NUTRITION AND MENOPAUSE

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Service de Médecine Interne – CHRU de Lille
PHYSIOLOGICAL CHANGES WITH NUTRITIONAL IMPACT

- Increase of bone loss
- Reduction of lean mass
- Resting energy expenditure
- Change in adipose tissue distribution
  - Glucose tolerance
- Changes in lipid metabolism
  - LDL
  - TG
  - HDL
- No menstruation
- Decrease of iron requirements

Nutrition and Menopause
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PSYCHOLOGICAL AND DIETARY CONTEXT

Psychological frailty
- Familial disturbance
- Loss of femininity and/or women status
- Disturbance of bodily image

Depressive mood
- Dietary adjustment

Restrictive regimen

Disturbance of dietary behaviors
- Weight gain
- Cognitive restriction
DISEASES WITH A NUTRITIONAL COMPONENT

- Weight gain – Metabolic syndrome
- Metabolic diseases: diabetes – dyslipidémia
- Cardiovascular diseases: (atherosclerosis)
- Degenerative disease: breast and endometrial cancer – colon cancer
- Osteoporosis
- Age related macular degeneration and age related cognitive decline
FACTORS IMPLIED IN WEIGHT GAIN

- **LEAN MASS**
  - Resting energy expenditure
  - Fat mass

- **PHYSICAL ACTIVITY**
  - Physical activity expenditure

- **DIETARY INTAKE**
  - Dietary intake in restraint subjects in case of stress

- **HORMONAL FACTORS**
  - Adipose tissue distribution

- **GENETIC FACTORS**
  - Early obesity

- **PSYCHOLOGICAL FACTORS**
  - Dietary adjustment for the mood
### BODY SHAPES AND OVERWEIGHT

**MORPHOTYPE**

**ADIPOSE TISSUE**
- **ABDOMINAL AND VISCERAL**
- **FEMORAL**

**METABOLIC RISK**
- **CARDIOVASCULAR**
  - +++
- **CANCER**
  - ++
- **OSTEOPOROSIS**
  - +

**UPPER BODY OVERWEIGHT**
- ++++

**LOWER BODY OVERWEIGHT**
- -
- ±
- +
- ±

APPLE OR PEAR
BODY CHANGES DURING PERIMENOPAUSAL PERIOD

543 WOMEN OF 42 – 52 YEARS
FOLLOW UP DURING 6 YEARS
7 MEASUREMENTS

<table>
<thead>
<tr>
<th></th>
<th>/ year</th>
<th>Total on 6 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>WEIGHT</td>
<td>+ 0,6 % (0,5 kg)</td>
<td>+ 3,4 % (+ 2,9 kg)</td>
</tr>
<tr>
<td>HEIGHT</td>
<td>- 0,064 cm</td>
<td>- 0,38 cm</td>
</tr>
<tr>
<td>BMI</td>
<td>+ 0,7 %</td>
<td>+ 4 % (+ 1,2 kg/m2)</td>
</tr>
<tr>
<td>Warst circumference</td>
<td>+ 1%</td>
<td>+ 6,2 % (+ 5,7 cm)</td>
</tr>
<tr>
<td>Fat mass</td>
<td>+ 1,6 % (+ 0,57 kg)</td>
<td>+ 10,1 % (+ 3,4 kg)</td>
</tr>
<tr>
<td>Lean mass</td>
<td>– 0,18 %</td>
<td>1 1,08 % (- 0,23 kg)</td>
</tr>
</tbody>
</table>

Waist circumference increase is correlated to ovarian age

J. Clin Endocrinol Metab 2007, 92, 895-901
Nutrition and Menopause
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Int J Obes 2001, 25, 844-879
Int J Obes 2001, 25, 874-879

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CHANGES IN ADIPOSE TISSUE DISTRIBUTION

MENOPAUSE

→ ↑ ABDOMINAL ADIPOSE TISSUE
- Sub cutaneous
- Perivisceral +++

CARDIOVASCULAR RISK FACTORS

→ ↑ CORONARY HEART DISEASE RISK

Hormonal factors
Nutritional factors
Physical activity
Social stress
In primates
- < menopause → intra abdominal in dominates
- > menopause → intra abdominal in dominants

↑ Blood pressure
↑ Triglycerides
↑ HDL C
↑ Glycemia
**ENERGY BALANCE**

- **PHYSICAL ACTIVITY**: 5 to 40%
- **THERMOGENESIS**: 10 – 15%
- **RESTING ENERGY EXPENDITURE**: 65 to 70%

---

**ALCOHOL**
- 30 to 40%

**FAT**
- 15 to 20%
- 40 to 55%

**PROTEINS**
- 10 – 15%

**CARBOHYDRATES**
- 65 to 70%

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**FIBRES**
- BENEFICIAL EFFECT
- NOT IMPLIED

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## ENERGY DENSITY

### ENERGY / VOLUME

<table>
<thead>
<tr>
<th>Food Item</th>
<th>Energy (Kcal)</th>
<th>Volume (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chocolate</td>
<td>550</td>
<td>18</td>
</tr>
<tr>
<td>Cake</td>
<td>400</td>
<td>25</td>
</tr>
<tr>
<td>Sweetened bars</td>
<td>350</td>
<td>30</td>
</tr>
<tr>
<td>Bread</td>
<td>220</td>
<td>40</td>
</tr>
<tr>
<td>Vegetables</td>
<td>30</td>
<td>300</td>
</tr>
<tr>
<td>Fruits</td>
<td>50</td>
<td>200</td>
</tr>
</tbody>
</table>

Dietary intake control
Satiation
DIETARY RECOMMENDATIONS

Increase of physical activity

- ➔ Lean mass
- ➔ Energy expenditure

Reasonable decrease of energy intake carbohydrates and fats

Progressive changes of dietary habits

Daily protein intake

Dietary balance

Variety and regularity

To change the food relation and to have a positive behaviour
WEIGHT AND MENOPAUSE

ADIPOSE TISSUE DISTRIBUTION

- Change in lifestyle (dietary habits, physical activity)
  - Prevent WEIGHT GAIN
  - WAIST CIRCUMFERENCE INCREASE
    
  (Women’s Healthy Lifestyle Project)

- Hormonal Replacement Treatment (HRT) increase visceral adipose tissue loss observed in case of weight loss
**INTERVENTION**

**WOMEN HEALTHY LIFESTYLE PROJECT**

Circulation 2001, 103, 32-37
JACC 2004, 44, 579-85

- **OBJECTIVE**
  - PREVENT MENOPAUSAL WEIGHT GAIN
  - DECREASE WAIST CIRCUMFERENCE

- **METHODS**
  - DECREASE SATURATED FATTY ACIDS AND CHOLESTEROL
  - EXERCISE

- **RESULTS**
  - WEIGHT AND WAIST CIRCUMFERENCE DECREASE / COMPARISON GROUP
  - LESSER PROGRESSION OF ATHEROSCLEROSIS
PHYSICAL ACTIVITY AND ENERGY EXPENDITURE AFTER MENOPAUSE

ENDURANCE PHYSICAL ACTIVITY

POEHLMAN ➔ Energy expenditure
Direct
Indirect: lean mass

Dietary intakes

Physical activity during the day

MURIO ➔ Fat oxidation (nocturnal and diurnal)

ENERGY BALANCE = EQUILIBRIUM

PHYSICAL ACTIVITY (walking 3 x / week)

+ MODERATE RESTRICTION

➔ Muscular fat

➔ Improve glycemic and lipid metabolic parameters

➔ – 8 % WEIGHT (RYAN)
SEVERE RESTRICTION INDUCE SARCOPENIA IN OBESE SUBJECTS

78 ♀ menopausal women
50 – 70 years
BMI 25 – 40 kg/m²
Waist circumference > 88 cm
- 400 Kcalories/EE

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Regimen + mild physical activity</th>
<th>Regimen + intense physical activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 months</td>
<td>Weight ∩ 11.5 kg</td>
<td>Fat mass ∩ 8.2 kg</td>
</tr>
<tr>
<td></td>
<td>Fat mass ∩ 8.2 kg</td>
<td>Lean mass ∩ 3.6 kg</td>
</tr>
<tr>
<td>12 months</td>
<td>If weight gain ≥ 2 kg</td>
<td>Fat mass gain + 26%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lean mass gain + 6%</td>
</tr>
</tbody>
</table>

- 1 kg fat = - 260g muscle
+ 1 kg fat = + 120g muscle

AJCN 2011, 94, 767-74
HORMONAL MODIFICATIONS INDUCING WEIGHT GAIN AND HUNGER SENSATION ARE MAINTAINED AT 62 WEEKS

50 OBESE SUBJECTS
VERY LOW CALORIE DIET
8 WEEKS
If weight loss > 10% (moy 13,5 kg)
Stabilisation 2 weeks
Follow-up 62 weeks
Weight gain 5,5 kg

<table>
<thead>
<tr>
<th>Weeks</th>
<th>Hunger</th>
<th>Leptin</th>
<th>PYY</th>
<th>CCK</th>
<th>INS</th>
<th>Amyline</th>
<th>Ghrelin</th>
<th>GIP</th>
<th>PP</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>↑</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
</tr>
<tr>
<td>62</td>
<td>↑</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
</tr>
</tbody>
</table>

NEJM 2011, 365, 1597-604
VICIOUS CIRCLE OF COGNITIVE RESTRICTION

I don’t feel well

I want to do a regimen

I have to do a regimen

Forbidden foods

Frustration

I eat more again

I STOP

I STOP

I have to do a regimen

I want to do a regimen

I don’t feel well

Weight (re)gain

Depression

Guilt complex

Guilt complex

Weight (re)gain

I eat more again

I STOP

I STOP

I have to do a regimen

I want to do a regimen

I don’t feel well

I don’t feel well

I don’t feel well

I don’t feel well

I don’t feel well

I don’t feel well

I don’t feel well

I don’t feel well

I don’t feel well
UPPER BODY OBESITY
RISK FACTORS

MENOPAUSE
TESTOSTERONE DEFICIENCY

HIGH
GLUCOCORTICOIDSECRETION

SOCIAL STRESS

THRIFTY GENOTYPE
LOW BIRTH WEIGHT

MICROBIOTA

DIETARY
FACTORS
(excess)

INACTIVITY

ALCOHOL
SMOKING

PSYCHOTIC DISEASES
NEUROLEPTIC DRUGS
METABOLIC SYNDROME

- HIGH TRIGLYCERIDES
- LOW HDL C
- DIETARY FACTORS
- YOYO SYNDROME
- INACTIVITY
- OESTROGEN OR TESTOSTERONE DEFICIENCY
- HIGH WAIST CIRCUMFERENCE
- HIGH BLOOD PRESSURE
- HIGH GLYCEMIA
- LOW DENSITY LDL
- INSULINO RESISTANCE
- LOW GRADE INFLAMMATION
- POST PRANDIAL HYPERLIPIDEMIA
- OXYDATIVE STRESS
- HYPERINSULINEMIA
- LDL OXYDATION
- STRESS (GLUCOCORTICOID)
- INTRA UTERINE RETARDATION
- GENETIC FACTORS
- MICROBIOTA

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CARDIOVASCULAR PREVENTION

NUTRITION

ABDOMINAL ADIPOSITY

HTA  DIABETES  DYSLIPIDEMIA  OXIDATIVE STRESS

INACTIVITY – STRESS – GENETIC – HORMONAL DEFICIENCY - AGE

SMOKING
## PREVENTION GENERAL POPULATION

**WOMEN’S HEALTH INITIATIVE JAMA 2006, 295, 655-656**

48 835 W 62,3 years 2 groups – 8,1 years – BMI (mean) 29 kg/m²

<table>
<thead>
<tr>
<th>OBJECTIVE</th>
<th>INTERVENTION</th>
<th>CONTROL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>INITIAL</td>
<td>REAL</td>
</tr>
<tr>
<td>Fat</td>
<td>20 %</td>
<td>37,8 %</td>
</tr>
<tr>
<td>SFA</td>
<td>12,7 %</td>
<td>9,5 %</td>
</tr>
<tr>
<td>TFA</td>
<td>2,8 %</td>
<td>1,6 %</td>
</tr>
<tr>
<td>PUFA</td>
<td>7,8 %</td>
<td>6,1 %</td>
</tr>
<tr>
<td>MUFA</td>
<td>14,4 %</td>
<td>10,8 %</td>
</tr>
</tbody>
</table>

+ 5 fruits and vegetables/day
6 grains /day

**RESULTS**

<table>
<thead>
<tr>
<th></th>
<th>INTERVENTION</th>
<th>CONTROL</th>
<th>HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHD</td>
<td>0,63 %</td>
<td>0,65 %</td>
<td>0,97</td>
</tr>
<tr>
<td>Stroke</td>
<td>0,28 %</td>
<td>0,27 %</td>
<td>1,02</td>
</tr>
<tr>
<td>CVD</td>
<td>0,86 %</td>
<td>0,88 %</td>
<td>0,98</td>
</tr>
</tbody>
</table>

MAJOR EVENTS RISK in women with previous cardiovascular disease (3,4 %) +26%
Figure 2  Women’s health initiative dietary modification trial (reproduced from Howard et al.⁶).
CARDIOVASCULAR PREVENTION

- Reduction Saturated fats: butter, meat, cheese, processed meat and trans (fatty acids in pastry, hard margarines, cakes, biscuits...)
- Increase of polyunsaturated fatty acids
  - Particularly omega 3
  - Rapeseed or walnut oils
  - Fatty fish
- 5 fruits and vegetables/day, half a plate
- Fibers (bread and wholegrains - leguminous)
- Decrease salt
- Abdominal weight loss
- Low glycemic index carbohydrates
NUTRITIONAL ADVICES
FOR METABOLIC SYNDROME MANAGEMENT

WEIGHT LOSS (MODERATE) (5%)

INCREASE PHYSICAL ACTIVITY

DECREASE ENERGY INTAKE

DECREASE CARBOHYDRATES \(>\) FATS (CHO \(\leq\) 40-45\% et F 35-40\%)

FATTY ACIDS CHOICE - SFA 12\% - Dairy fat +

- \(\omega 6\) not too much

- \(\omega 3\) ++ (ALA – EPA – DHA)

CARBOHYDRATE QUALITY : LOW GLYCEMIC – FEW FRUCTOSE

GLOBAL NUTRITION +++ (F & V…) MEDITERRANEAN DIET
VIGOROUS WALK IS ASSOCIATED WITH A LOWER CARDIOVASCULAR RISK EVEN FOR A SHORT DURATION

73,743 women 50 – 79 years
W.H.I. Study
5.9 years (follow-up)

Figure 3. Joint Association of Walking and Vigorous Exercise with the Age-Adjusted Relative Risk of Cardiovascular Disease. RR denotes relative risk.
## CARBOHYDRATES FOODS

<table>
<thead>
<tr>
<th>FRUCTOSE</th>
<th>HIGH GLYCEMIC INDEX FOODS OR PURIFIED CARBOHYDRATES</th>
<th>LOW GLYCEMIC INDEX FOODS AND HIGH NUTRITIONAL DENSITY FOODS</th>
<th>RICH IN FIBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWEETENED DRINKS</td>
<td>White bread, Potatoes</td>
<td>Lentils, Leguminous Fruits</td>
<td>Whole bread, Whole grain Oats</td>
</tr>
<tr>
<td>FAT AND SWEETENED FOODS</td>
<td>Cakes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOW NUTRITIONAL DENSITY FOODS</td>
<td>Sweets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AVOID</td>
<td>MODERATE</td>
<td>FAVOUR</td>
<td>FAVOUR</td>
</tr>
<tr>
<td><strong>SALT</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ADDED</strong></td>
<td><strong>NOT VISIBLE</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| COOKING  
Low salt (at the beginning of cooking) | ON THE TABLE  
Avoid | Bread  
Cheese  
Processed meat  
Canned foods  
Soups  
Ready cooked dishes |
|  | POTASSIUM  
Fruits  
Vegetables |
OSTEOPOROSIS – MECHANISMS WITH AGE

Bone mass peak

MAX 20 – 30 years = higher bone mass

Bone mass loss after 30-35 years

- 0,2 à 1,3% /year
- 2 à 3% /year > menopause

Between 30 and 80 years

- 50% trabecular mass pool
- 30% bone mass pool

Genetic
Calcium
Vit D
Physical activity

Osteoformation
Stable Resorption

Cellular ageing
Oestrogens \(\ominus\) resorption

Decrease of cutaneous vit D synthesis
Low intake of Vit D and calcium

\(\oplus\) PTH

Bone resorption
SUN SHINE
VITAMINES D and K

TEA

PHYSICAL ACTIVITY AND GRAVITY

ALCALINIC FOODS

PROTEINS

VITAMINE A

EXCESS OF SALT

CALCIUM

SILICE

OSTEOPOROSIS

VITAMINE C

SMOKING
STRESS
CORTISOL

SOFT DRINKS (SODAS)

COFFEE

LOW BMI

ACIDIFIC FOODS

EXCESS OF ANIMAL PROTEINS

CALCIURIA
IS THERE A BONE BENEFIT OVERWEIGHT AFTER MENOPAUSE?

LESS PREVALENCE OF OSTEOPOROSIS FOR A BMI 25-28/LOWER BMI

PERIPHERAL ADIPOSE TISSUE

\[ \Delta 4A \]

AROMATASE

OESTRONE

BMD

OSTEOPOROSIS

BUT FAT MASS PLAYS A LESSER ROLE THAN MENOPAUSE

Low mineral bone density at menopause \( \Rightarrow \) Mortality

= low oestrogenic impregnation ?

HIGH BMI

HIGH CALCIUM INTAKES

MUSCULAR STRENGTH

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WEIGHT LOSS IN PREMENOPAUSAL WOMEN HAS A FAVORABLE IMPACT ON CARDIOVASCULAR RISK BUT NOT ON BONE MASS

WOMEN’S HEALTHY LIFESTYLE PROJECT
373 ♀ 44 – 50 years
2 groups - Control
- 1 with dietary changes + physical activity and weight loss
54 months

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>2.6 kg</td>
<td>- 0.4 kg</td>
</tr>
<tr>
<td>Bone mass</td>
<td>- 0.03 % / year</td>
<td>- 0.20 % / year</td>
</tr>
<tr>
<td>NS after intervention (54 → 78 months)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If HRT
WEIGHT LOSS + 3%
WEIGHT GAIN

Bone mass
⊕ 0.25 % / an
⊕ 0.02 % / an

J Clin Endocrinol Metab 2007, 92, 3809 - 3815
PREVENTION OSTEOPOROSIS

(2) – 3 dairy products (1 cheese)

Vitamin D (sun – fatty fish)

Sufficient protein intake = one source of animal proteins

Acide – base balance : fruits and vegetables

Phytoestrogens - Lignans (cereals)

- Soy isoflavones very early in youth

Decrease urinary calcium loss (less salt)

Maintain moderate fat mass (BMI 25-28)
PREVENTION OF AGE RELATED MACULAR DEGENERATION

- **Lutein**
- **Zeaxanthin**
- **Carotenoids**
  - **Cabbage**
  - **Lettuce**
  - **Spinach**

- **EPA**
- **DHA**
- **Long chain omega 3 PUFA**
  - **Poissons Gras**

- **Antioxidants**
  - Vitamins E, C
  - Selenium, zinc

- **Vegetables, fruits, fish, vegetable oils**

**Increase macular pigment**

**Turn over of photoreceptor disks**

**Against oxidative stress**
<table>
<thead>
<tr>
<th>LIPIDS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TRANS FA</strong></td>
</tr>
<tr>
<td>Hard margarines</td>
</tr>
<tr>
<td>Pastry</td>
</tr>
<tr>
<td>Biscuits</td>
</tr>
<tr>
<td>Cakes</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Avoid</td>
</tr>
</tbody>
</table>

- **OMEGA 6**
  - Linolenic acid
    - Rapeseed
    - Walnut
    - Soybean
    - Linseed
    - Rabbit
    - Spinach
    - Pursle
- **OMEGA 3**
  - EPA
    - Fish
  - DHA

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OXIDATIVE STRESS

IRON
Mercury
UV – excess of sunshine
Tobacco
Excess of exercise
Grilled foods (Maillard reaction)

VITAMIN C
Vitamin E 8 isomers
Betacarotene
Carotenoids (600)
Polyphenols (4000)
Ferulic acid

PRODUCTION OF FREE RADICALS

Fruits
Vegetables
Nuts
Cocoa
Tea
Wine
Virgin olive oil
Grains
Soy
Spices

ANTIOXIDANT NUTRIENTS AND PHYTOCHEMICALS
CANCER PREVENTION

- Iron (moderate)
- Calcium (sufficient)
- Physical activity
  - Weight
  - Fat
  - Fiber
- Alcohol
  - Omega 3

- LUNG
- SMOKING

FRUITS AND VEGETABLES

ANTIOXIDANTS – POLYPHENOLS - CAROTENOIDS

COLORECTAL

ENDOMETRIAL

BREAST
PHYSICAL ACTIVITY

- Energy expenditure for physical activity
- Lean mass
- Total energy expenditure
- Immune defenses
- More micronutrients
- Osteoporosis prevention
- Cardiovascular and metabolic risk factors
- Weight control
### Basic Principles of Prevention Nutrition

<table>
<thead>
<tr>
<th>Condition</th>
<th>Suggestion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight Gain</td>
<td>Energy Balance</td>
</tr>
<tr>
<td></td>
<td>Fat and Carbohydrate</td>
</tr>
<tr>
<td>Hyperlipidemia</td>
<td>Avoid Excess of Saturated and Trans Fatty Acids</td>
</tr>
<tr>
<td>Glucose Tolerance</td>
<td>Choice of Carbohydrates High in Fibers and Low Glycemic Index</td>
</tr>
<tr>
<td>Oxidative Stress</td>
<td>Favour Antioxidant Foods</td>
</tr>
<tr>
<td>Homocysteinemia</td>
<td>Folate</td>
</tr>
<tr>
<td>Platelet Aggregation</td>
<td>Omega 3 Fatty Acids</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>Omega 6 / Omega 3 Ratio</td>
</tr>
<tr>
<td>Hypertension</td>
<td>Reduce Salt</td>
</tr>
<tr>
<td></td>
<td>Avoid Alcohol</td>
</tr>
</tbody>
</table>
IN PRACTICE

- EMPTIED CALORIES
- PORTION SIZE
- HELP AGAIN TO A DISH
- COOKING
- FAT USE
- BETWEEN THE MEALS
- ALCOHOL
- SOFT DRINKS ++
- FOOD CHOICE
DIETARY BEHAVIOURS

⇒ COOKING HERSELF
⇒ TIME SPENT FOR THE MEALS + WITHOUT WATCHING TV
⇒ EAT WITH PLEASURE
⇒ MANAGE THE EXCESS INTO THE REGIMENS
⇒ LISTEN THE BODY AND THE SENSES – SATIATION + HUNGER
⇒ CHANGE THE TASTE FOR SOME FOODS