Diet according to blood pressure in 18-74-year-old adults. The French Nutrition and Health Survey (ENNS 2006-2007)

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Introduction

- Background
  - Dietary recommendations widely disseminated
    - To prevent and treat high blood pressure (BP)
    - To reduce hypertension prevalence in populations
  - In 2001, The French nutrition and health program (Programme national nutrition santé, PNNS) implemented
    - To improve the population health status by acting on nutrition
  - The French nutrition and health survey (Etude nationale nutrition santé, ENNS)
    - Carried out in continental France in 2006-2007
    - To describe dietary intake, physical activity and nutritional status in a national sample of adults and children
- Objectives of the present analysis
  - To examine linear associations between diet and BP in 18-74-year-old adults
  - To assess dietary intake across BP categories
  - Hypotheses:
    - High BP category was associated with unfavorable diet compared to optimal category
    - Intermediate BP category was associated with moderately unfavorable diet, between optimal and high BP categories

Methods (1)

- ENNS survey
  - Cross-sectional
  - Multistage population-based sampling
- Data collection
  - Food consumption
    - Three 24-h recalls (one on the week-end), randomly distributed within a period of two weeks
    - Through phone interviews by trained dieticians
  - BP measurement
    - Systolic BP (SBP) and diastolic BP (DBP) on the left harm of seated subjects
    - After five minutes rest and repeated three times
    - By trained physicians, nurses and dieticians according to standardized protocols and using identical device

Methods (2)

- Data treatment
  - SBP and DBP defined as the average of the two last BP measures
  - BP categories defined according to the ESH guidelines:
    - Optimal (SBP < 120 mmHg and DBP < 80 mmHg)
    - Intermediate (120 mmHg ≤ SBP <140 mmHg or 80 mmHg ≤ DBP <90 mmHg)
    - High (SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg)
  - Daily dietary intake described as
    - Mean energy intake:
      - Total energy intake (EI)
      - Macronutrient energy intake (%EI): fat, carbohydrates and proteins
    - Foods and beverages categorized into groups according to PNNS guidelines

Methods (3)

- Statistical analysis
  - Analyses performed among participants with available data on
    - Dietary intake
    - BP measurements
    - Socio-demographic and behavioral characteristics
  - Calibration on age, education diploma, period of data collection and whether the household included or not at least one child
  - Sampling scheme taken into account in all analyses
  - Continuous association between SBP/DBP and dietary variables
    - Adjusted linear regression model for each dietary group
  - Comparison of adjusted mean dietary intake across BP categories
    - Tested by adjusted Wald test

Results (1)

- Analyses carried out in 1,951 subjects of 18-74-years (747 men and 1,204 women)
  - 39.2% optimal, 37.9% intermediate, 22.9% high BP
  - Prevalence of hypertension (high BP or use of antihypertensive drugs): 31.0%

Adjusted* linear regressions between SBP and DBP values and dietary intake

	SBP		DBP	
Mean consumption	**Coefficient (se)**	***P***	**Coefficient (se)**	***P***
Dairy products (g/day)	-0.01 (0.003)	**0.001**	-0.005 (0.002)	**0.02**
Milk (serving/day)	-1.58 (0.50)	**0.001**	-0.88 (0.33)	**0.008**
Whole grain food (serving/day)	-1.76 (0.50)	**$<10^{-3}$**	-1.10 (0.39)	**0.001**
Fruits & vegetables (serving/day)	-0.37 (0.15)	**0.01**	-0.18 (0.12)	0.12
Fibers (g/day)	-0.13 (0.06)	**0.04**	-0.07 (0.05)	0.15
Alcoholic beverages (serving/day)	0.99 (0.24)	**$<10^{-3}$**	0.60 (0.19)	**0.001**

*Adjustment for age, sex, birthplace, marital status, education, occupation, going on holiday trip during past twelve months, smoking habits, total energy intake, BP lowering medication, ongoing diet due to CVD co-morbidities and delay between 24-h recall and BP measurements. Se, standard error

- No association between SBP, DBP and
  - energy intake included energy from fat (saturated fatty acid, home-added fat and added vegetable fat), carbohydrates (complex carbohydrate, simple sugar) and protein
  - intake of dietary calcium, salt, starchy food, meat, seafood and eggs and sweetened beverages

Results (2)

Adjusted mean (se) food intake according to BP categories

	BP categories			
Mean consumption	**Optimal**	**Intermediate**	**High**	***P*** [§]
Dairy products (g/day)	221.07 (8.63)	206.17 (8.28)	181.18 (9.16)	A*B**
Milk (serving/day)	0.72 (0.05)	0.63 (0.05)	0.47 (0.05)	A*B**
Whole grain food (serving/day)	0.44 (0.03)	0.41 (0.03)	0.29 (0.04)	A*B**
Fruits & vegetables (serving/day)	5.28 (0.12)	5.13 (0.12)	4.75 (0.18)	B*
Fibers (g/day)	17.61 (0.27)	17.37 (0.30)	16.44 (0.40)	B*
Calcium (mg/day)	885.00 (16.00)	867.00 (16.00)	829.00 (19.00)	B*
Alcoholic beverages (serving/day)	0.80 (0.07)	0.91 (0.09)	1.32 (0.11)	A**B**

[§] **A**, significant differences between intermediate and high; **B**, significant differences between optimal and high; ***P* < 0.05; ****P* < 0.01**

- Mean dietary intake of subjects in the intermediate BP category was not different with optimal category
- Mean energy intake and mean intake of dietary calcium, salt, starchy food, meat, seafood and eggs, and sweetened beverages were not significantly different between optimal and high BP categories

Conclusion

- Association of reduction of mean SBP and DBP with
  - Increased intake of dairy products, fruits and vegetables and whole-grain food
  - Decreased alcohol consumption
- Compared to optimal BP category
  - Subjects with high BP
    - Lower mean intake of dairy products, fruits and vegetables and whole-grain food
    - Higher alcohol consumption
  - Subjects with intermediate BP
    - Dietary intake comparable to those in the optimal BP category
- Results generally in accordance with epidemiological studies for food groups and nutrients previously identified as factors decreasing BP
- Improvement of consumption of such food groups (PNNS recommendations)
  - Control of average values of SBP and DBP in France general population
  - Reduction of high BP prevalence
  - Prevention of CVD co-morbidities and mortality among subjects with hypertension