the possibility of becoming hypertensive, reduce sodium intake to less than 2000 mg/day

Healthy diet	High in fresh fruits, vegetables, low fat dairy products, dietary and soluble fibre, whole grains, and protein from plant sources, low in saturated fat, cholesterol, and sodium in accordance with Canada's Food Guide
Regular physical activity	Accumulation of 30-60 minutes of moderate intensity dynamic exercise 4-7 days per week in addition to daily activities
Low risk alcohol consumption	≤2 standard drinks/day, <14/week for men and <9/week for women
Attaining and maintaining ideal body weight	BMI 18.5-24.9 kg/m ²
Waist circumference	Men <102 cm; Women <88 cm
Tobacco free environment	



24

Key Points

- Guidelines recommend lifestyle interventions as part of an overall effort to reduce BP in patients with hypertension.
- Reducing sodium intake is an measure for the prevention of hypertension.
- Other lifestyle recommendations include: achieving and maintaining a healthier weight, limiting the intake of alcohol, increasing physical activity, and smoking cessation.
- Make note of the patient's history and any risk factors, if additional focus should be on additional lowering of BMI and waist circumference given patient's background.

Lifestyle Recommendations for Hypertension: Physical Activity

Should be prescribed to reduce blood pressure

F	Frequency	- Four to seven days per week
I	Intensity	- Moderate
T	Time	- 30-60 minutes
T	Type	Cardiorespiratory Activity - Walking, jogging - Cycling - Non-competitive swimming

Exercise should be prescribed as an adjunct to pharmacological therapy



25

Key Points

- Lifestyle interventions to reduce BP should include physical activity. The acronym F-I-T-T can be used to remember adequate recommended physical activity.
- Beneficial activity should include 30-60 minutes of moderate intensity dynamic exercise, such as walking, jogging, cycling, or swimming, performed 4-7 days per week.
- It is important to note that increased physical activity is only one part of the treatment plan for patients with hypertension.

III. Assessment of the Overall Cardiovascular Risk

- Over 90% of hypertensive Canadians have other cardiovascular risks
- Assess and manage hypertensive patients for dyslipidemia, dysglycemia (e.g. impaired fasting glucose, diabetes), abdominal obesity, unhealthy eating and physical inactivity



26

Key Points

Since most patients have multiple cardiovascular risk factors, it is important to assess patients with hypertension for all risk factors.

Laboratory Investigations

Test	Results	Normal Values
Glucose	5.9 mmol/L	4.0-8.0 mmol/L
Urea	7.8 mmol/L	3.0-7.0 mmol/L
Creatinine	88 µmol/L eGFR 63 ml/min	44-106 µmol/L
K	4.1 mmol/L	3.5-5.0 mmol/L
Hb	134 g/L	115-165 g/L

- Note that labs are done prior to the next visit



27

Instructions

Review the results of lab tests that were performed prior to the next office visit.

Discuss any implications of these findings.

Laboratory Investigations

Test	Results	Normal Values
LDL	2.55 mmol/L	<2.50 mmol/L
Total chol	4.98 mmol/L	<5.20 mmol/L
TG	1.7 mmol/L	<1.70 mmol/L
HDL	1.35 mmol/L	>0.99 mmol/L
TC:HDL	3.7	High risk target: <4.0 Mod risk target: <5.0 Low risk target: <6.0



28

Instructions

Review the results of lab tests that were performed prior to the next office visit.

Discuss any implications of these findings.

Case Progression: At the Dietitian

Survey of a typical day's diet for Lavani

- Breakfast
 - Puri, chole, halwa
- Lunch
 - Paneer sandwich with canned fish
- Dinner
 - Chicken tikka, basmati rice, gulab jamun, and basil tea



29

Instructions

Review the case progress slide with the group.

Discuss any implications of these findings.

Case Progression: At the Dietitian

Lavani's sodium intake on a typical day is reviewed

Breakfast	Sodium
Bread, chickpeas from a can, semolia pudding	1100 mg
Lunch	
Cottage cheese, butter, salt to taste, soft bread, ½ can of salted dry fish	1400 mg
Dinner	
Rice, chicken, butter, tamarind chutney, onion rings, yogurt, mix of spices with canned tomatoes, Indian pickle, baking soda, tea	2500 mg
Grand total	
	5000 mg



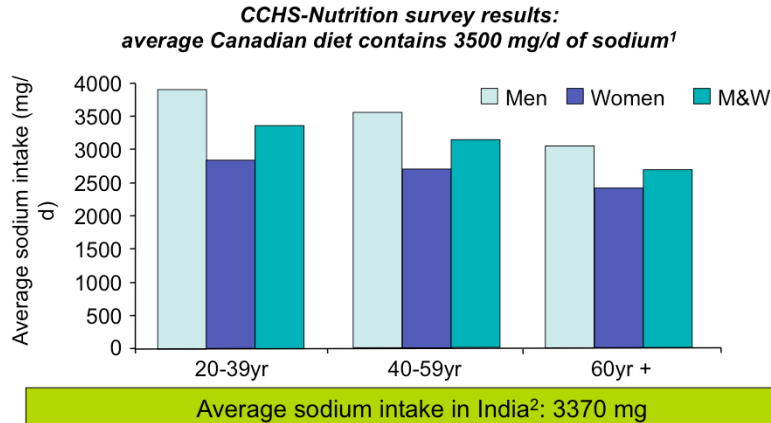
30

Instructions

Review the case progress slide with the group.

Discuss any implications of these findings.

Sodium Intake* Among Canadian Adults



*Does not include sodium added at the table or during home cooking

1. Garriguet. *Health Reports* 2007;18:47-52;

2. Radhika et al. *J Assoc Physicians India* 2007;55:405-11



31

Key Points

- In 2004, the Canadian Community Health Survey (CCHS), Nutrition Survey, reported on the sodium intake from food among Canadians.¹
- The graph shows that, on average, men consumed 3,039-3,906 mg/day of sodium depending on their age group. For women, the average intake across age groups was 2,398-2,845 mg/day.
- An additional 10-20% would need to be added for the salt added in cooking and at the table. Therefore, the average Canadian diet contains about 3500 mg of sodium per day. This amount of sodium is more than double the recommended adequate intake (AI) (1,200 – 1,500) and much higher than the upper limit (UL) of 2300 mg a day.

References

1. Garriguet D. Sodium consumption at all ages. *Health Rep* 2007;18:47-52.
2. Radhika G, et al. Dietary salt intake and hypertension in an urban south Indian population. *J Assoc Physicians India* 2007;55:405-11.

Indian Hypertension Prevalence Studies (BP 140/90)

First author	Year	Age group	Place	Sample size		Prevalence (%)	
Urban				Men	Women	Men	Women
Gupta R	1995	20–75	Jaipur	1415	797	29.5	33.5
Gupta	1999	18–60	Mumbai	40067	59522	43.8	44.5
Joseph	2000	20–89	Trivandrum	76	130	31.0	41.2
Anand	2000	30–60	Mumbai	1521	141	34.1	
Mohan	2001	20–70	Chennai	518	657	14.0	
Gupta R	2002	20–75	Jaipur	550	573	36.4	37.5
Rural							
Gupta R	1994	20–75	Rajasthan	1982	1166	23.7	16.9
Malhotra	1999	16–70	Haryana	2559		3.0	5.8

Gupta. *J Hum Hyperten* 2004;18:73–8



32

Key Points

- The table summarizes data on the prevalence of hypertension among Indian patients. Pooling of epidemiological studies showed that hypertension was present in 25% urban and 10% rural individuals in India.
- There was a strong correlation between changing lifestyle factors and an increase in hypertension in India.

Reference

1. Gupta R. Trends in hypertension epidemiology in India. *J Hum Hyperten* 2004;18:73-8.

Recommendations for adequate daily sodium intake

2,000 mg sodium (Na)
= 87 mmol sodium (Na)
= 5 g of salt (NaCl)
~1 teaspoon of table
salt



- 80% of average sodium intake is in processed foods
- Only 10% is added at the table or in cooking

Sodium: Meta-analyses

<u>Average reduction of sodium</u> 1800 mg/day 2300 mg/day	Hypertensives <u>Reduction of BP</u> 5.1/2.7 mm Hg 7.2/3.8 mm Hg
<u>Average reduction of sodium</u> 1700 mg/day 2300 mg/day	Normotensives <u>Reduction of BP</u> 2.0/1.0 mm Hg 3.6/1.7 mm Hg

The Cochrane Library 2006;3:1-41



34

Key Points

- A Cochrane meta-analysis on the effects dietary sodium on blood pressure, included randomized trials in which interventions were for more than 4 weeks duration and resulted in significant reduction in dietary sodium. The range in baseline sodium intake was from 2800-4400 mg/day and intervention resulted in reductions to 1300-2875 mg per day.
- An 1800 mg/day reduction in dietary sodium was associated with a 5.1/2.7 mm Hg reduction in BP among hypertensive patients. There was a dose response with larger reductions in BP with greater reductions in dietary sodium.
- While there was also a BP lowering effect in normotensive patients, it was less than that seen in hypertensive patients.

Reference

1. *The Cochrane Library 2006;3:1-41.*

To Reduce Blood Pressure

Advise patient to:

- Follow DASH diet principles
 - Similar to Canada's Food Guide
- Reduce sodium in the diet
 - Sea salt, Kosher salt, “fleur de sel” are high in sodium and not better than table salt

DASH: Dietary Approaches to Stop Hypertension



35

Key Points

- Key suggestions for patients with hypertension are to follow the DASH dietary principles, and reduce sodium in the diet.
- One component of an effective blood pressure lowering strategy is the DASH diet (Dietary Approaches to Stop Hypertension).
- It is important to advise patients that salts such as sea salt or kosher salt do not have a lower sodium content than table salt.

The DASH Diet

Advise patient to:

- Eat healthy diet according to Canada's Food Guide
 - 7-8 servings of vegetables and fruit each day
 - Have more whole vegetables and fruit than juices
 - 2 servings of low fat milk products each day
 - 1% or skim milk and yogurt, low-fat cheeses
- Use whole –grain, higher -fibre grain foods
 - Breads, rice, cereals, pastas
- Small amounts of lean meats, poultry and fish
 - Cooked without added fat (or salt)
- Frequent use of legumes, seeds and nuts
 - Lentils, chick peas, dried beans, etc.



36

Key Points

- The DASH diet (Dietary Approaches to Stop Hypertension) is similar to Canada's Food Guide. It emphasizes vegetables, fruits, whole-grains, and legumes, while minimizing intake of foods high in sodium or refined sugars.

To Reduce Dietary Sodium

Advise patient to:

Buy lower sodium foods

- Common **high sodium** culprits: vegetable juices, soups, bouillons, sauces, deli meats, prepared meals, snack foods, breads, crackers, and bakery products

Read the information on food packages

- Compare food labels
- Look for foods that contain low amounts of sodium, less than 120mg of sodium per serving
- Use the '**% Daily Value**' on food labels to choose foods with less than **5%** Daily Value of sodium

Prepare home cooked meals using little or no salt

- Reduce salt in bread recipes and do not use in home baking recipes
- Use more spices and yogurt to flavour foods
- Rinse canned vegetables and canned beans to wash away some of the sodium



37

Key Points

- Recommend that your hypertensive patients use strategies to reduce dietary sodium.
- Patients should be advised to become more informed about the sodium content of their food purchases, and not only buy lower sodium food items, but also prepare lower sodium meals.

To Reduce Dietary Sodium

Advise patients to:

- Use less salt and high sodium foods at the table
 - Common high sodium culprits: ketchup, mustard, pickles, chutneys, soy sauce, olives, salad dressings, gravies, and sauces
- Eat less restaurant meals or take out foods
 - Ask for menu nutrition information to choose lower sodium options

Advise patients NOT to:

- Add table salt (sea salt, Kosher salt, fleur de sel) in cooking and at the table
- Eat foods with more than 360 mg of sodium or more than 15% Daily Value per serving



38

Key Points

- These dos and don'ts can help hypertensive patients to reduce dietary sodium.
- Patients should be encouraged to be more mindful of high sodium foods and to eat fewer restaurant prepared meals.
- Patients should also be reminded to eliminate their use of table salt.

Discussion Question 2

How does excess sodium intake
(>2000 mg/d) increase BP?



39

Instructions

Discuss the question with the group.

Reminder: Allow the group to discuss their possible answers and the rationale behind them before moving on to review feedback from the case authors.

Discussion Question 2) How Does Excess Sodium Intake (>2000 mg/d) Increase BP?

- a. Renal retention of fluid (acutely)
- b. Renal sodium excretion threshold reset (chronically) →
↓ sodium excretion
- c. Increases peripheral resistance
- d. Decreases endothelial vasodilation

Note: Discussion questions do not necessarily have only one correct answer



40

Instructions

Review the options and pause here to discuss with the group.

Discuss the potential merits of each answer.

There is not necessarily one right answer; the goal of the exercise is to have an open discussion.

When you have discussed each possible answer, proceed to see the feedback provided by the case authors.

a) Renal retention of fluid (acutely)

- The immediate effect of a dietary sodium excess is to promote water retention and expand extra-cellular (circulating) volume



41

Instructions

Review this answer choice regarding effect of sodium on blood pressure.

Briefly discuss any rationale that participants may have for selecting this answer choice.

**b) Renal sodium excretion threshold
reset (chronically) → ↓ sodium excretion**

- After months of sodium dietary excess, the capacity of sodium excretion diminishes as the excretion threshold is adjusted upwards



42

Instructions

Review this answer choice regarding effect of sodium on blood pressure.

Briefly discuss any rationale that participants may have for selecting this answer choice.

c) ↑ **Peripheral resistance**

- A direct effect of excess sodium exposure is to decrease arterial compliance independently of BP level

Instructions

Review this answer choice regarding effect of sodium on blood pressure.

Briefly discuss any rationale that participants may have for selecting this answer choice.

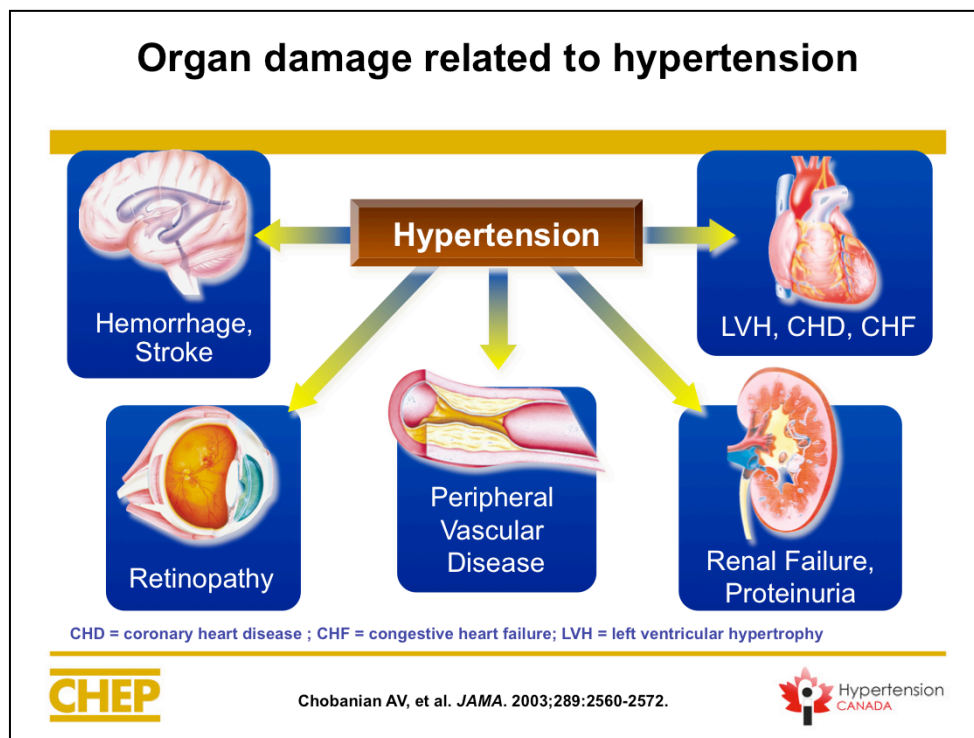
d) ↓ Endothelial vasodilation

- Excess sodium will bring on endothelial dysfunction and therefore decrease the vasodilatory capacity.

Instructions

Review this answer choice regarding effect of sodium on blood pressure.

Briefly discuss any rationale that participants may have for selecting this answer choice.



Complications of Hypertension: End-Organ Damage

Hypertension is an important contributing risk factor for end-organ damage and for the development of cardiovascular and other diseases, including retinopathy, peripheral vascular disease, stroke, coronary heart disease, heart failure, cardiac disease, renal failure, and proteinuria.

Blood pressure reduction has been shown to decrease the rate of stroke, myocardial infarction, end-stage renal disease, and proteinuria.

Reference:

Chobanian AV, Bakris GL, Black HR, et al, for the National High Blood Pressure Education Program Coordinating Committee. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. *JAMA*. 2003;289:2560-2572.

Discussion Question 3

Independent from its effect on BP, can excess sodium intake cause organ damage?



46

Instructions

Discuss the question with the group.

Reminder: Allow the group to discuss their possible answers and the rationale behind them before moving on to review feedback from the case authors.

Discussion Question 3) Independent From its Effect on BP,
Can Excess Sodium Intake Cause Organ Damage?

- a) Yes
- b) No



47

Instructions

Review the options and pause here to discuss with the group.

When you have discussed the answers, proceed to see the feedback provided by the case authors.

Discussion Question 3) Independent From its Effect on BP,
Can Excess Sodium Intake Cause Organ Damage? YES

- Endothelial dysfunction and aortic stiffness
- Left ventricular hypertrophy
- Chronic kidney disease

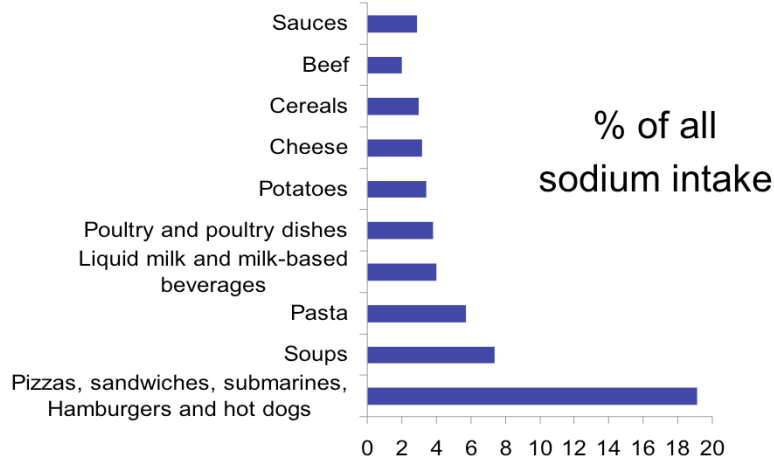


48

Key Points

- Sodium intake may cause organ damage independent of its effect on BP. Negative effects may include: endothelial dysfunction and aortic stiffness, left ventricular hypertrophy, and chronic kidney disease.

Sources of Sodium Within “Processed Food” Categories in Canada



Garriguet. *Health Reports* 2007;18:47-52



49

Key Points

- The graph above shows the major sources of sodium from processed foods in Canada. These 10 groups of processed foods/beverages account for over half (55%) of all sodium consumed by Canadians.
- In general, sodium is added to almost all food and hence there are substantive contributions from most food sources.

Reference

- 1.Garriguet D. Sodium consumption at all ages. *Health Rep* 2007;18:47-52.

Case Progression

After counselling with Lavani on lifestyle modifications and the impact of high sodium intake on BP, she has committed to:

- Avoid canned foods
- Limit sauce and condiment intake
- Not to use salt freely and discard baking soda
- Change to small amounts of unsalted butter
- Eat more fresh fruits and vegetables

ABPM done 3 weeks after dietary counselling:

→ 24-hour average = 136/84

→ Daytime average = 142/86



50

Instructions

Review the progress of the patient case and her current BP levels and then proceed to the next slide.

Case Progression

3 months after her original visit, Lavani:

- Walks 30 minutes, 3-4 times/week
- Continues to apply dietary changes
- Has no complaints
- Weight = 62 kg
- BP average in clinic = 140/88 mm Hg
- Rest of her physical exam is remarkable



51

Instructions

Review the progress of the patient case and her current status and then proceed to the next slide.

Impact of Lifestyle Therapies on Blood Pressure in Hypertensive Adults

Intervention	Intervention	SBP/DBP
Reduce sodium intake	-1800 mg/day sodium Hypertensive	-5.1/-2.7
Weight loss	per kg lost	-1.1/-0.9
Alcohol intake	-3.6 drinks/day	-3.9/-2.4
Aerobic exercise	120-150 min/week	-4.9/-3.7
Dietary patterns	DASH diet Hypertensive	-11.4/-5.5

Padwal et al. *CMAJ* 2005;173:749-51



52

Key Points

Guidelines recommend considering lifestyle interventions as part of an overall strategy to reduce BP in patients above target. These may include: achieving and maintaining a healthier weight, limiting the intake of sodium and alcohol, increased physical activity, and smoking cessation.

Note

The extent of blood pressure change from each intervention should not be compared because the participants, the type and duration of intervention, and the basic design of the trials differed substantially.

Reference

1. Padwal R, et al. CHEP Recommendations: Applying the 2005 Canadian Hypertension Education Program recommendations: 3. Lifestyle modifications to prevent and treat hypertension. *CMAJ* 2005;173:749-51.

Meta-analysis (53 studies): Average Change in SBP and DBP Going From Sedentary to More Active Status

Table 1. Mean Net Changes in Systolic and Diastolic Blood Pressure according to Different Exclusion Criteria

Variable	Systolic Blood Pressure			Diastolic Blood Pressure		
	Trials Examined	Net Change (95% CI)	P Value	Trials Examined	Net Change (95% CI)	P Value
	<i>n</i>	<i>mm Hg</i>		<i>n</i>	<i>mm Hg</i>	
All trials	53	-3.84 (-4.97 to -2.72)	<0.001	50	-2.58 (-3.35 to -1.81)	<0.001
Exercise supervised*	45	-4.13 (-5.21 to -3.05)	<0.001	42	-2.68 (-3.55 to -1.81)	<0.001
Antihypertensive medication not administered†	49	-4.23 (-5.42 to -3.05)	<0.001	46	-2.91 (-3.69 to -2.13)	<0.001
Single intervention between groups‡	47	-4.39 (-5.68 to -3.10)	<0.001	44	-2.97 (-3.82 to -2.12)	<0.001
Blood pressure as primary outcome§	37	-4.39 (-5.93 to -2.86)	<0.001	36	-2.87 (-3.91 to -1.84)	<0.001

* Trials that did not require supervised exercise intervention were excluded (19, 25, 27, 31, 44–46).

† Trials in which antihypertensive medications were administered were excluded (25, 32, 33).

‡ Trials that conducted multiple interventions were excluded (25, 30, 32, 38, 42).

§ Trials in which blood pressure was not the primary outcome were excluded (22–24, 26, 30, 35, 37, 39, 43, 45).

↓ SBP = 3.8 mm Hg; ↓ DBP = 2.6 mm Hg

Whelton et al. *Ann Intern Med* 2002;136:493-503



53

Key Points

- A meta-analysis by Whelton et al. demonstrated the effect of physical activity lifestyle interventions on blood pressure.
- Patients who transitioned from a sedentary lifestyle to a more active one including supervised exercise, experienced a net reduction in systolic BP of -3.8 mm Hg and in diastolic BP of -2.6 mm Hg.

Reference

1. Whelton SP, et al. Effect of aerobic exercise on blood pressure: a meta-analysis of randomized, controlled trials. *Ann Intern Med* 2002;136:493-503.

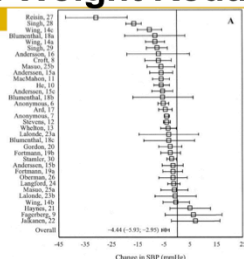
Meta-analysis (25 randomized studies): Effects of Weight Reduction on BP

n = 4874

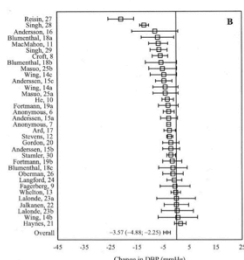
For every kg lost:

SBP ↓ 1.05 mm Hg

DBP ↓ 0.92 mm Hg



↓ SBP = 4.44 mm Hg



↓ DBP = 3.57 mm Hg

Neter et al. *Hypertension*
2003;42:878-84

CHEP

**Hypertension
CANADA**

54

Key Points:

- A meta-analysis of 25 randomized controlled trials, including 4,874 patients, estimated the effect of weight reduction on BP.
- A 1 kg decrease in body weight was associated with a decrease in systolic BP of -1.05 mm Hg and in diastolic BP of -0.92 mm Hg. A net weight reduction of -5.1 kg by means of energy restriction, increased physical activity, or both reduced SBP by -4.44 mm Hg and DBP by -3.57 mm Hg.
- Weight loss is important for the prevention and treatment of hypertension.

Reference

- 1.1. Neter JE, et al. Influence of weight reduction on blood pressure: A meta-analysis of randomized controlled trials. *Hypertension* 2003;42:878-84.

Observed Effect of Lower Sodium Intake on Cardiovascular Events in TOHP Trials

- 25-30% lower risk of cardiovascular events in those who had been in the low sodium groups
- 759-1012 mg/day reduction in dietary sodium during intervention

Cook et al. *BMJ* 2007;334:885-92



55

Key Points

Trials of Hypertension Prevention (TOHP)

- The effects of reduction in dietary sodium intake on cardiovascular events was examined using data from two completed randomised trials, TOHP I and TOHP II (Trials of Hypertension Prevention). Adults with pre-hypertension in TOHP I (n=744) and TOHP II (n=2382) were randomised to a sodium reduction intervention or control.
- Long term follow-up results 10-15 years after the original trial showed a 25-30% reduction in cardiovascular event rates among those in the low sodium group. During the intervention, reduction in dietary sodium was 759-1012 mg/day.
- Sodium reduction, previously shown to lower blood pressure, may also reduce long term risk of cardiovascular events.

Reference

1. Cook NR, et al. Long term effects of dietary sodium reduction on cardiovascular disease outcomes: observational follow-up of the trials of hypertension prevention (TOHP). *BMJ* 2007;334:885-92.

Health Care Cost Savings in Canada by Reducing Dietary Sodium

Using the Cochrane review data, a reduction in average dietary sodium intake by 1800 mg/d (from 3500 mg to 1700 mg in Can) would result in:

- 1 million fewer hypertensive Canadians
- Almost double the BP treatment and control rate
- Hypertension care cost savings of \$430 to 538 million /yr

Joffres et al. *Can J Cardiol* 2007;23:437-43



56

Key Points

Data from clinical trials and the Canadian Heart Health Survey was used to estimate the effect dietary sodium reduction on hypertension in Canada.

Canadians consume approximately 3500 mg of sodium a day.

The Cochrane review results showed that an average sodium reduction of 1800 mg/day would decrease SBP by 5.06 mm Hg and DBP by 2.7 mm Hg.

Reducing the sodium intake of Canadians' by 1800 mg/day (from 3500 mg/d down to 1700 mg/d) may decrease hypertension prevalence by 30%, resulting in one million fewer hypertensive patients in Canada, and almost double the treatment and control rate. There would be substantial cost savings, with direct cost savings related to fewer physician visits, laboratory tests and lower medication estimated to be \$430 million per year. Physician visits and laboratory costs would decrease by 6.5%, and 23% fewer treated hypertensive patients would require medications for control of blood pressure.

This analysis did not examine the potential impact on cardiovascular disease and related healthcare utilization and costs.

Reference

1. Joffres MR, et al. Estimate of the benefits of a population-based reduction in dietary sodium additives on hypertension and its related health care costs in Canada. *Can J Cardiol* 2007;23:437-43.

Impact of Reducing BP Through Dietary Sodium in Canada

Modeling results

- Annual reduction in incidence of:
 - Myocardial infarction (5%)
 - Strokes (13%)
 - Heart Failure (17%)
- Reduction in health care costs associated with the overall predicted 8.6% reduction CVD
 - \$1.7 billion per year (1998 costs)

Penz et al. *Can J Cardiol* 2008;24:497-501



57

Key Points

- Data from clinical trials and the Canadian Heart Health Survey was used to estimate the potential effects on cardiovascular disease incidence of lowering blood pressure through reducing dietary sodium in Canada.
- BP reductions associated with different levels of reduction in dietary sodium were used in the model. The RR for cardiovascular events associated with the BP reduction was modelled based on a meta-analysis of diuretic trials. Cardiovascular events in Canada for 2002 were used to estimate the decrease in cardiovascular events.
- The Cochrane review results showed that an average sodium reduction of 1800 mg/day would decrease SBP by 5.06 mm Hg and DBP by 2.7 mm Hg.
- Reducing the sodium intake of Canadians by 1800 mg/day (from 3500 mg/d down to 1700 mg/d) was estimated to result in a 5% reduction in myocardial infarction, 13% reduction in stroke, and 17% reduction in heart failure. Total cardiovascular events would be reduced by 8.6%, thus preventing an estimated 11,550 cardiovascular events per year.
- Reducing dietary sodium was estimated to save almost 2 billion dollars/year (based on 1998 costs). Because costs have risen substantively, the cost saving would be greater today.

Reference

1. Penz E, et al. Reducing dietary sodium and decreases in cardiovascular disease in Canada. *Can J Cardiol* 2008;24:497-501.

Health Behaviour Management: Summary

Intervention	Target
Reduce foods with added sodium	→ 2000 mg /day
Weight loss	BMI <25 kg/m ²
Alcohol restriction	≤ 2 drinks/day
Physical activity	30-60 minutes 4-7 days/week
Dietary patterns	DASH diet
Smoking cessation	Smoke free environment
Waist circumference	Men <102 cm Women <88 cm



Note: the extent of blood pressure change from each intervention should not be compared because the participants, the type and duration of intervention, and the basic design of the trials differed substantially.

Key Learnings

- ✓ High dietary sodium is an key contributor to high blood pressure. Processed foods are our main source of dietary sodium. Eating fresh vegetables and fruits and low fat milk products helps to control BP
- ✓ To decrease blood pressure, consider reducing sodium intake towards 2,000 mg (5g of salt or 87mmol of sodium) per day
- ✓ Improving more than one lifestyle has an additive effect



59

Instructions

Review the key points discussed during the meeting.

Discuss other health benefits of decreased sodium, aside from BP control, such as decreasing CV risk.

**The full slide set of the
2015 CHEP Recommendations
is available at
www.hypertension.ca**

