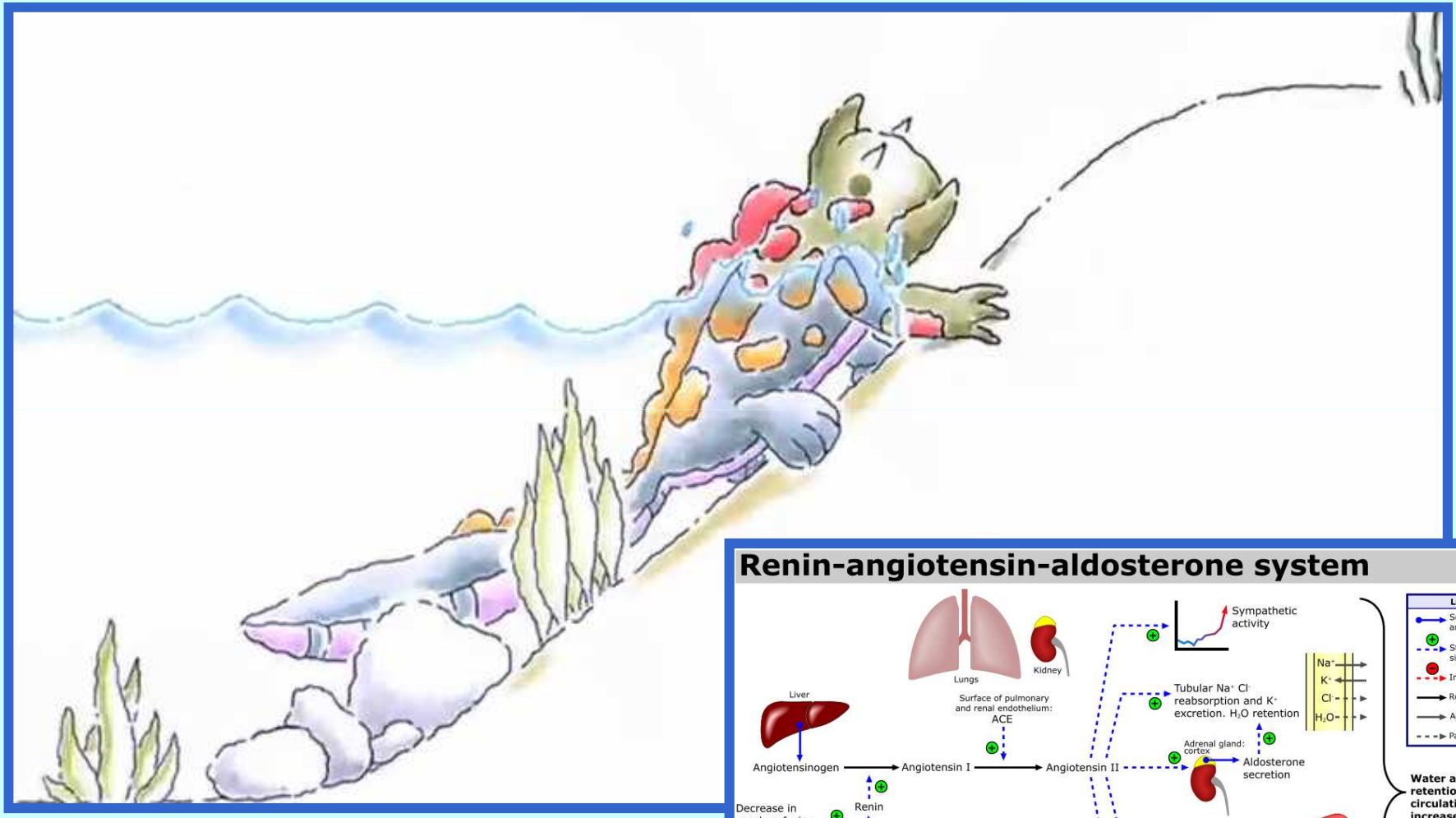
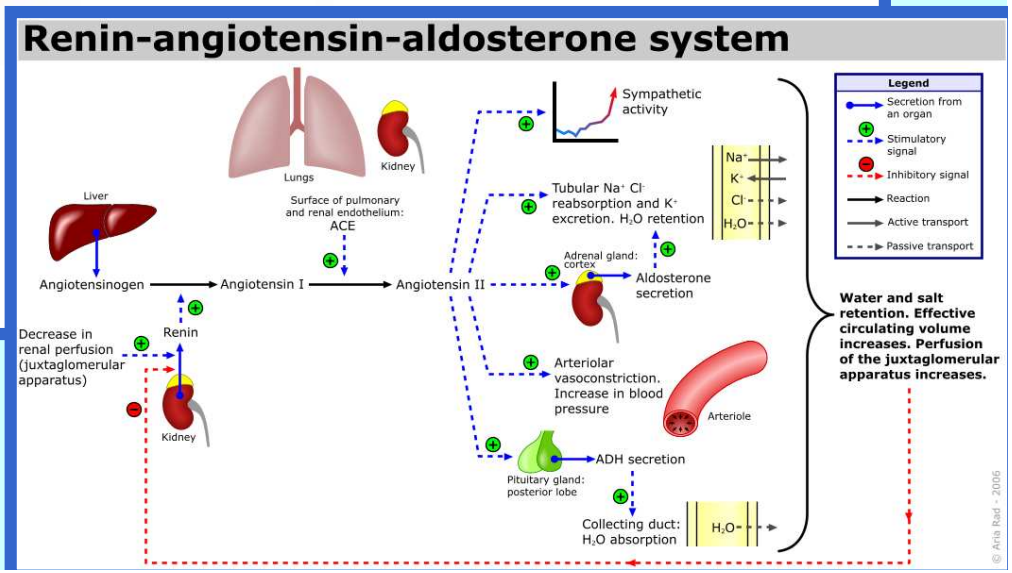
**Una alimentazione più insipida allunga la vita: rapporti tra sale e pressione arteriosa nel bambino**

**Marco Giussani**

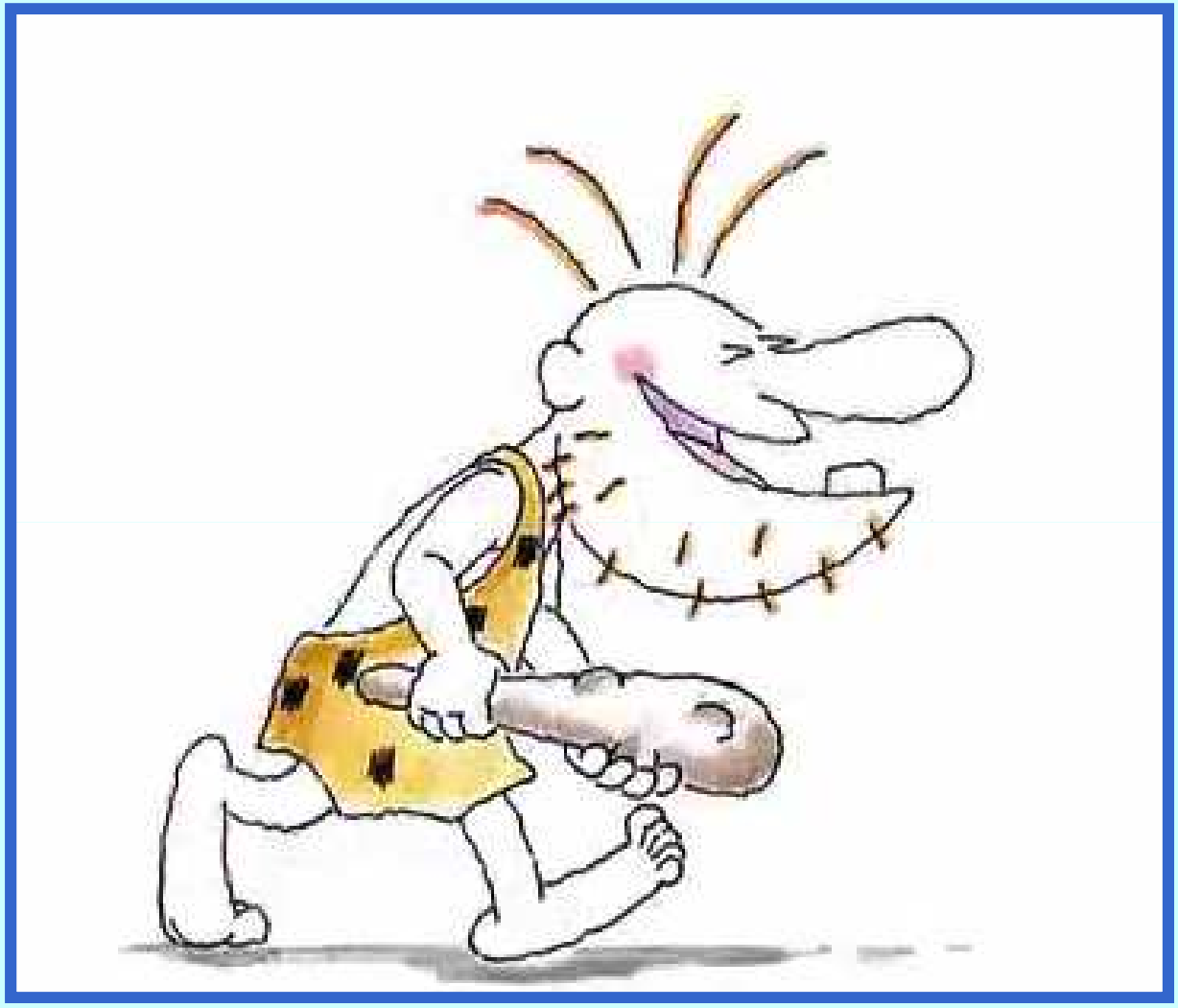
Società Italiana di Pediatria
GSIPER
GRUPPO DI STUDIO DELL'IPERTENSIONE ARTERIOSA

# Alcuni milioni di anni fa …





Circa 200.000 anni fa



9.500 anni fa inizia l’agricoltura
e la domesticazione di alcuni animali

**TABELLA 2-10** Dosi di sodio, cloro e potassio per individui in buona salute*

| Età | Peso (kg)* | Sodio (mg)** | Cloro (mg)** | Potassio (mg)*** |
|---|---|---|---|---|
| 0-5 mesi | 4,5 | 120 | 180 | 500 |
| 6-11 mesi | 8,9 | 200 | 300 | 700 |
| 1 anno | 11,0 | 225 | 350 | 1.000 |
| 2-5 anni | 16,0 | 300 | 500 | 1.400 |
| 6-9 anni | 25,0 | 400 | 600 | 1.600 |
| 10-18 anni | 50,0 | 500 | 750 | 2.000 |
| > 18 anni§ | 70,0 | 500 | 750 | 2.000 |

* Non sono incluse le perdite abbondanti attraverso la sudorazione profusa.

** Non vi è alcuna evidenza che introduzioni maggiori apportino benefici alla salute.

*** Apporti auspicati di potassio possono superare questi valori (≅ 3.500 mg per gli adulti—vedi voce bibliografica 32).

§ Non sono incluse le raccomandazioni per la crescita. I valori riportati per i soggetti sotto i 18 anni considerano una percentuale di crescita al 50° percentile (secondo il National Center for Health Statistics [Hamill et al., 1979]) e una media tra maschi e femmine. Vedi voce bibliografica 32 per gravidanza e allattamento.

Per gentile concessione di: Recommended Dietary Allowances, 10th ed. Copyright 1989 by the National Academy of Sciences. e del National Academy Press, Washington, DC.

- **Tra adulti ipertesi il 51% è “salt-sensitive” e il 33% è “salt-resistant”**
- **Tra gli adulti normotesi il 26% è “salt-sensitive” e il 58% è “salt-resistant”**

**Table 1. Estimated Changes in Systolic Blood Pressure Associated with Reductions in Dietary Salt.***

| Group | Salt Reduction, 1 g/day | | Salt Reduction, 3 g/day | | Reference No. |
|---|---|---|---|---|---|
| | Low Estimate of SBP Decrease | High Estimate of SBP Decrease | Low Estimate of SBP Decrease | High Estimate of SBP Decrease | |
| | *mm Hg* | | | | |
| Entire U.S. population | | | | | |
| Persons with hypertension† | 1.20 | 1.87 | 3.60 | 5.61 | 3, 15 |
| Persons ≥65 yr old | 1.20 | 1.87 | 3.60 | 5.61 | 17, 19–22 |
| All others | 0.60 | 1.17 | 1.80 | 3.51 | 3, 15 |
| Black subpopulation | | | | | |
| Persons with hypertension† | 1.80 | 3.03 | 5.40 | 9.10 | 3, 17, 19–22 |
| Persons ≥65 yr old | 1.20 | 1.87 | 3.60 | 5.61 | 17, 19–22 |
| All others | 1.20 | 1.87 | 3.60 | 5.61 | 17, 19–22 |

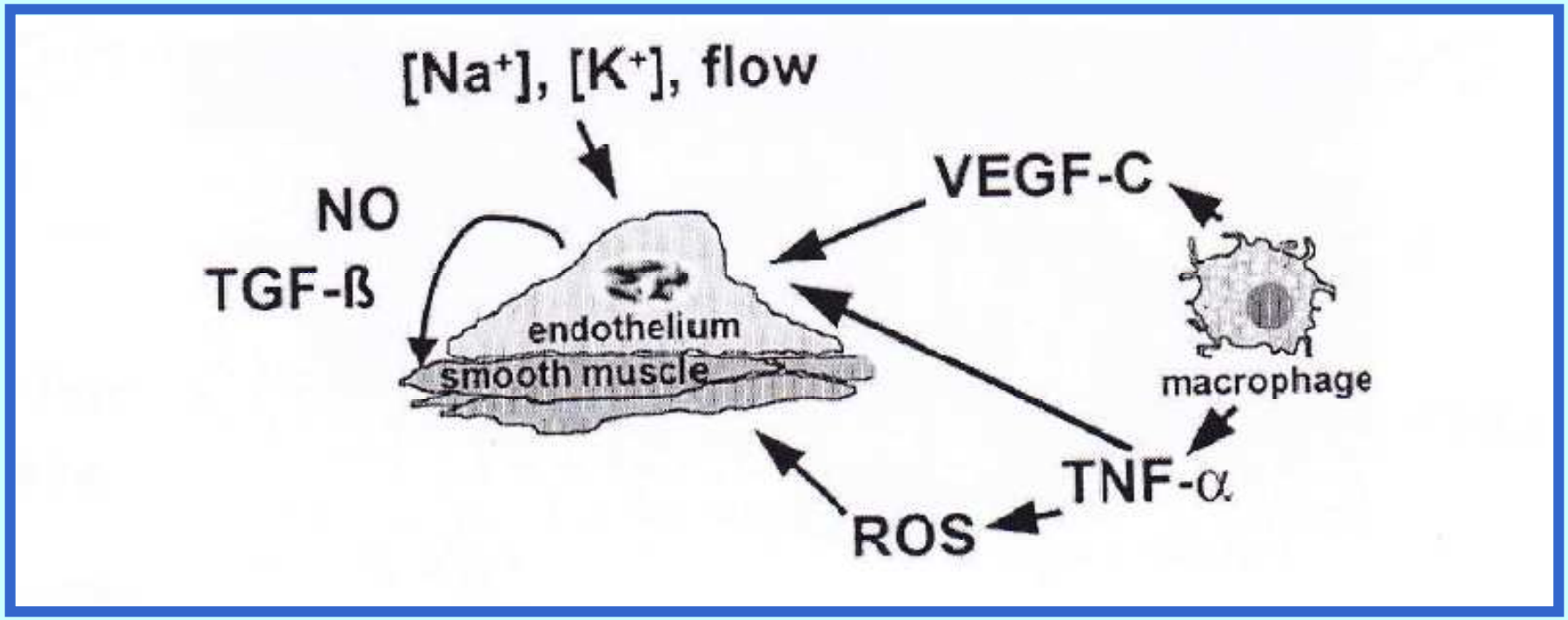
* SBP denotes systolic blood pressure.
† Hypertension was defined as a systolic blood pressure of 140 mm Hg or higher, a diastolic blood pressure of 90 mm Hg or higher, or use of an antihypertensive medication.

K. Bibins-Domingo, NEJM 2010

**Table 3. Projected Estimates of Comparative Effect of Various Population Interventions on Annual Reductions in Cardiovascular Events.***

| Intervention | Incidence of CHD | Total MI† | Incidence of Stroke | Death from Any Cause |
|---|---|---|---|---|
| | *reduction in absolute number of events (% change from expected)* | | | |
| Salt reduction | | | | |
| 1 g/day | | | | |
| Low estimate | 22,000±2000 (2.0) | 20,000±1800 (2.6) | 13,000±1800 (1.7) | 17,000±2400 (0.9) |
| High estimate | 37,000±3300 (3.3) | 32,000±2900 (4.2) | 20,000±2900 (2.7) | 28,000±3800 (1.4) |
| 2 g/day | | | | |
| Low estimate | 44,000±4000 (4.0) | 39,000±3500 (5.1) | 25,000±3500 (3.4) | 34,000±4600 (1.7) |
| High estimate | 71,500±6300 (6.4) | 62,500±5400 (8.1) | 40,000±5400 (5.3) | 55,000±7500 (2.8) |
| 3 g/day | | | | |
| Low estimate | 66,000±5800 (5.9) | 58,000±5100 (7.6) | 37,000±5100 (5.0) | 51,000±7100 (2.6) |
| High estimate | 110,000±9200 (9.6) | 92,000±7800 (12.0) | 59,000±8100 (7.8) | 81,000±11,000 (4.1) |
| Smoking cessation‡ | 41,000±10,000 (3.7) | 92,000±14,000 (11.9) | 32,000±13,000 (4.4) | 84,000±9300 (4.3) |
| Weight loss§ | 59,000±3500 (5.3) | 61,000±3200 (8.0) | 5600±600 (0.7) | 36,000±2000 (2.0) |
| Statin therapy for primary prevention¶ | 52,000±5600 (5.3) | 17,000±1800 (2.9) | 6600±200 (0.9) | 5400±540 (0.3) |
| Pharmacologic treatment of hypertension‖ | 100,000±11,000 (9.3) | 100,000±9700 (13.1) | 69,000±11,000 (9.3) | 80,000±10,000 (4.1) |

* Plus–minus values are means ±SE from the Monte Carlo simulations. CHD denotes coronary heart disease, and MI myocardial infarction.
† Total myocardial infarction includes new and recurrent myocardial infarctions.
‡ Smoking cessation was defined as elimination of 50% of use of or exposure to tobacco.
§ Weight loss was defined as a 5% reduction in body-mass index in an obese adult.
¶ Cholesterol treatment for primary prevention was defined according to the National Cholesterol Education Program Adult Treatment Panel III guidelines as treatment with statins in persons with a 10-year risk of CHD of less than 20%.
‖ Pharmacologic treatment of hypertension was defined on the basis of treatment of all persons with hypertension to the degree described in the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack Trial.[24]


[Na+], [K+], flow
NO
TGF-ß
endothelium
smooth muscle
VEGF-C
macrophage
TNF-α
ROS

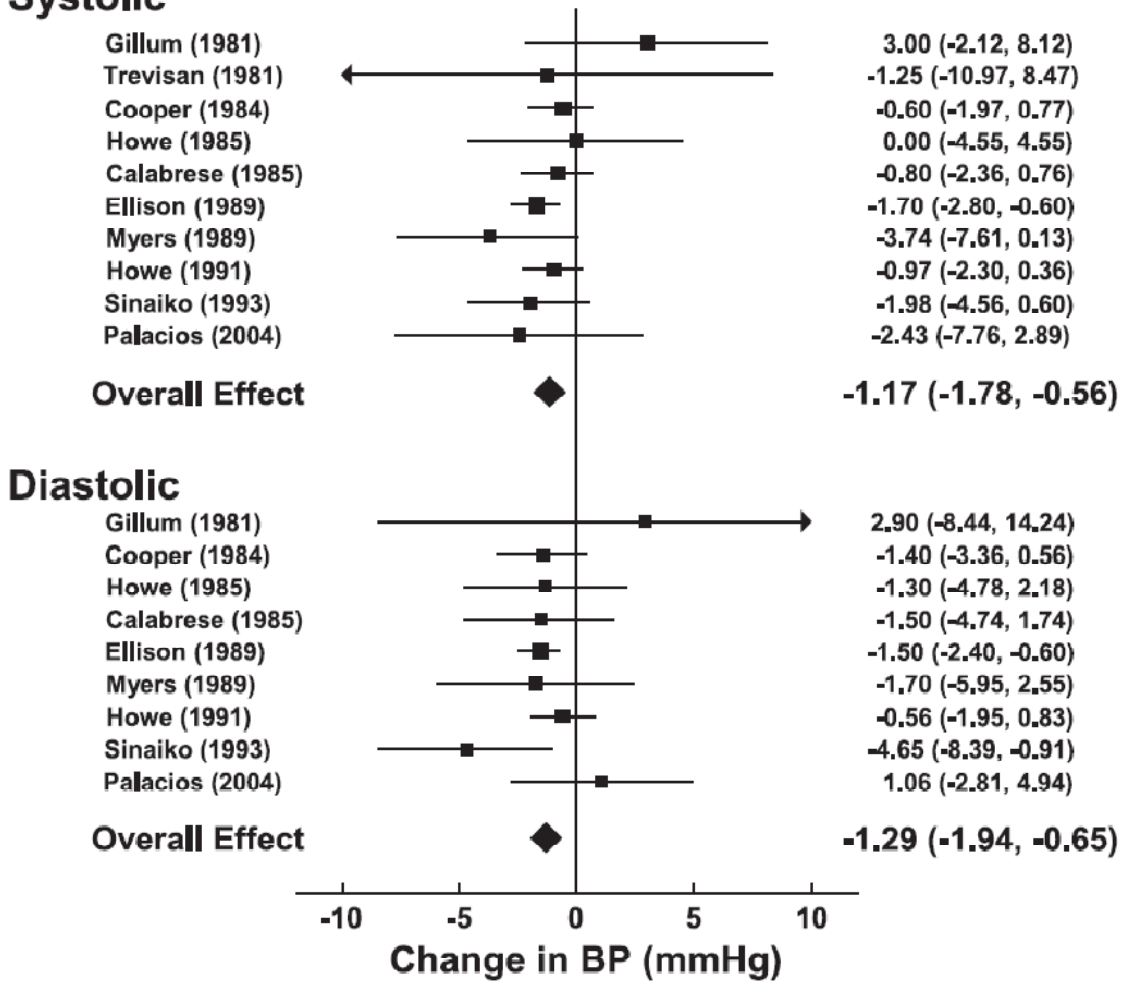


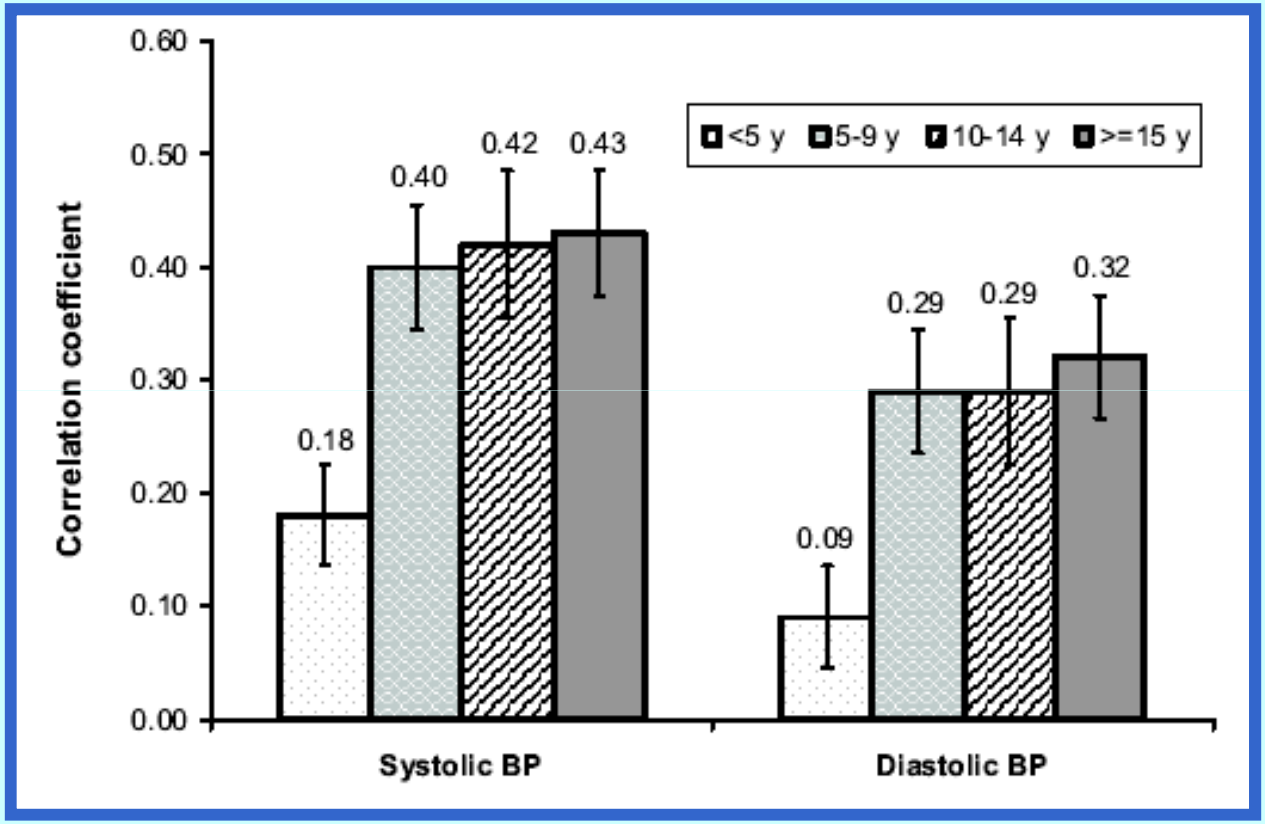

**Figure 2.** Mean net change in BP and corresponding 95% CI in individual trials included in the meta-analysis. The overall effect represents the pooled estimate of mean net change in BP. The size of the symbol is in proportion to the weight (ie, inverse of the variance of the net change in BP) of the trial.

He and Mac Gregor, Hypertension 2006

- **Nella stessa metanalisi vengono citati tre studi, di cui due su neonati e uno su lattanti di tre mesi, che dimostravano una minor SBP (3 mm Hg) nei soggetti con alimentazione a più basso contenuto di sodio.**
- **Alcuni soggetti, arruolati in uno di questi studi, sono stati rivalutati dopo 15 anni e hanno dimostrato dei valori più bassi di SBP (3.6 mm Hg) e DBP (2.2 mm Hg) rispetto ai controlli.**

J.M. Geleijnse BMJ 1990

Tracking of BP from childood to adulthood : base-line age

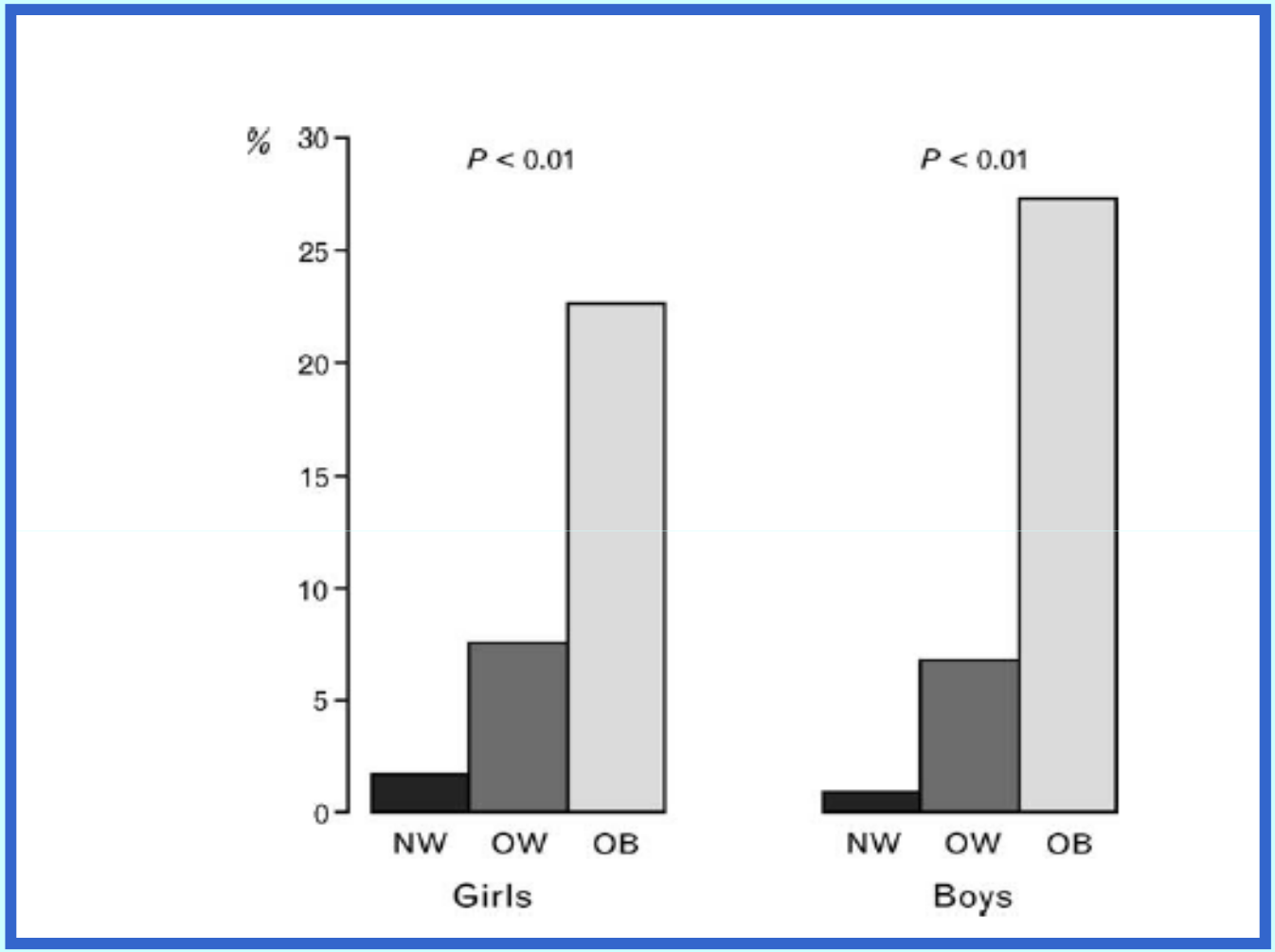



*Chen, Circulation,2008*

A.Chiolero, P.Bovet, G.Paradis and F.Paccaud
Has Blood Pressure Increased in Children in Response to the Obesity Epidemic ?
Pediatrics 2007;119;544-553

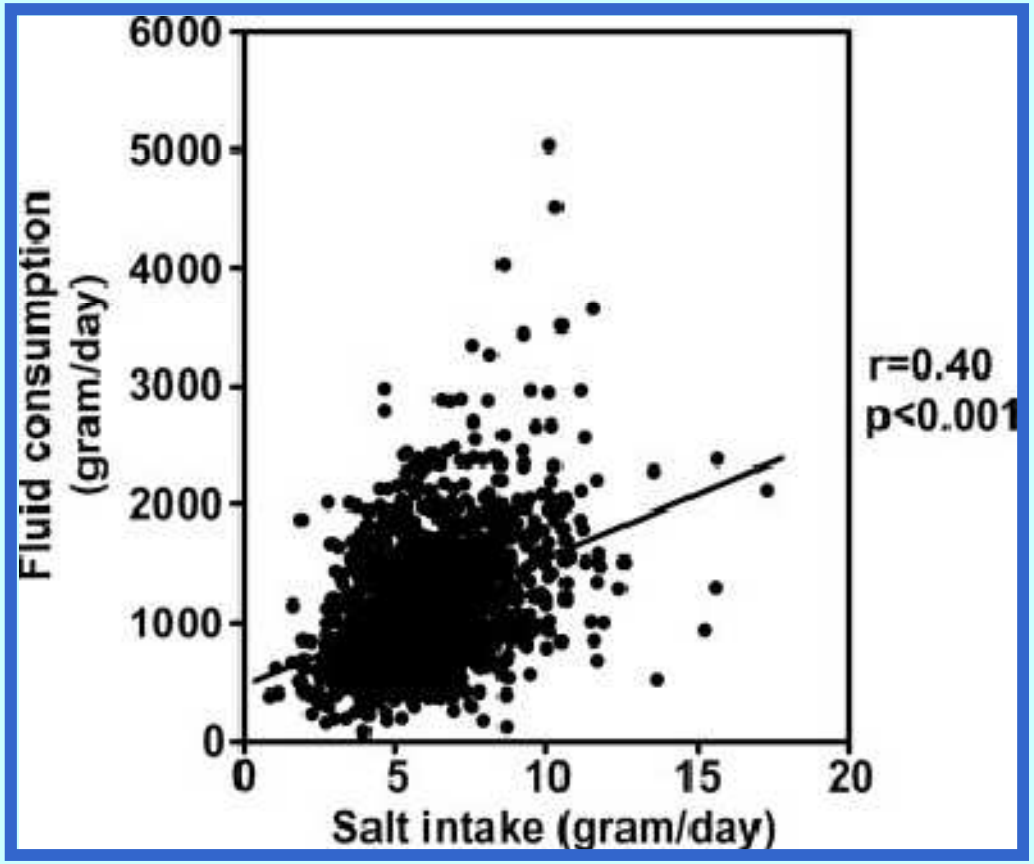
| studio | Età | Anno | N | PAS | PAD | PAS e/o PAD |
|---|---|---|---|---|---|---|
| Adrouguè et al. (Minneapolis) | 10-15 | 1986-87 | 19.542 | 1°set 2.7%<br>2°set 0.8% | 1°set 2.0%<br>2°set 0.4% | NA<br>NA |
| Jafar et al. (Pakistan) | 5-14 | 1990-94 | 5.641 | M 8.7%<br>F 6.2% | M 9.6%<br>F 3.2% | M 13.8%<br>F 8.7% |
| Paradis et al. (Canada) | 9<br>13<br>16 | 1999 | 3.589 | 7%<br>13%<br>17% | 0%<br>0%<br>0% | 7%<br>13%<br>17% |
| Sorof et al. (Houston) | 12-16 | 2000-01 | 2.460 | 1°set 1 6%<br>2°set 11% | 1°set 2%<br>2°set 1% | 1°set 16.8%<br>2°set 11.5% |
| Sorof et al. (Houston) | 13±1.7 | 2002 | 5.102 | NA | NA | 1°set 19.4%<br>2°set 9.5%<br>3°set 4.5% |
| Genovesi et al. (Milano) | 6-11 | 2003-04 | 2.416 | NA | NA | 1°set 8.8%<br>2°set 4.2% |
| Falkner et al. (Delaware) | 2-19 | 2002 | 18.618 | 6% | 2% | 7.2% |
| Chiolero et al. (Seychelles) | 5-16 | 2002-04 | 15.612 | M 6.1%<br>F 6.0% | M 5.1%<br>F 6.9% | M 9.1%<br>F 10.1% |

## Prevalenza di ipertensione e classe ponderale



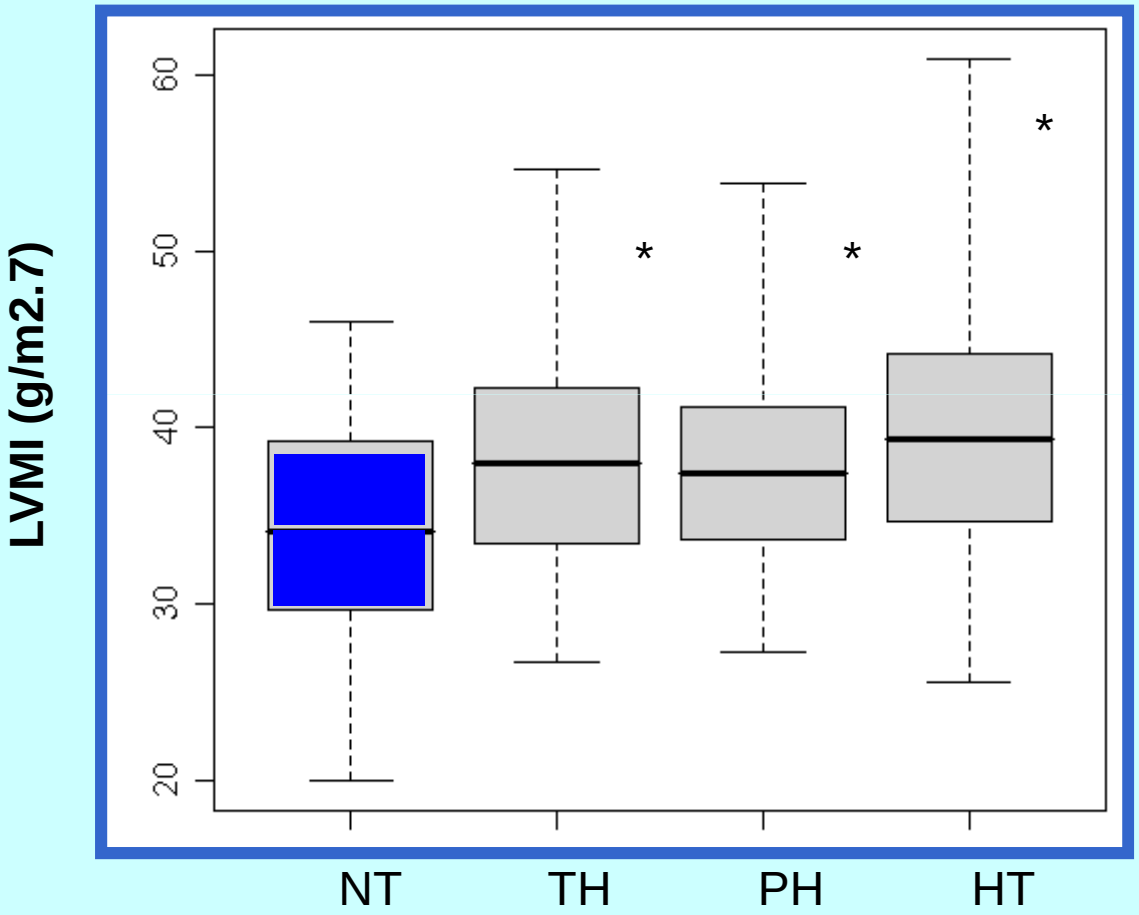

progetto pab pressione arteriosa bambino

*Genovesi, J Hypertension,2008*




He et al. Hypertension 2008

# Variazioni della massa cardiaca per classe pressoria




* = p<0.001 vs NT

| Recettore | Stimolo | Gradimento | Funzione finalistica |
|---|---|---|---|
| Dolce (più recettori ?) | Zuccheri semplici, carboidrati, dolcificanti | Innato | Ricerca sostanze energetiche |
| Amaro (più recettori ?) | Sostanze differenti | Non innato | Evitamento sostanze tossiche |
| Salato | NaCl | Innato | Ricerca sale |
| Acido | $H^+$ | Non innato | Evitamento sostanze in decomposizione |
| Umami (più recettori ?) | Glutammato GMP, IMP | Innato | Ricerca sostanze proteiche |
| ? | Lipidi | Innato | |

Am J Clin Nutr. 2012 Jan;95(1):123-9

**The development of salty taste acceptance is related to dietary experience in human infants: a prospective study.**

Stein LJ, Cowart BJ, Beauchamp GK.

**CONCLUSIONS:**

The findings suggest an influential role of early dietary experience in shaping salty taste responses of infants and young children.

# Sodio nella dieta

- **Non discrezionale**

  **10% presente naturalmente negli alimenti**

- **Discrezionale**

  **54% aggiunto nella produzione degli alimenti**

  **36% aggiunto durante o dopo la preparazione casalinga**

## Where's the Sodium?

Only a small amount of sodium occurs naturally in foods. Most sodium is added during processing. This table gives examples of the varying amounts of sodium in some foods.

| Food Groups | Sodium (mg) |
|---|---|
| **Grains and grain products** | |
| Cooked cereal, rice, pasta, unsalted, 1/2 cup | 0–5 |
| Ready-to-eat cereal, 1 cup | 100–360 |
| Bread, 1 slice | 110–175 |
| **Vegetables** | |
| Fresh or frozen, cooked without salt, 1/2 cup | 1–70 |
| Canned or frozen with sauce, 1/2 cup | 140–460 |
| Tomato juice, canned 3/4 cup | 820 |
| **Fruit** | |
| Fresh, frozen, canned, 1/2 cup | 0–5 |
| **Lowfat or fat free dairy foods** | |
| Milk, 1 cup | 120 |
| Yogurt, 8 oz | 160 |
| Natural cheeses, 1 1/2 oz | 110–450 |
| Processed cheeses, 1 1/2 oz | 600 |
| **Nuts, seeds, and dry beans** | |
| Peanuts, salted, 1/3 cup | 120 |
| Peanuts, unsalted, 1/3 cup | 0–5 |
| Beans, cooked from dried, or frozen, without salt, 1/2 cup | 0–5 |
| Beans, canned, 1/2 cup | 400 |
| **Meats, fish, and poultry** | |
| Fresh meat, fish, poultry, 3 oz | 30–90 |
| Tuna canned, water pack, no salt added, 3 oz | 35–45 |
| Tuna canned, water pack, 3 oz | 250–350 |
| Ham, lean, roasted, 3 oz | 1,020 |

# Contenuto di sodio (mg/100 ml) in alcuni sostituti del latte materno

Latte materno 17 mg/100ml

Latte vaccino 50 mg/100 ml

| | Partenza | Proseguimento | Crescita |
|---|---|---|---|
| **Aptamil** | **17** | **20** | **26** |
| **Formulat** | **23** | **25** | |
| **Humana** | **20** | **20** | **25** |
| **Mellin** | **17** | **20** | **25** |
| **Nestlè** | **16** | **22** | **28** |
| **Novolac** | **20** | **25** | **25** |
| **Nutriben** | **20** | **25** | **38** |
| **Plasmon** | **19** | **32** | **34** |
| **Media** | **19** | **23.6** | **28.7** |

Contenuto medio di Na in 100 g di omogenizzato di carne ……120 mg
Contenuto medio di Na della quantità di carne contenuta…….16.8 mg

**In conclusione: quanto sale dovrebbe assumere un bambino?**

**Potrebbe essere sufficiente la quantità di sodio naturalmente presente negli alimenti freschi. Quindi, sarebbe possibile eliminare completamente la quota discrezionale (alimenti conservati e sale durante e dopo la cottura)**

**Tuttavia questa non è una risposta di "buon senso"**

**È "buon senso" diminuire la quantità di sale consumata invertendo il trend attualmente in atto, facendo passare il messaggio che "tanto sale fa male"**

**Questo obiettivo si può raggiungere attraverso**

- ❑ **scelte personali**
- ❑ **strategie di popolazione**

**Il pediatra dovrebbe:**

- ❑ **rinforzare il messaggio sulla riduzione del sale**
- ❑ **limitarne l'uso soprattutto nei primi mesi/anni di vita ("imprinting")**

**Nei bambini ipertesi (ma anche preipertesi o con famigliarità per ipertensione) la diminuzione del sale è un cardine del trattamento dietetico-comportamentale**