THE IMPACT OF OVERWEIGHT AND OBESITY ON ADOLESCENCE: CONSEQUENCES ON METABOLIC BIOMARKERS

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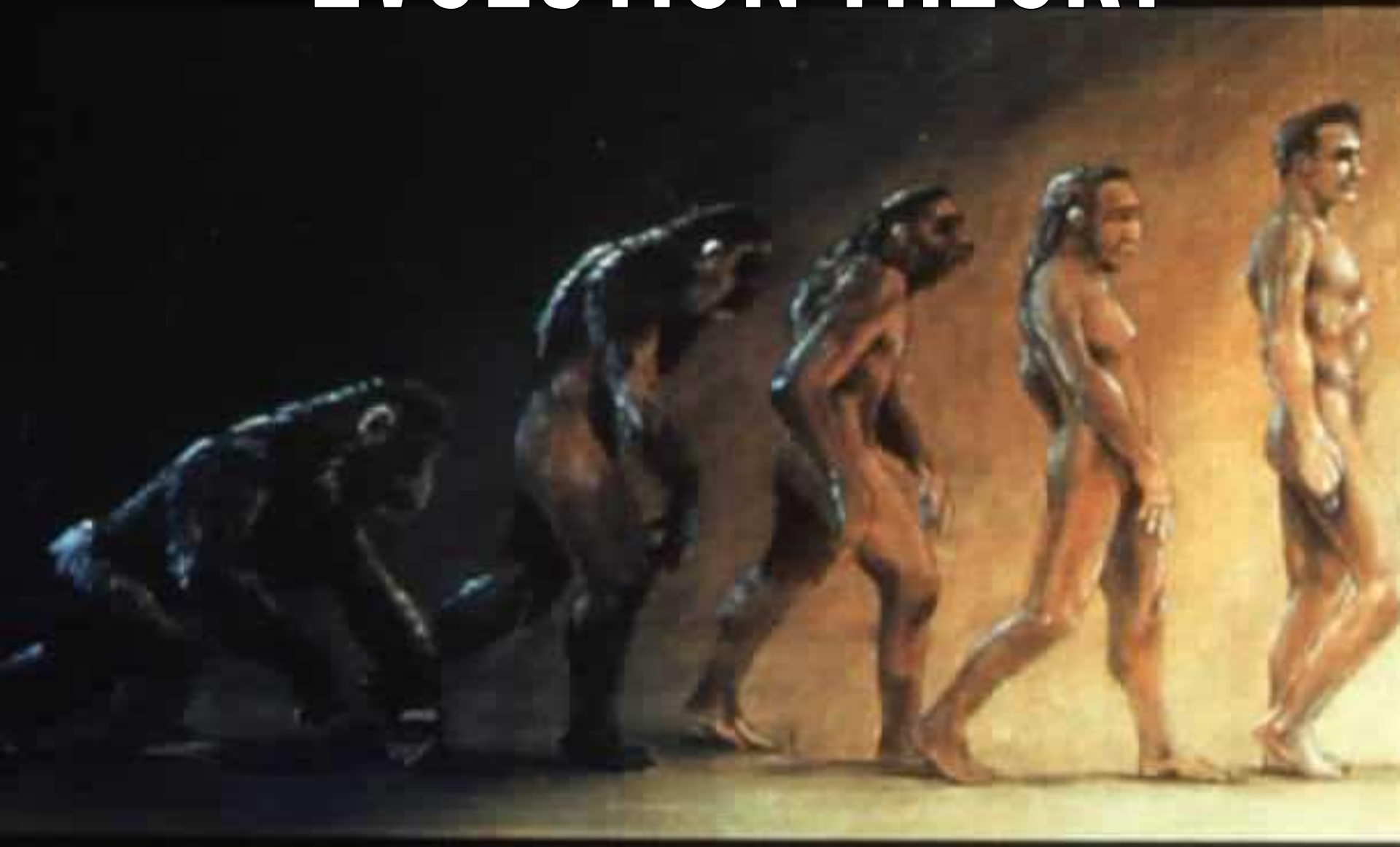
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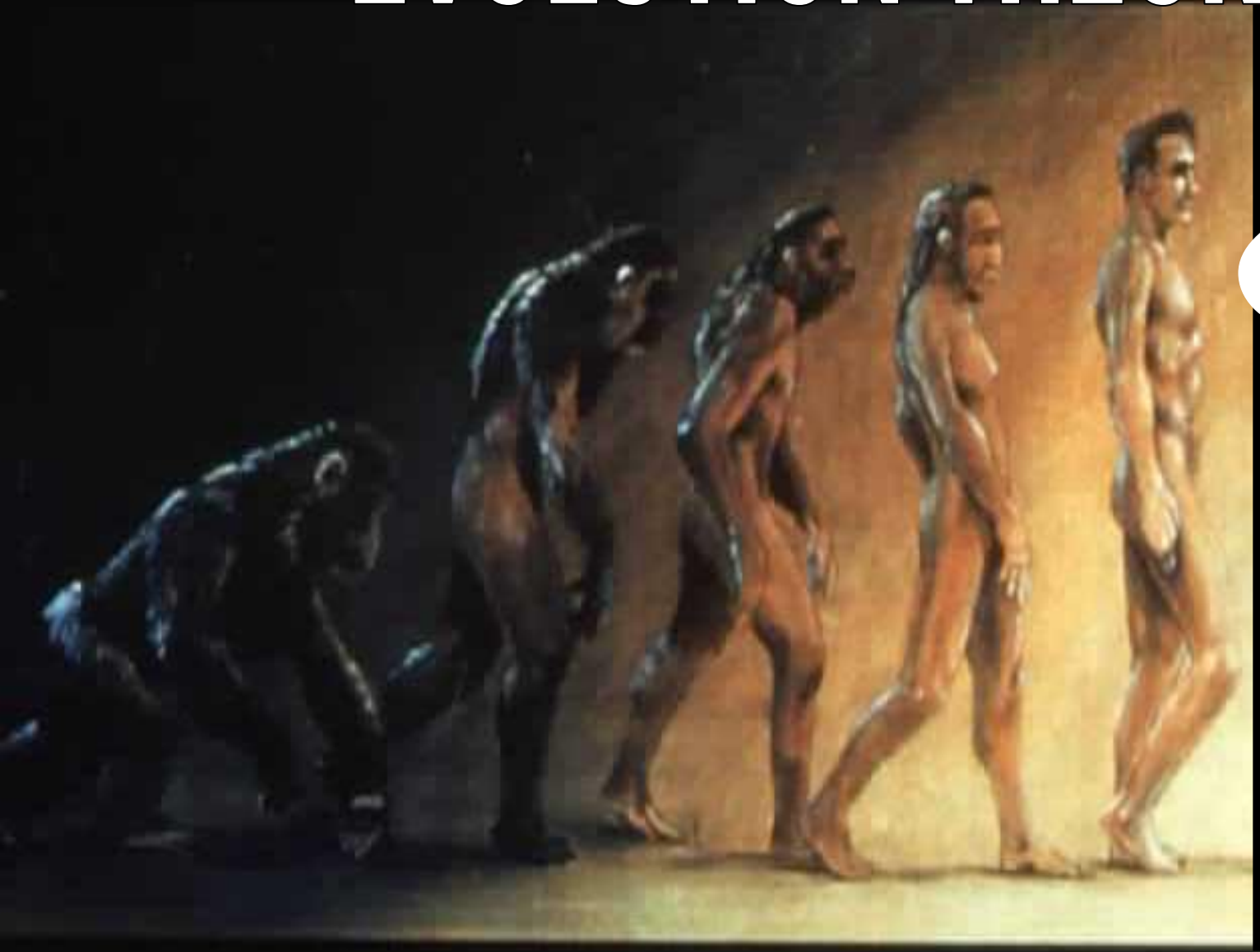
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EVOLUTION THEORY

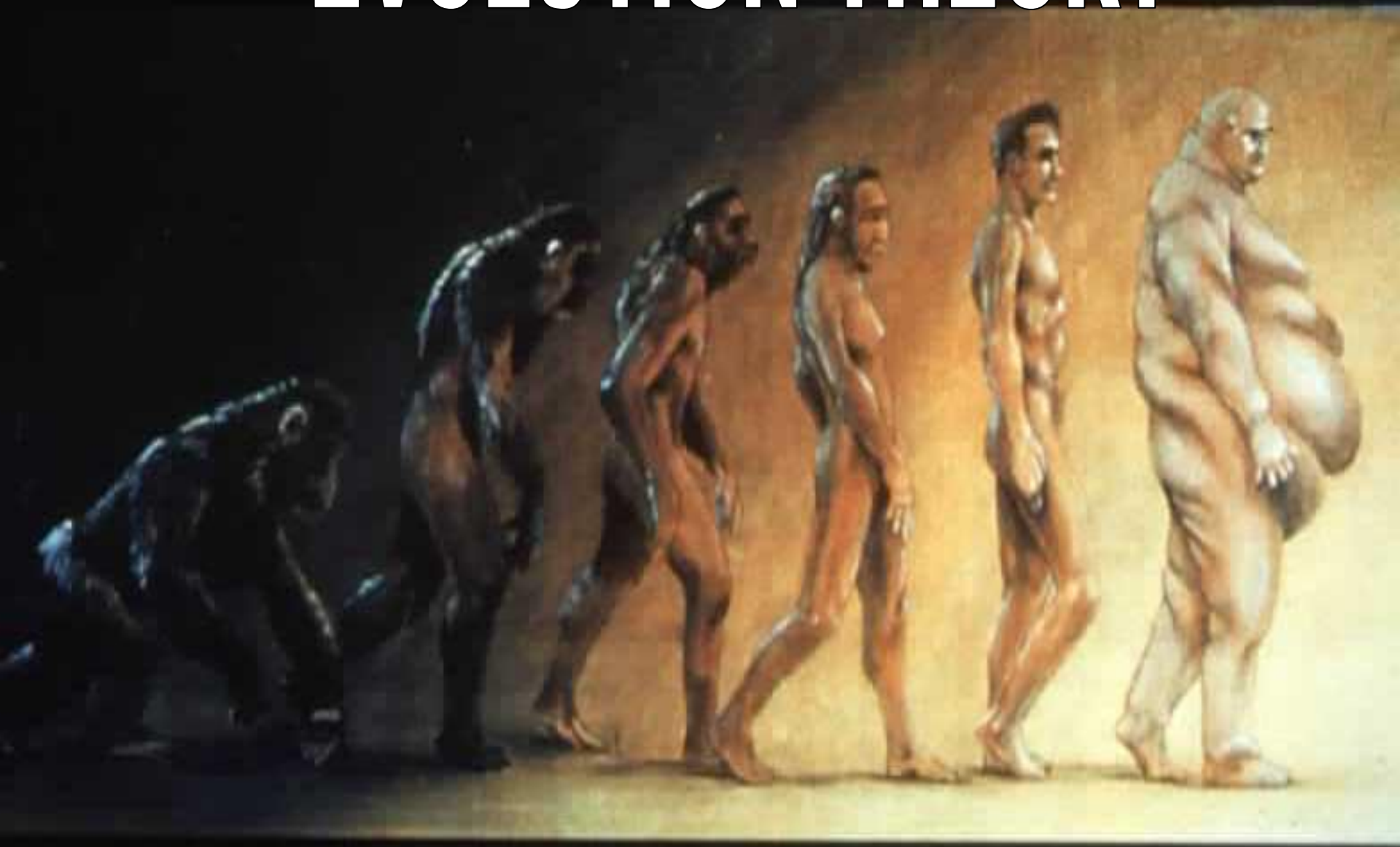


EVOLUTION THEORY

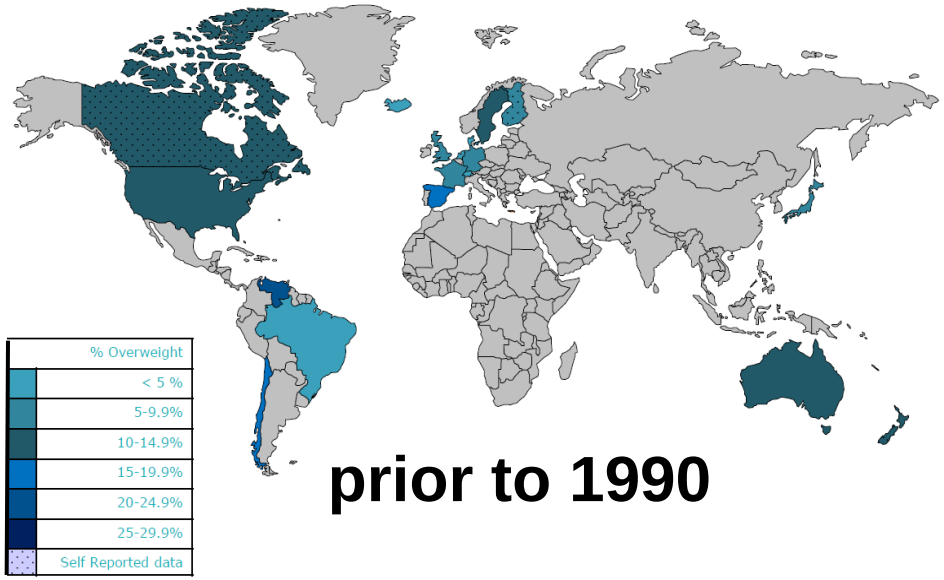


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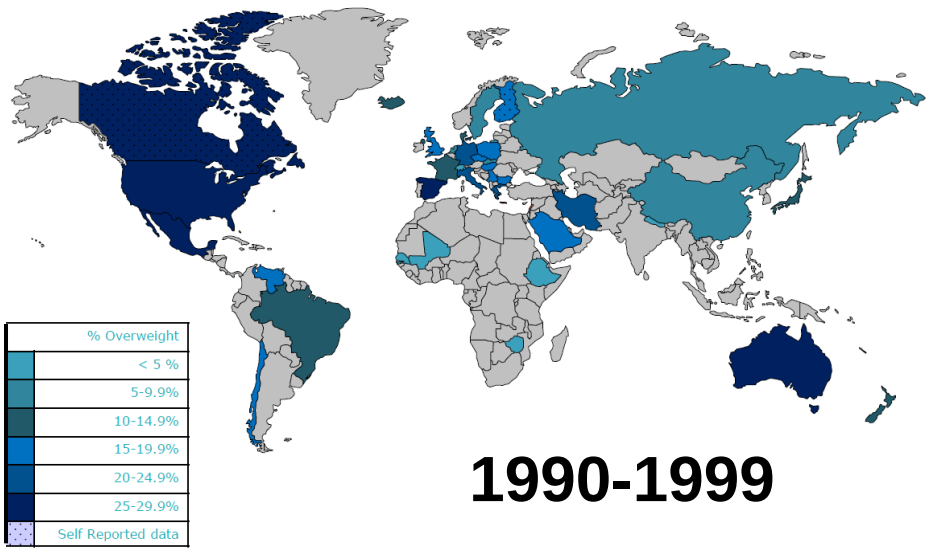
EVOLUTION THEORY



TACKLE OBESITY!!

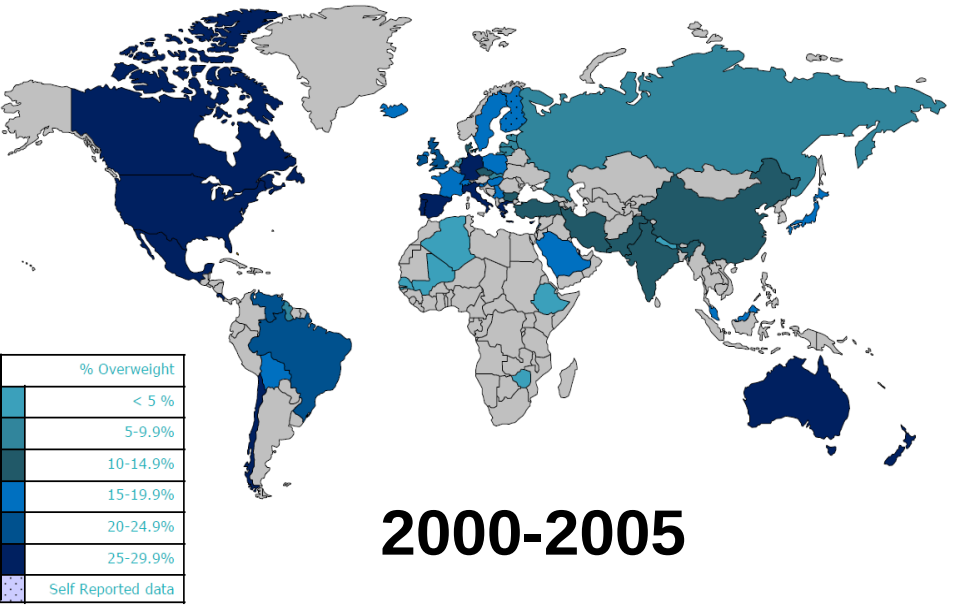


prior to 1990

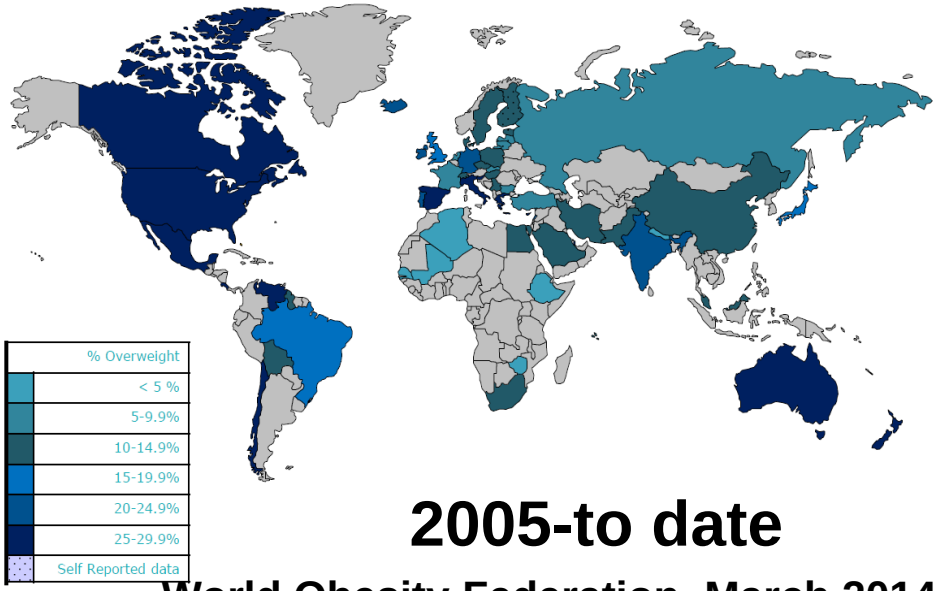


1990-1999

GLOBAL PREVALENCE OF OVERWEIGHT IN BOYS

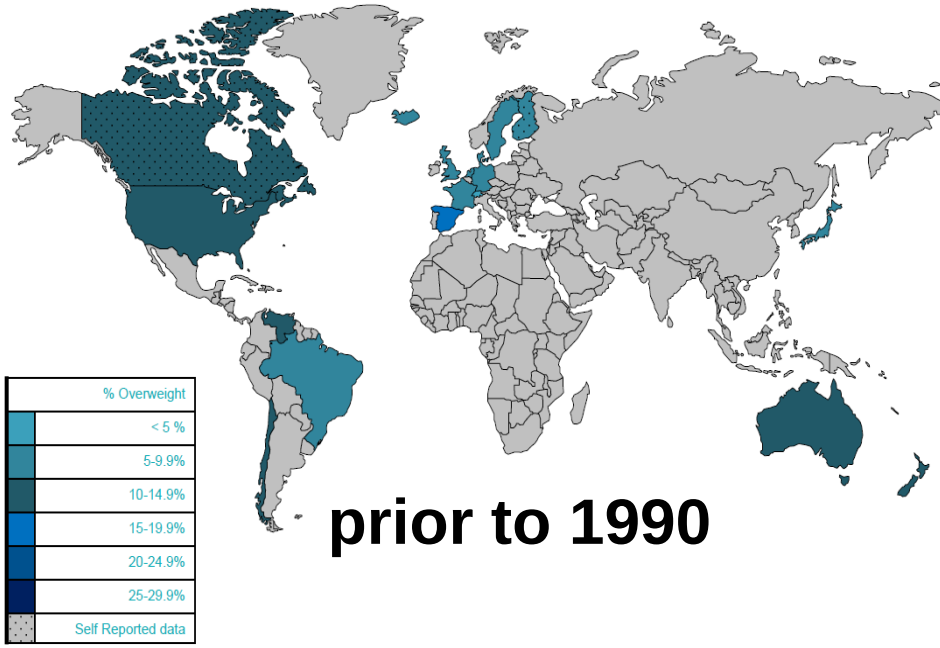


2000-2005

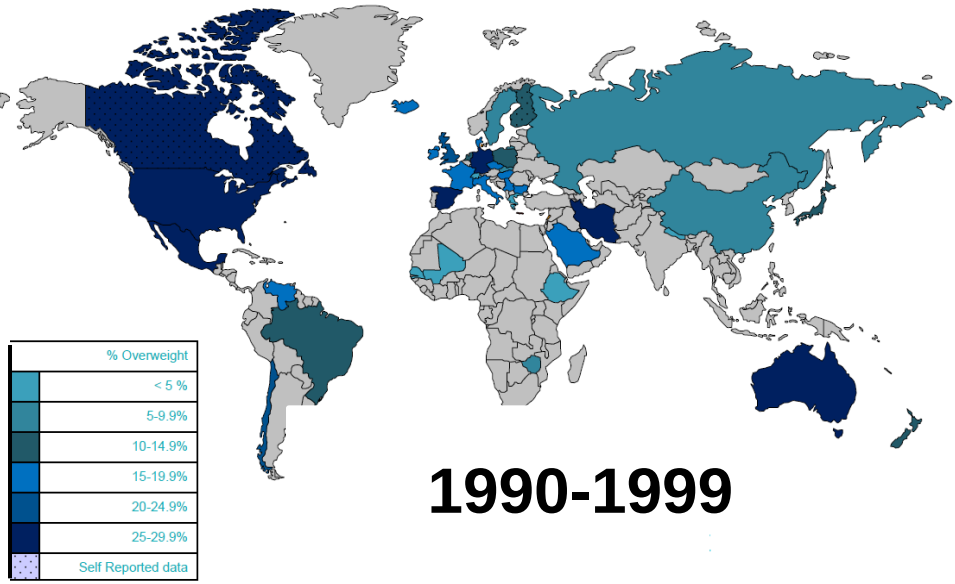


2005-to date

World Obesity Federation, March 2014

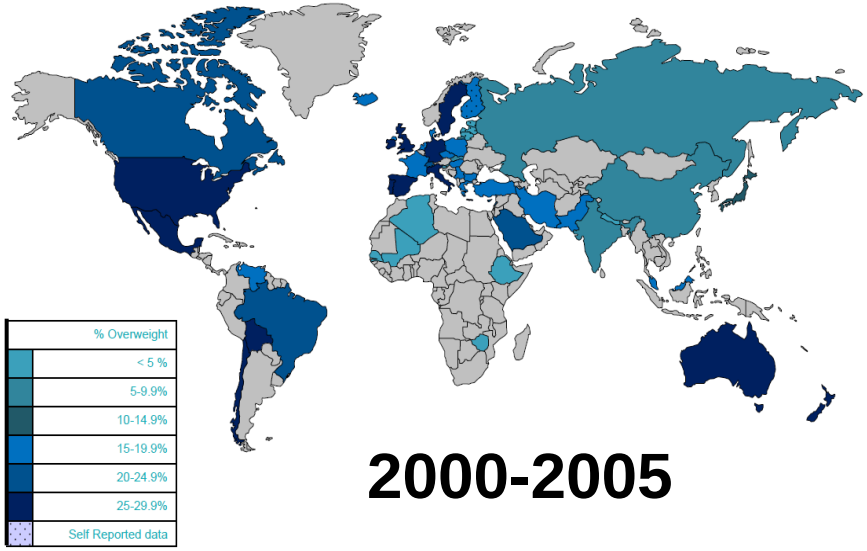


prior to 1990

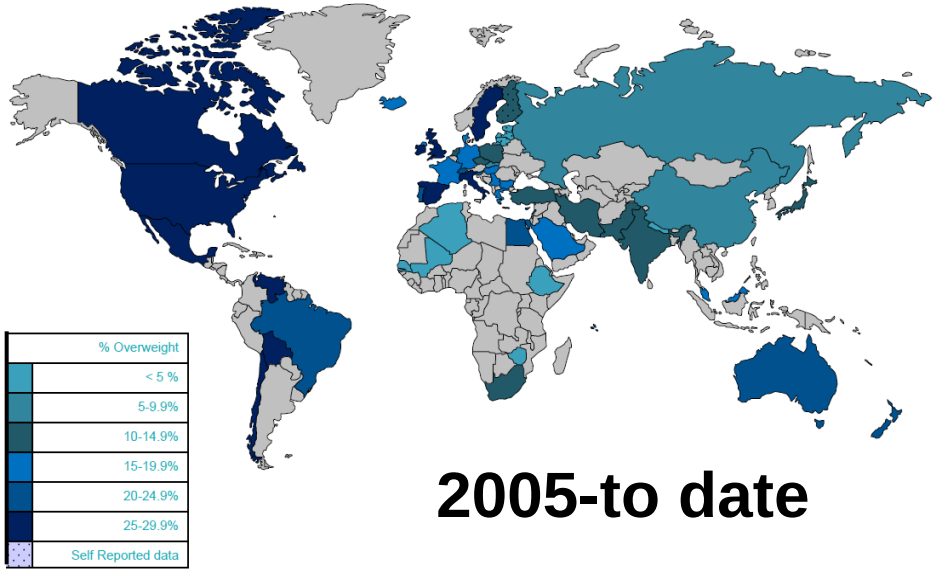


1990-1999

GLOBAL PREVALENCE OF OVERWEIGHT IN GIRLS

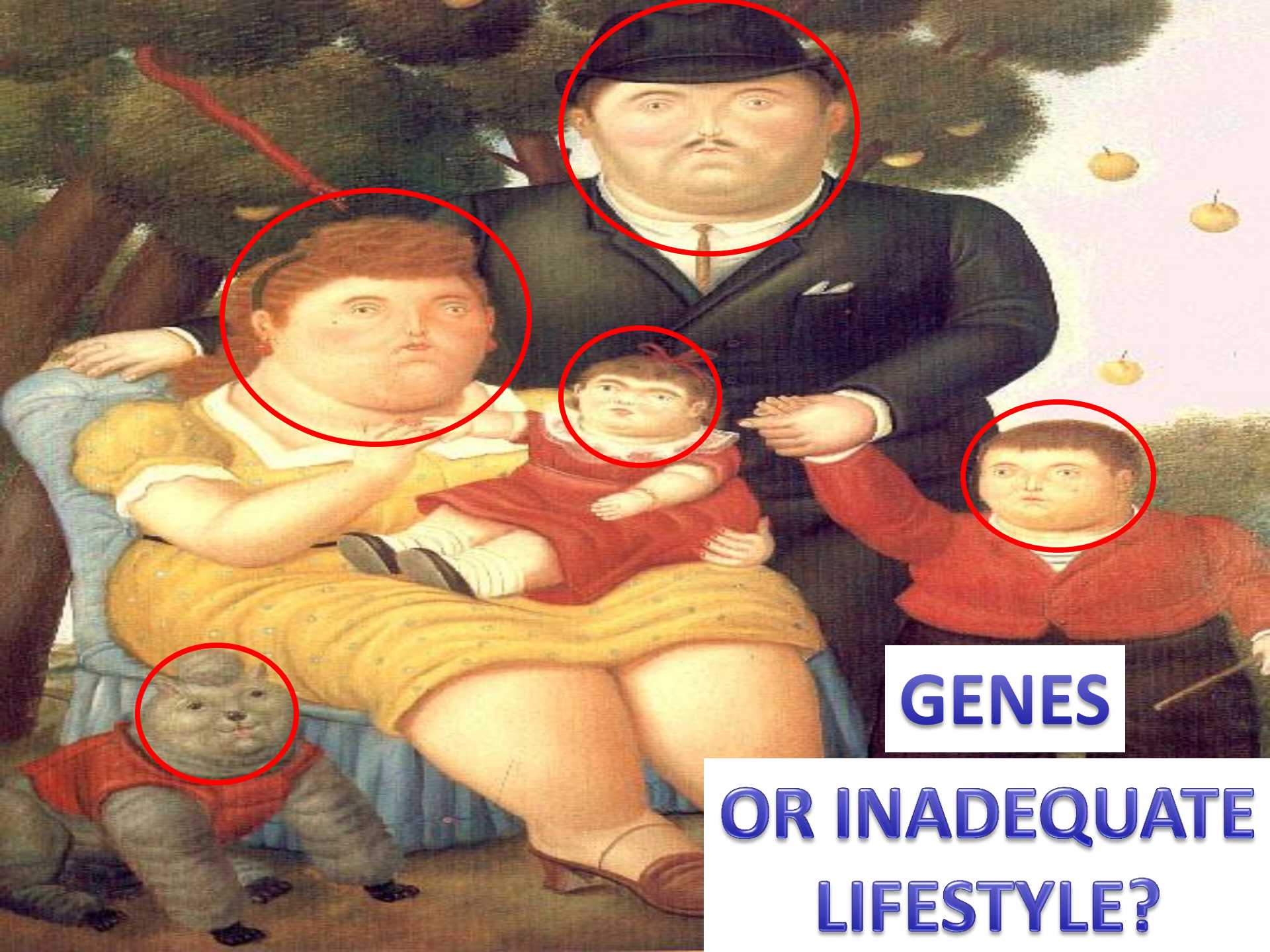


2000-2005



2005-to date

World Obesity Federation, March 2014

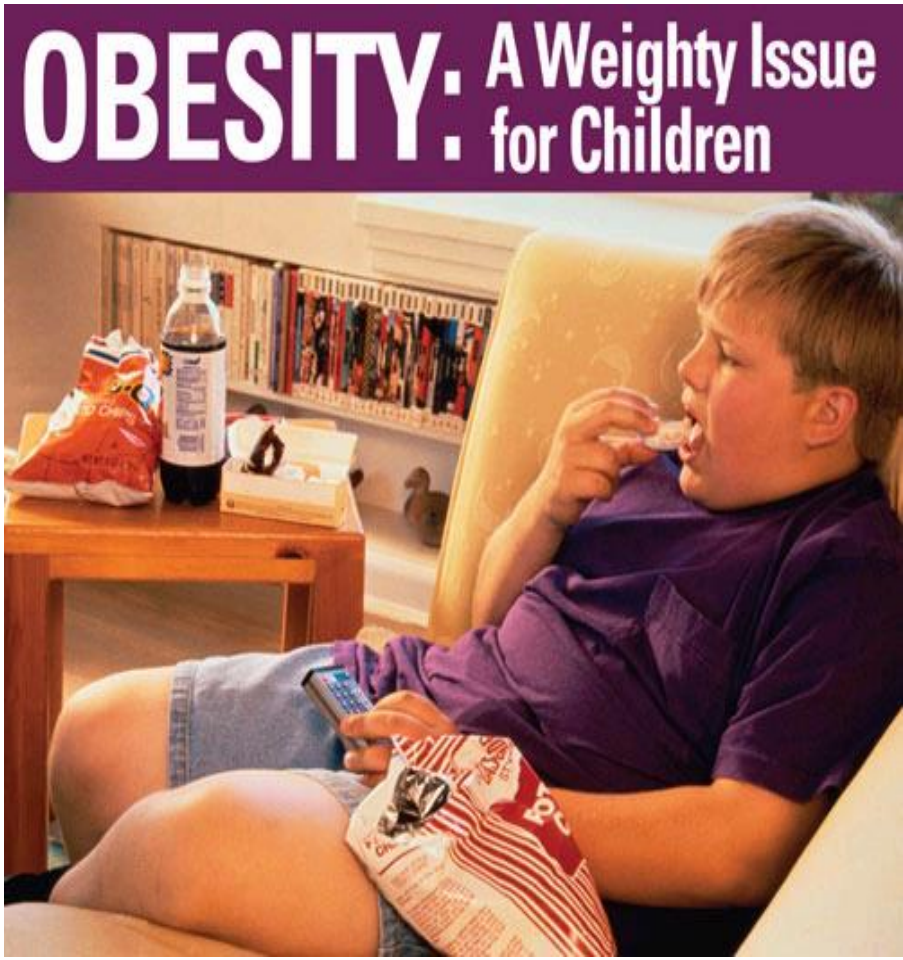

GENES
OR INADEQUATE
LIFESTYLE?

OBESITY EPIDEMIC



LOW PHYSICAL ACTIVITY





TOO MANY CALORIES!

VERY HIGH FOOD INTAKE!

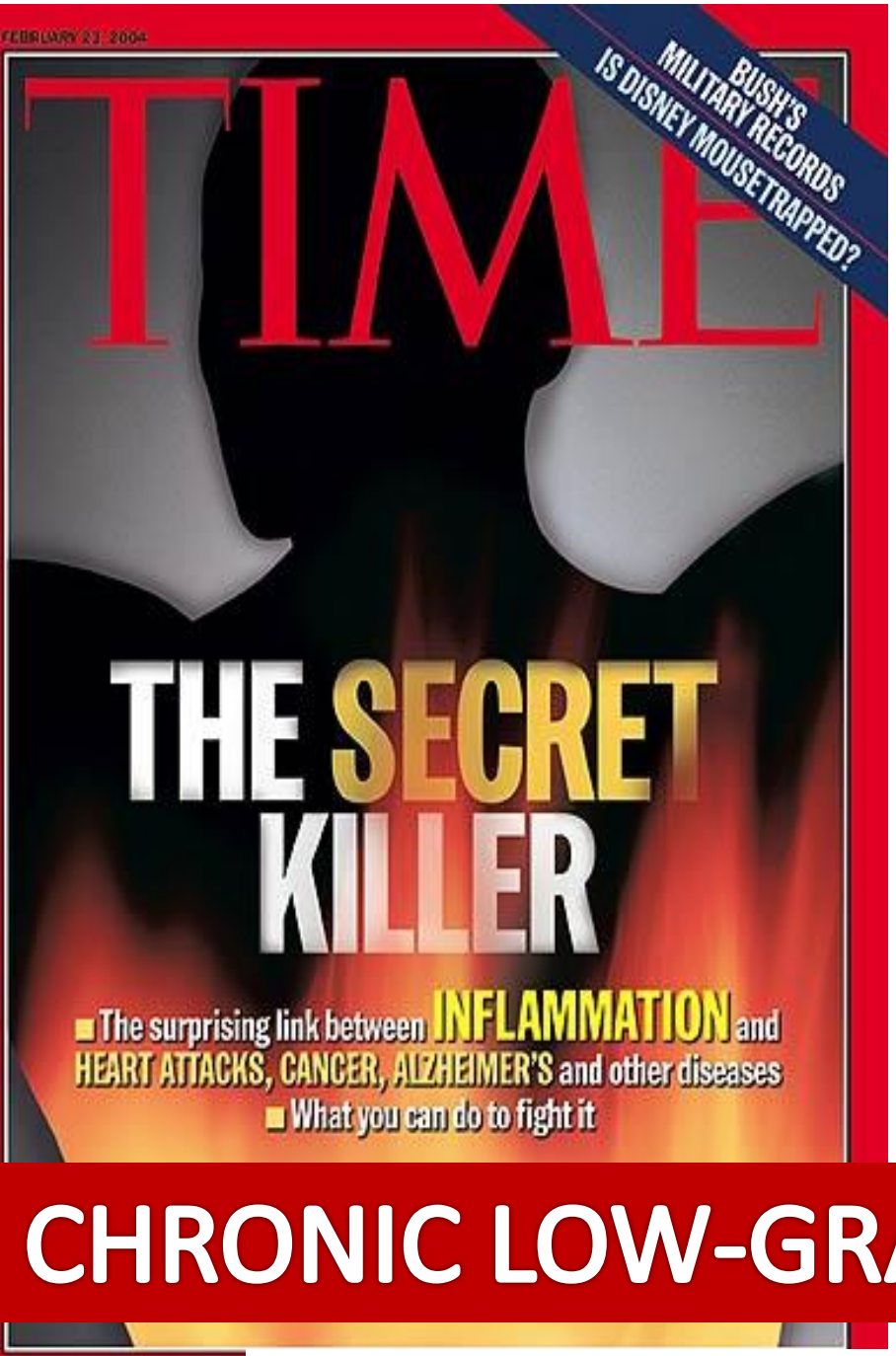
SEDENTARY HABITS





Sedentariness has been considered to be a predictor of chronic diseases, even much more powerful than the recognized classic risk factors such as:

HYPERTENSION, HYPERLIPIDEMIA, DIABETES, OBESITY



INFLAMMATION

INJURY INFECTION

~~The acute phase of inflammation normally leads to recovery from infection to healing, and return to normal values within a few days~~

CHRONIC LOW-GRADE INFLAMMATION

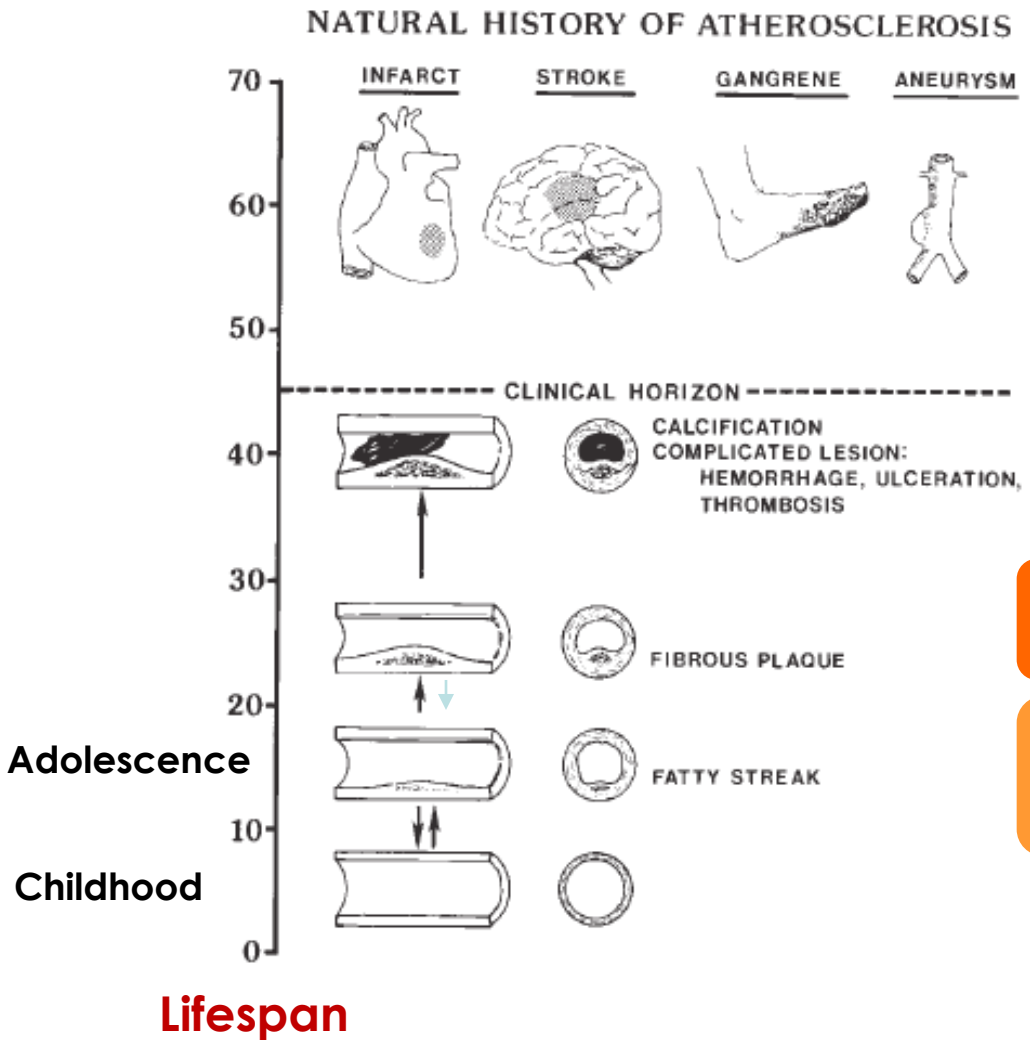
Pérez de Heredia F, Gómez-Martínez S, Marcos A. Proc Nutr Soc. 2012; 71(2):332-8

CHRONIC LOW-GRADE INFLAMMATION



Pérez de Heredia F, Gómez-Martínez S, Marcos A. Proc Nutr Soc. 2012; 71(2):332-8

Atherosclerotic risk – ADOLESCENCE



The presence of early precursors of atherosclerosis and atherosclerotic lesions in early stages (adolescence)

Lipid accumulation and development of fibrous plaque

Fat presence in blood vessels during adolescence is more dangerous

Fat presence in blood vessels during childhood is reversible

Mc Gill HC et al, *Am J Clin Nutr* 2000:72(suppl):1307S-15S

AVENA

Alimentación y valoración del estado nutricional de los adolescentes españoles

Proyecto financiado por el Fondo de Investigaciones Sanitarias (FIS 00/0015)

THE SPANISH EXPERIENCE OF THE AVENA STUDY

Alimentación y Valoración del Estado Nutricional de los Adolescentes

Food and Evaluation of the Nutritional Status of Adolescents

A national multicenter and interdisciplinary study

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Proyecto financiado por el Fondo de Investigaciones Sanitarias (FIS 00/0015)

MULTICENTER STUDY



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U
C

MADRID

- Immunology
- Psychology
- General anamnesis
- Statistics

SANTANDER

- Genetic study

ZARAGOZA

- Body Composition
- Anthropometry

MURCIA

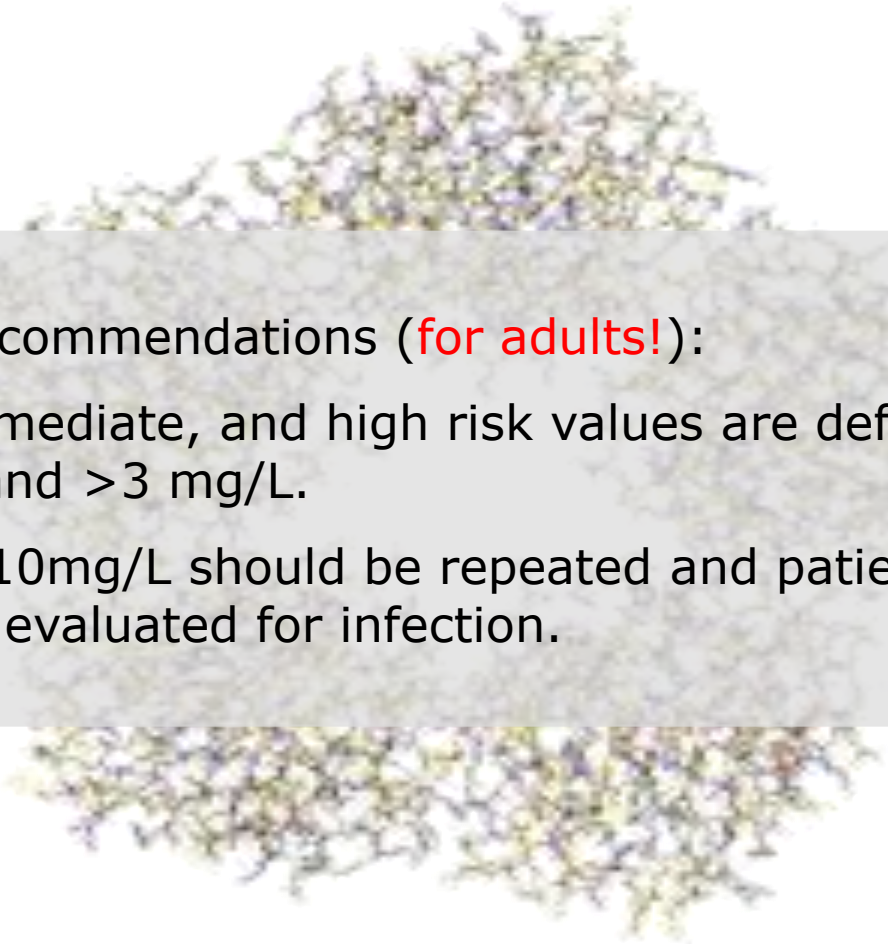
- Diet analysis

GRANADA

- Physical Activity
- Physical fitness
- Biochemical survey

Proyecto financiado por el Fondo de Investigaciones Sanitarias (FIS 00/0015)

C-Reactive Protein



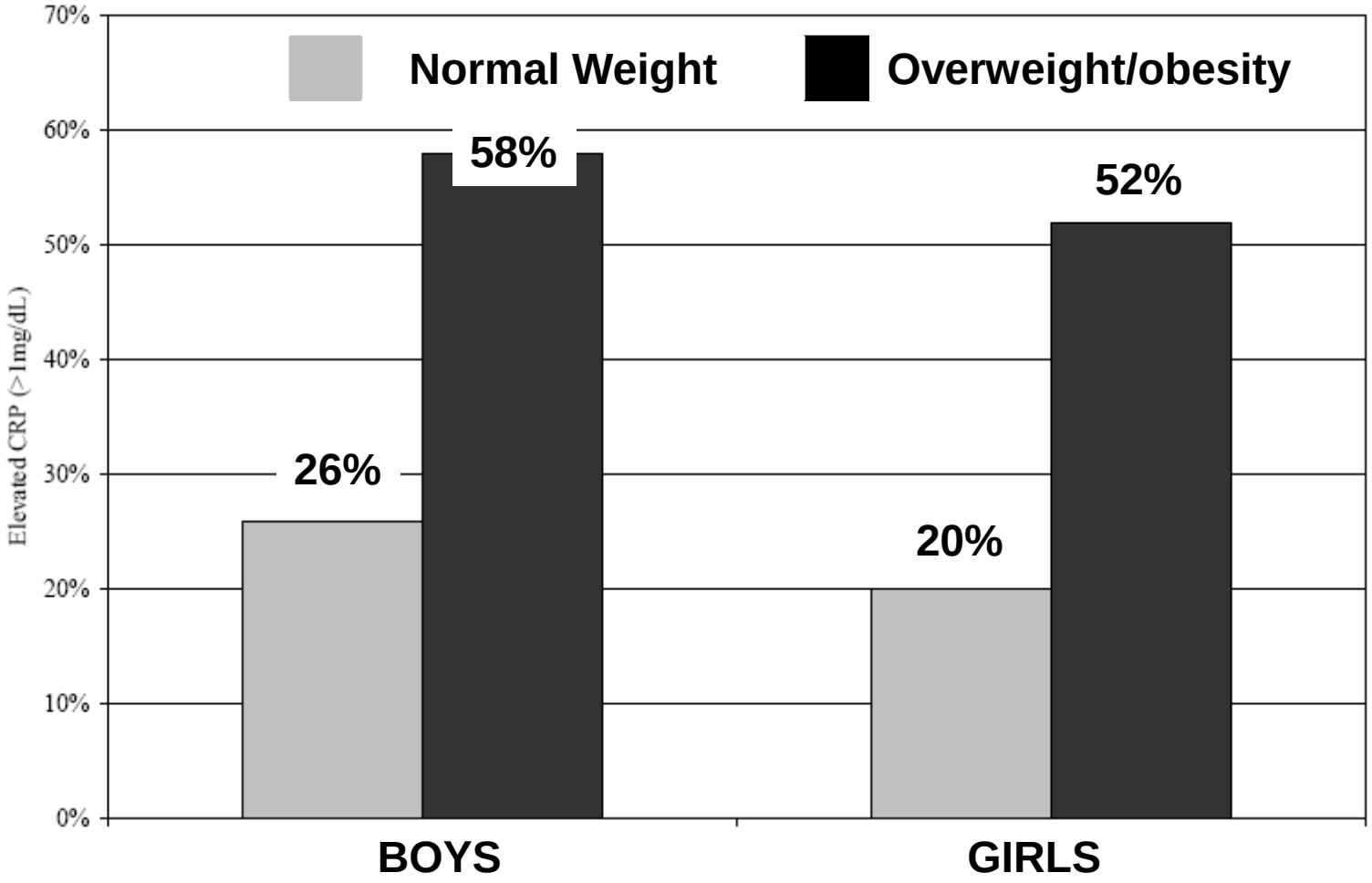
CDC/AHA recommendations (for adults!):

- Low, intermediate, and high risk values are defined as <1, 1-3, and >3 mg/L.
- A value >10mg/L should be repeated and patient should be evaluated for infection.

Pearson T, et al. Circulation 2003; 107:499-511

Proyecto financiado por el Fondo de Investigaciones Sanitarias (FIS 00/0015)

Prevalence of high levels of CRP (>1mg/L)



P < 0.001 between groups and sexes

C-Reactive Protein



78%	< 1	mg/L (low risk)
15%	1 – 3	mg/L (intermediate risk)
7%	> 3	mg/L (high risk)

22% of European adolescents have C-Reactive Protein levels above 1mg/L indicating low-grade inflammation

20 out of 986 (2%) adolescents were excluded for having CRP levels above 10 mg/l

Proyecto financiado por el Fondo de Investigaciones Sanitarias (FIS 00/0015)

Inflammatory proteins are related to total and abdominal adiposity a healthy adolescent population: the AVENA Study[1–3]

Julia Wärnberg, Esther Nova, Luis A Moreno, Javier Romeo, Maria I Mesana, Jonatan R Ruiz, Francisco B Ortega, Michael Sjöström, Manuel Bueno, Ascensión Marcos, and the AVENA Study group

Table 2: Inflammation markers of the studied group of male and female adolescents.

	Males			Females		
	All	*Normal weight*	*Overweight*	*All*	*Normal weight*	*Overweight*
Subjects (n)	*248*	*174*	*74*	*224*	*178*	*46*
CRP (mg/L)*[ab]	1.32 (1.61)	1.17 (1.62)	1.68 (1.55)	0.93 (1.03)	0.83 (0.86)	1.33 (1.47)
C3 (g/L)*[ab]	1.38 (0.25)	1.32 (0.22)	1.51 (0.28)	1.33 (0.24)	1.29 (0.20)	1.50 (0.28)
C4 (g/L)[ab]	0.27 (0.09)	0.25 (0.08)	0.32 (0.10)	0.27 (0.10)	0.26 (0.09)	0.31 (0.11)
Ceruloplasmin (g/L)*[b]	0.20 (0.04)	0.20 (0.04)	0.21 (0.05)	0.22 (0.05)	0.21 (0.05)	0.25 (0.05)
IL-6 (pg/L)	33789 (21567)	32306 (19549)	37264 (25527)	36025 (21542)	35263 (21967)	39137 (19683)
TNF-α (pg/L)	2421 (2177)	2290 (1624)	2724 (3095)	2275 (2337)	2275 (2451)	2276 (1825)

Values are mean (SD). CRP, IL-6 and TNF-a levels are expressed as antlog, C3, C4 and ceruloplasmin are expressed as squared.

* Differences between gender ($P < 0.05$).

[a] Significantly different between male normal weight and overweight/obesity group ($P < 0.01$)

[b] Significantly different between female normal weight and overweight/obesity group ($P < 0.01$)

Am J Clin Nutr 2006;84: 505-512 Printed in USA. © 2006 American Society for Nutrition

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WAIST CIRCUMFERENCE AND INFLAMMATION PROTEINS

Partial correlations between waist circumference and C-reactive protein (CRP), C3, C4, and ceruloplasmin after adjustment for age and Tanner stages and further adjustment for BMI[1]

Dependent variables	Pearson's partial correlation adjusted for age and Tanner stage	*P*	Pearson's partial correlation adjusted for age, Tanner stage, and BMI	*P*
ln CRP				
Males	0.226	0.001	−0.075	0.621
Females	0.220	0.002	−0.002	0.988
Sqrt C3				
Males	0.387	<0.001	0.286	0.042
Females	0.422	<0.001	0.303	0.016
Sqrt C4				
Males	0.315	<0.001	0.130	0.388
Females	0.229	0.001	0.100	0.462
Sqrt ceruloplasmin				
Males	0.019	0.788	−0.056	0.709
Females	0.295	<0.001	0.167	0.210

[1] Sqrt, square root. Sex differences ($P < 0.01$) in coefficients were found for Sqrt ceruloplasmin only.

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Proyecto financiado por el Fondo de Investigaciones Sanitarias (FIS 00/0015)

FITNESS & INFLAMMATION

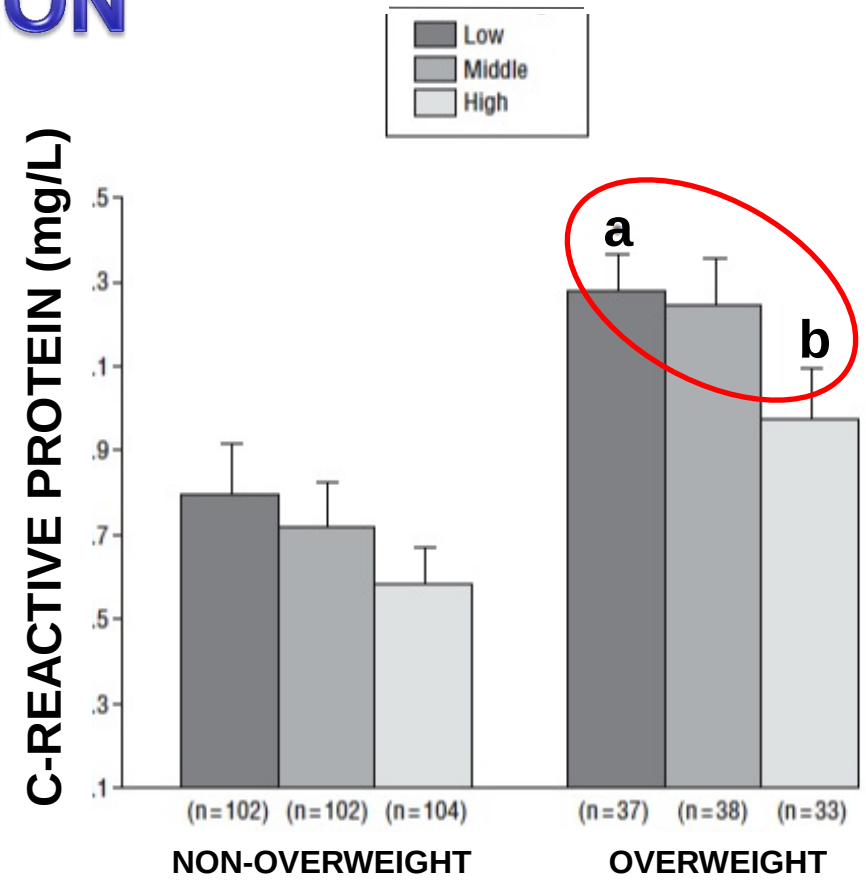
Table 2. Regression Coefficients, SEM, and Standardized Coefficient of Determination Showing the Association Between Inflammatory Proteins and Muscle Strength[a]

Measure	β	SEM	R^2	*P* Value
C-reactive protein	– 0.208	0.077	0.10	.007
Complement factor C3	– 0.115	0.013	0.20	.047
Complement factor C4	– 0.033	0.029	0.06	.26
Ceruloplasmin	– 0.142	0.004	0.10	.03
Prealbumin	0.054	0.090	0.01	.55

[a]Controlling for sex, age, pubertal status, weight, height, socioeconomic status, and cardiorespiratory fitness.

N = 416 ADOLESCENTS

MUSCLE STRENGHT



The higher muscle strenght level, the lower CRP values

Ruiz et al. Arch Pediatr Adolesc Med. 2008

HELENA Healthy Lifestyle in Europe by Nutrition in Adolescence

www.helenastudy.com

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Total n= 1000 adolescents from 10 cities (9 European countries)

CRF

CRF: cardio-respiratory fitness by the 20mSRT

→ **C reactive protein**

Rho = -0.116, p = 0.007

Muscular fitness

Counter movement jump
Abalakov jump
Bent arm hang
Standing broad jump

→ **C reactive protein**

Rho ≈ -0.100, p = 0.010

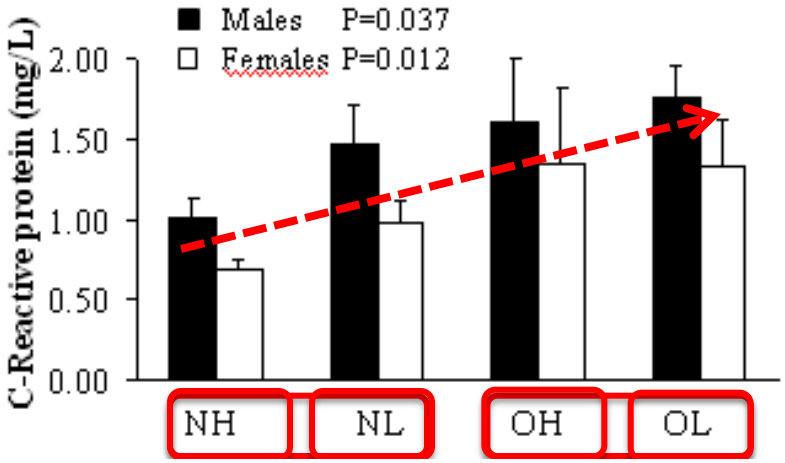
PA (accelerometry)

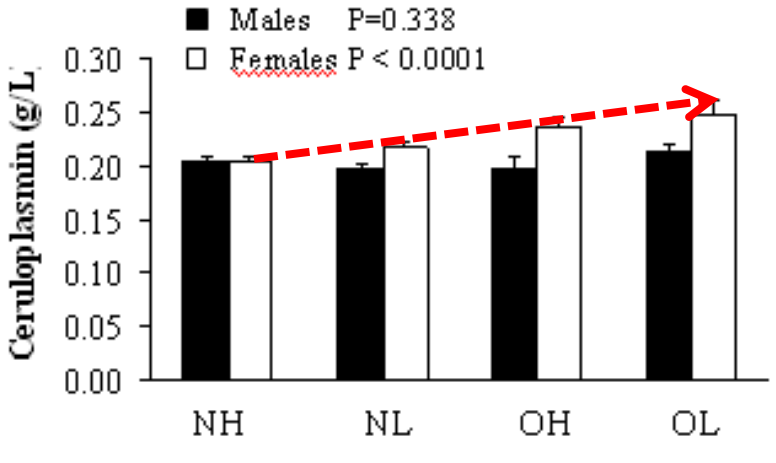
Light
Moderate
Vigorouse
Moderate-to-vigorouse
Total

→ X **C reactive protein**

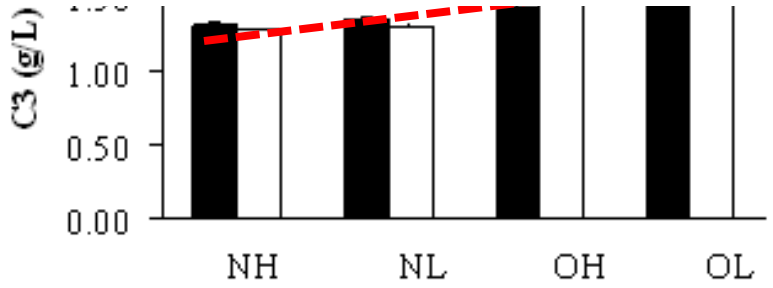
p > 0.05

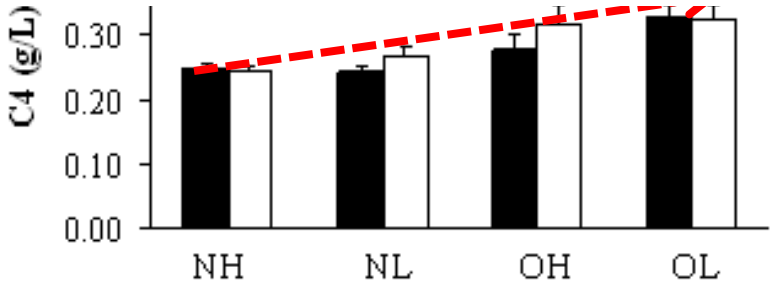
Proyecto financiado por el Fondo de Investigaciones Sanitarias (FIS 00/0015)





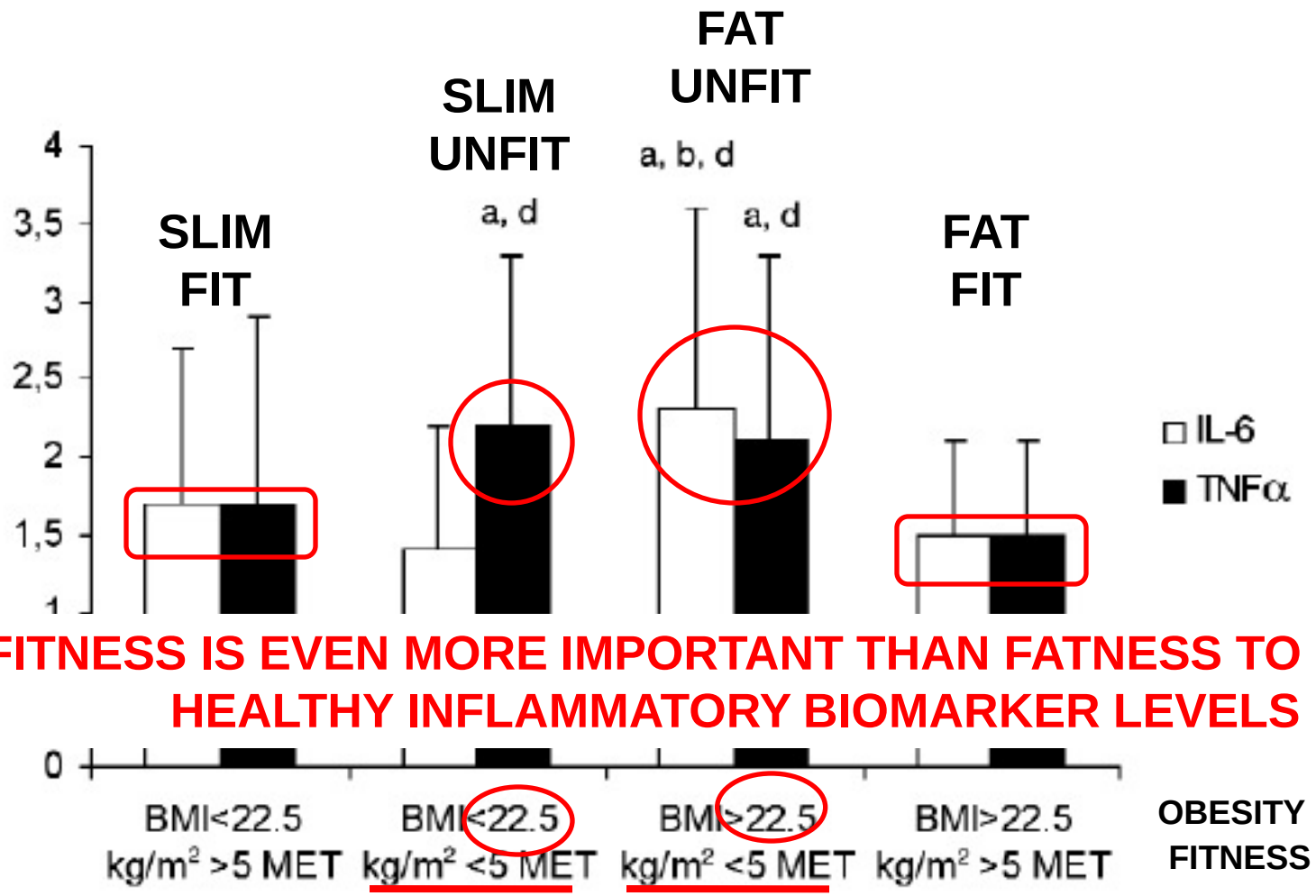
IT'S IMPORTANT TO BE FIT IN ORDER TO MITIGATE THE CONSEQUENCES OF INFLAMMATION DUE TO OBESITY





NH: normal weight-high fitness
NL: normal weight-low fitness
OH: overweight-high fitness
OL: overweight-low fitness

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FITNESS IS EVEN MORE IMPORTANT THAN FATNESS TO REACH HEALTHY INFLAMMATORY BIOMARKER LEVELS

N = 197 children

Halle et al. Exerc Immunol Rev. 2004



Physical activity

Defined as any body movement produced by skeletal muscular action that increases energy expenditure

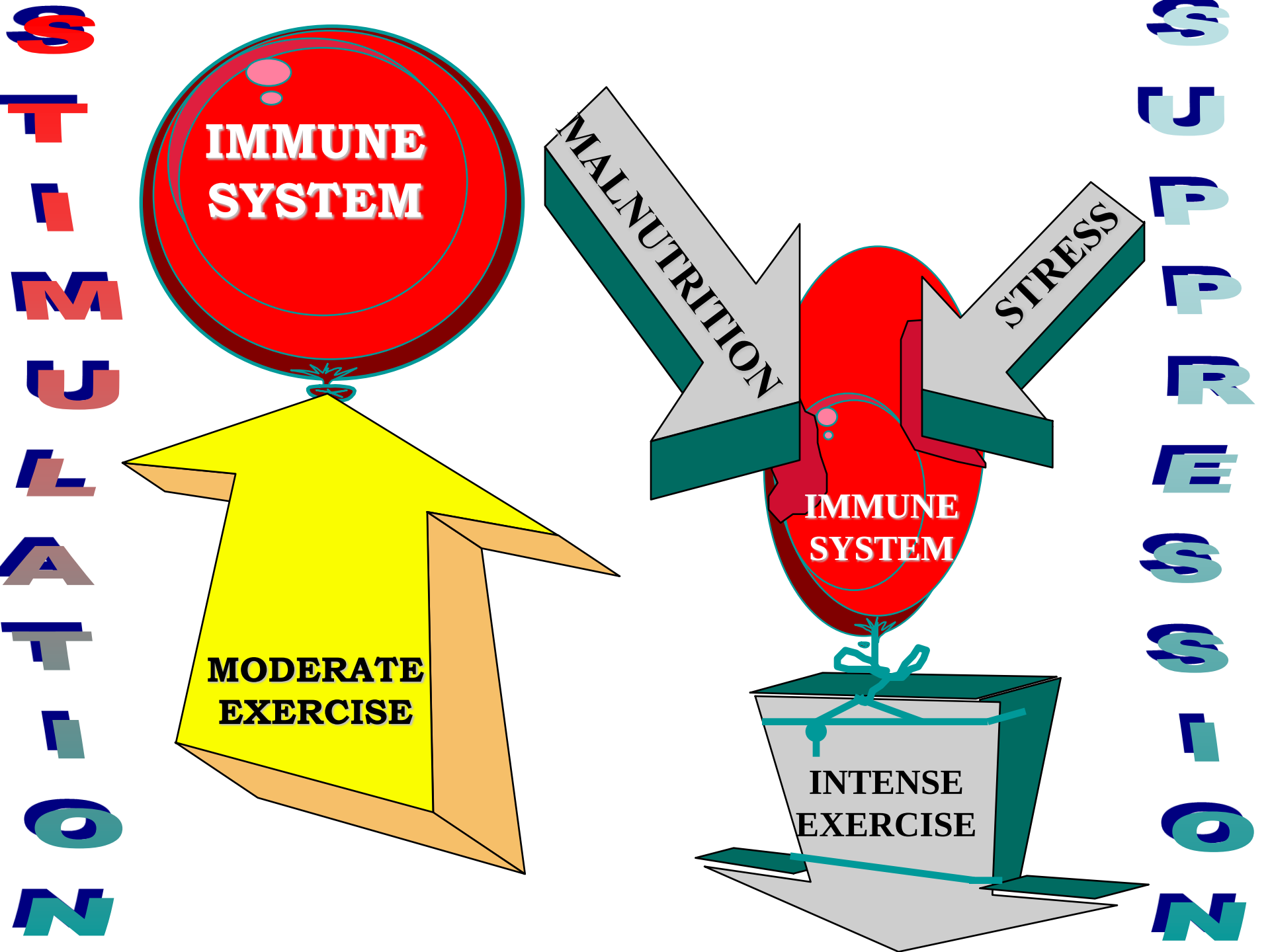


Regular physical activity seems to offer protection against a wide variety of these chronic disease-related risk factors, reducing morbidity and mortality



ANTI-INFLAMMATORY EFFECT

(Dandona P et al, 2004; Pedersen et al. 2006.)


STIMULATION
IMMUNE SYSTEM
MODERATE EXERCISE
MALNUTRITION
STRESS
IMMUNE SYSTEM
INTENSE EXERCISE
SUPPRESSION

Acute exercise



Plasma IL-6 levels

Exercise intensity
Exercise duration
The mass of muscle recruited
Endurance capacity

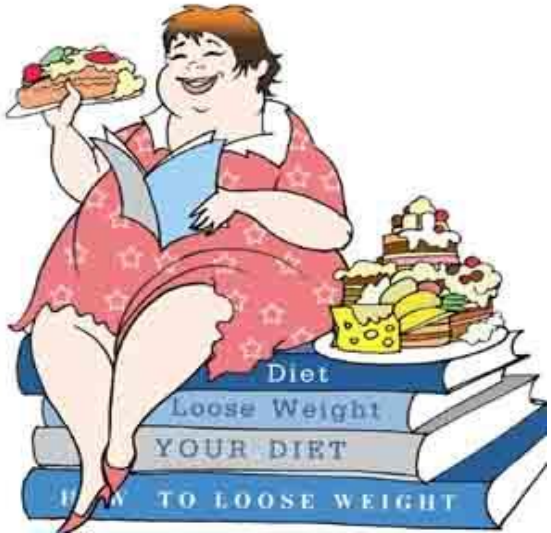
Skeletal muscle



During heavy exercise
up to **60-fold** increase in plasma IL-6 levels!

IL-6 show a markedly lower response to acute exercise in trained subjects

Untrained subjects



IL-6 and CRP

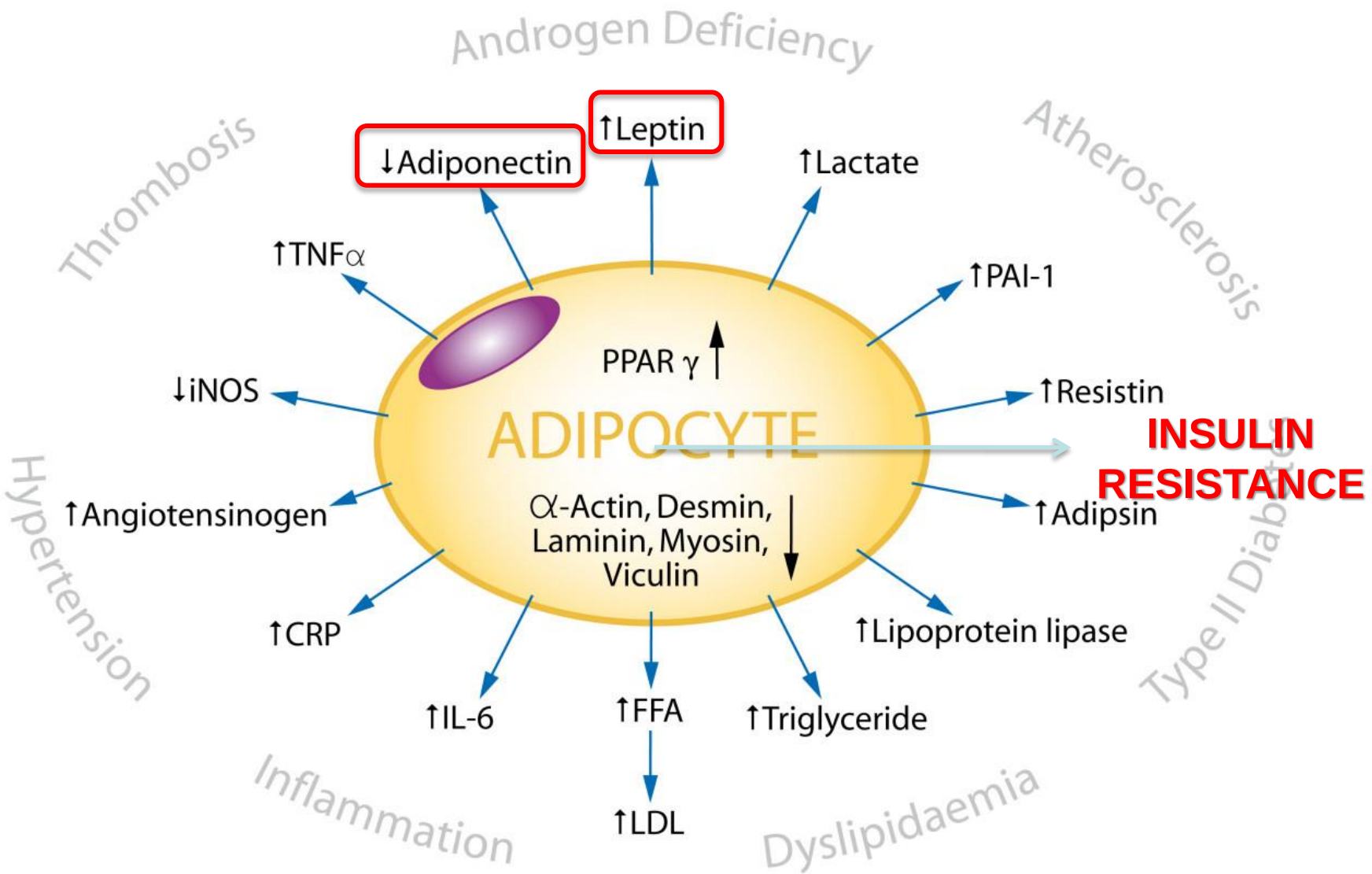
Anti-inflammatory cytokines
(IL-1ra and IL-10)

Pro-inflammatory cytokines
(TNF-α)

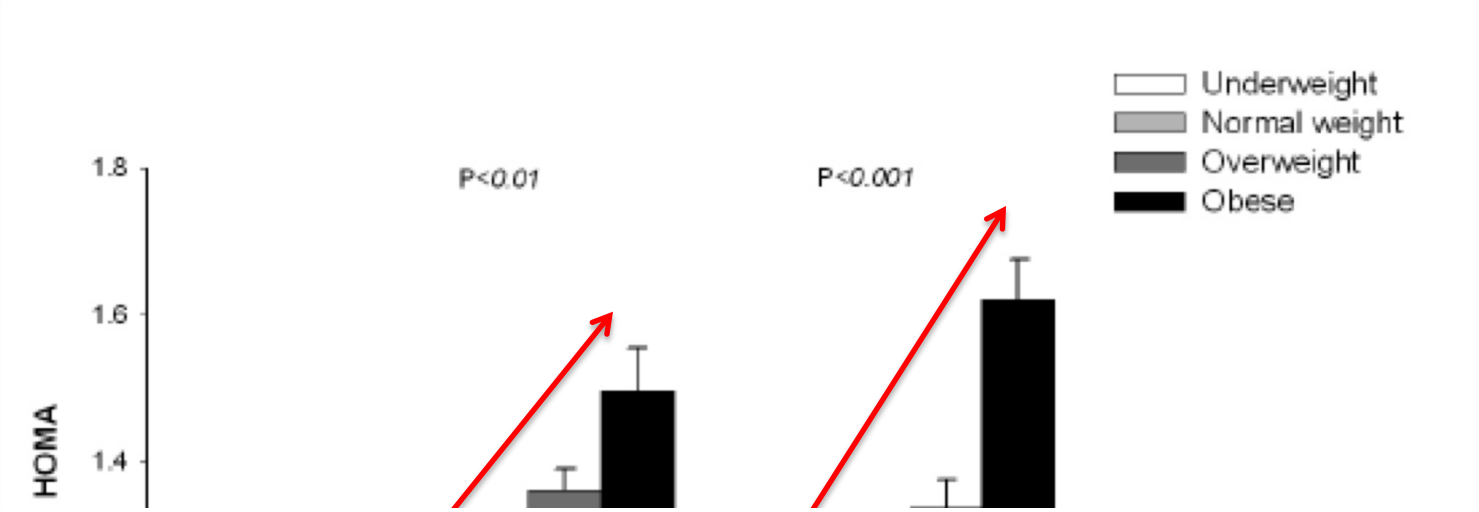
CRP

INFLAMMATION

THE METABOLIC AND CLINICAL EFFECTS OF ADIPOCYTE ACTIVITY



Healthy Lifestyle in Europe by Nutrition in Adolescence

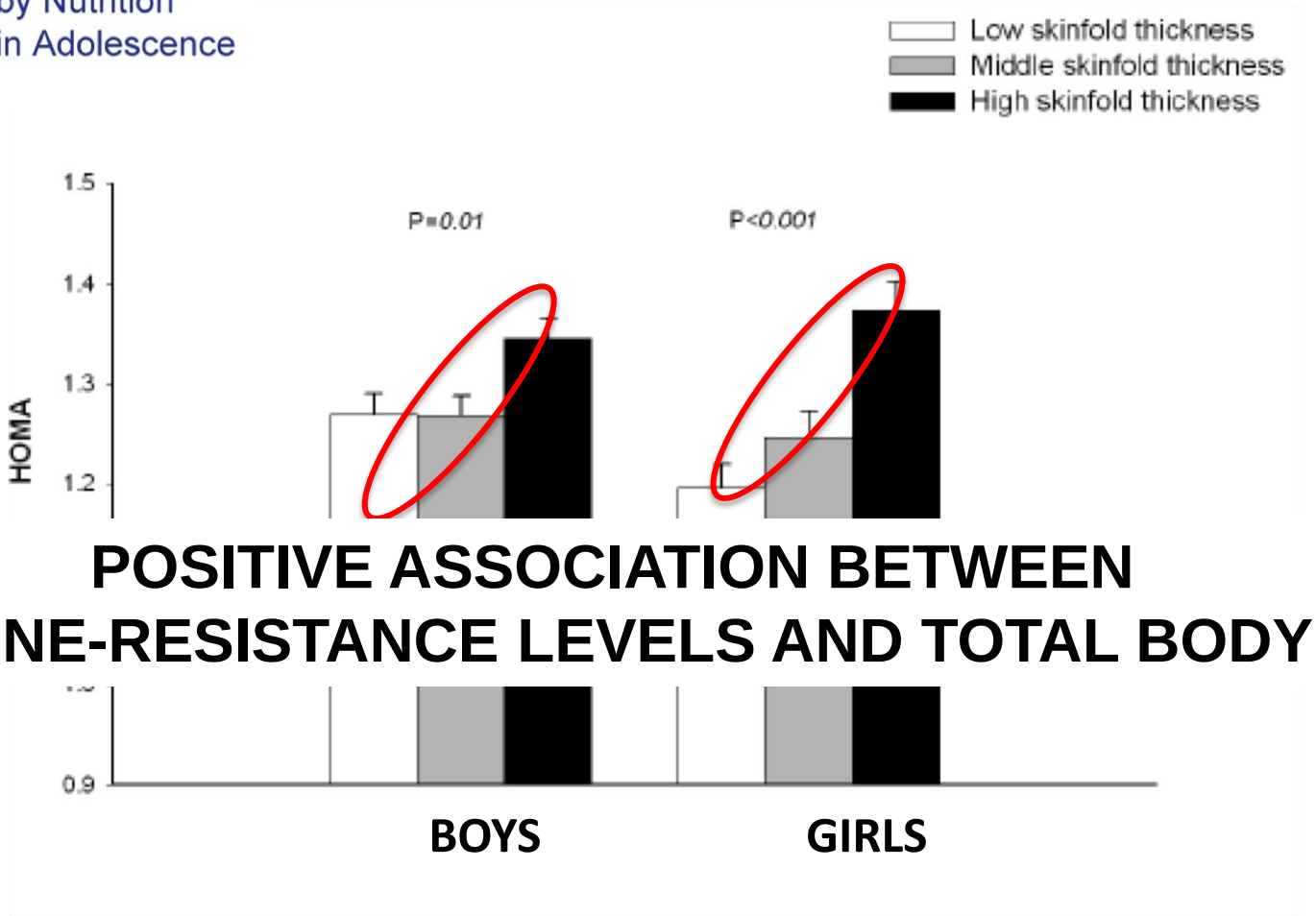


ASSOCIATION BETWEEN INSULIN RESISTANCE AND WEIGHT STATUS



Jimenez-Pavon et al. Fitness and fatness are independently associated with markers of insulin resistance in European adolescents; The HELENA Study. Submitted.

Healthy Lifestyle in Europe by Nutrition in Adolescence

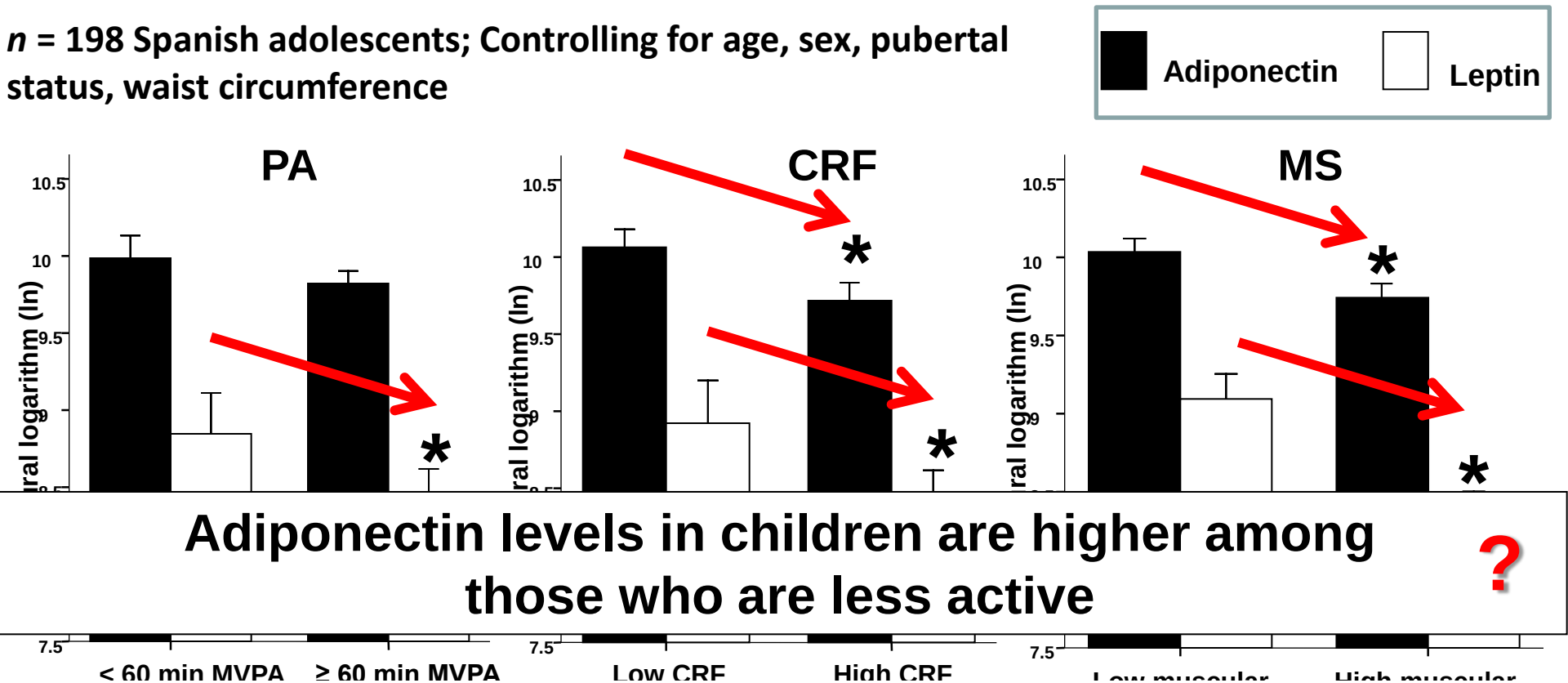


POSITIVE ASSOCIATION BETWEEN INSULINE-RESISTANCE LEVELS AND TOTAL BODY FAT

Jimenez-Pavon et al. Fitness and fatness are independently associated with markers of insulin resistance in European adolescents; The HELENA Study. Submitted.

PA: physical activity by accelerometer
CRF: cardiorespiratory fitness by the 20m shuttle run test
MS: muscular strength by handgrip strength the standing broad jump tests

n = 198 Spanish adolescents; Controlling for age, sex, pubertal status, waist circumference

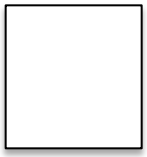


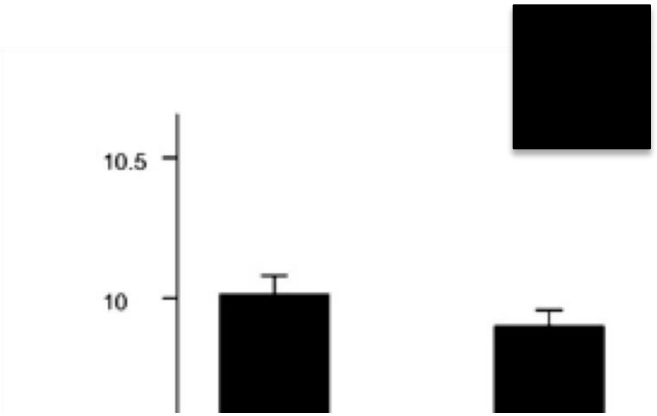
Adiponectin levels in children are higher among those who are less active ?

This outcome may be consistent with previous hypothesis related to the insulin sensitivity variability with regard to PA

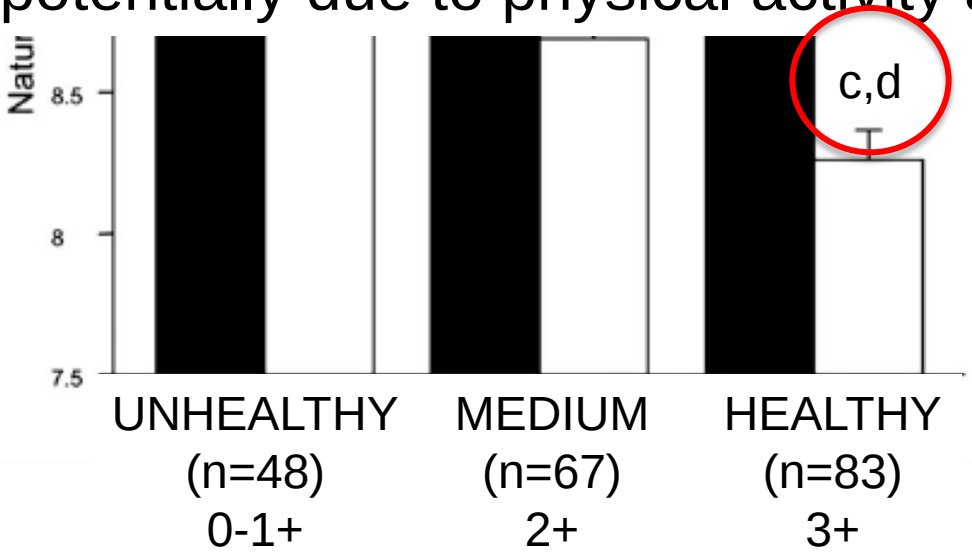
Martinez-Gomez D, Eisenmann JC, Gomez-Martinez S, Veses A, Romeo J, Veiga OL, Marcos A. Associations of physical activity and fitness with adipocytokines in adolescents: The AFINOS study. Nutr Metab Cardiovasc Dis.2010.

LEPTIN AND ADIPONECTIN



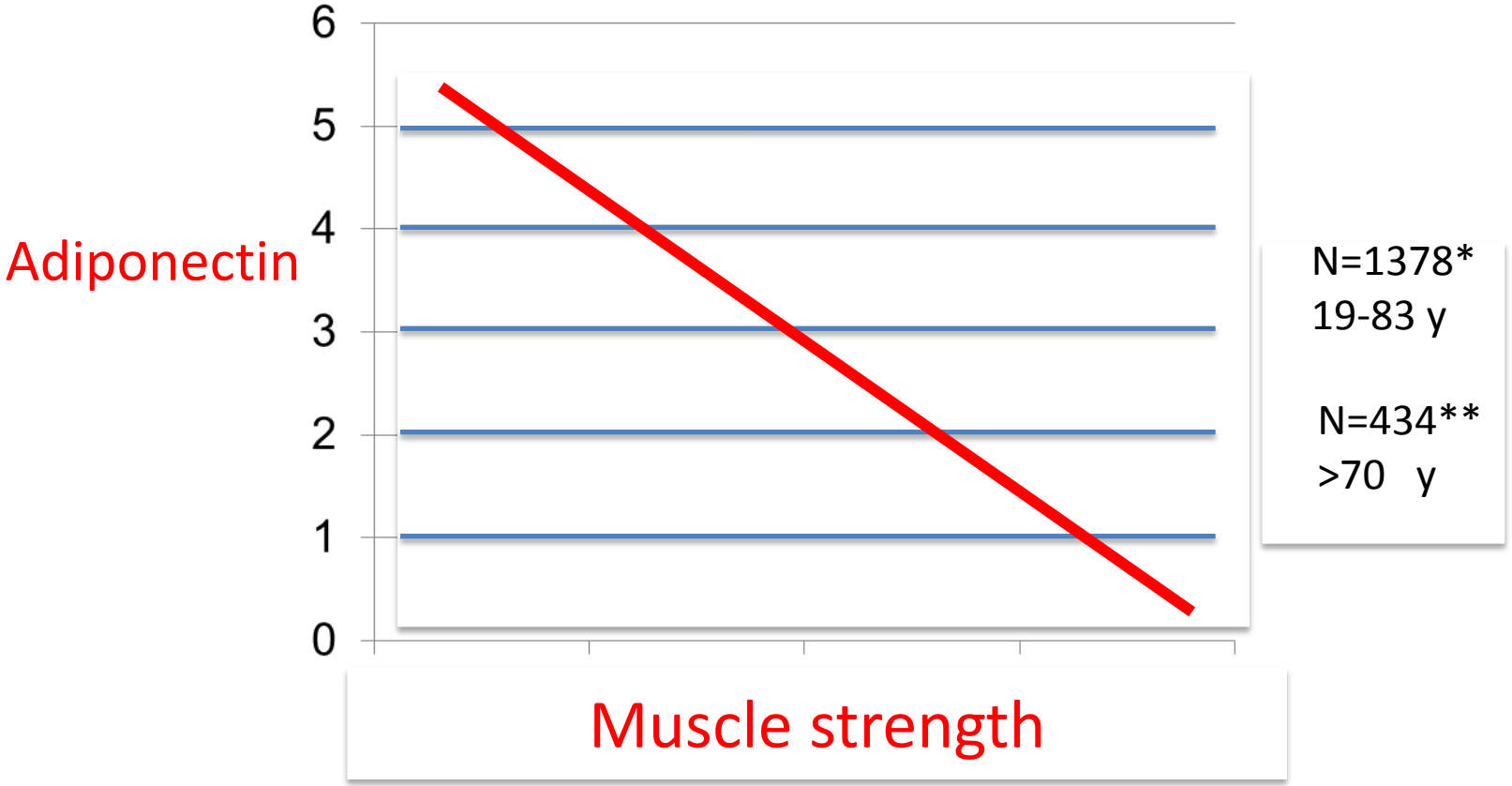


This outcome suggests that adiponectin secretion may be inhibited in those adolescents with enough insulin sensitivity, potentially due to physical activity and fitness



Martinez-Gomez et al., NMCD 2010

Inverse association between circulating adiponectin levels and skeletal muscle strength in Japanese men and women



**Huang et al., NMCD 2015; 25: 594-601

*Huang et al., NMCD 2014; 24: 42-9

Table 3 Partial correlations between PA, fitness, fatness and insulin resistance and low-grade inflammatory markers in adolescents ($n = 192$)

	Glucose	*Insulin*	*HOMA-IR*	*CRP*	*IL-6*	*C3*	*C4*
Total PA (c.p.m.)[a]	−0.048	−0.037	−0.043	0.036	0.002	−0.005	0.044
Moderate PA (min day^{-1})	0.043	0.038	0.042	0.075	0.029	0.118	0.104
Vigorous PA (min day^{-1})[b]	−0.042	−0.043	−0.047	−0.060	−0.061	−0.142	−0.084
MVPA (min day^{-1})[a]	0.012	0.019	0.021	0.016	−0.018	0.051	0.078
CRF (laps)[a]	−0.125	−0.151*	−0.158*	−0.148*	0.019	−0.323***	−0.250***
Body mass index (kg m^{-2})[a]	0.123	0.162*	0.173*	0.250***	−0.014	0.454***	0.337***
Sum of six skinfolds (mm)[a]	0.214**	0.190**	0.211**	0.236***	0.050	0.474***	0.404***
Waist circumference (cm)[a]	0.129	0.186*	0.197**	0.301***	0.031	0.467***	0.318***
Glucose (mmol l^{-1})	—	0.207**	0.353***	0.100	−0.031	0.277***	0.257***
Insulin (mU dl^{-1})[a]		—	0.988***	0.049	0.124	0.126	0.103
HOMA-IR			—	0.063	0.112	0.165*	0.139
C-reactive protein (mg l^{-1})[a]				—	0.179*	0.379***	0.331***
Interleukin-6 (pg ml^{-1})[b]					—	0.035	0.012
C3 (g l^{-1})[b]						—	0.635***
C4 (g l^{-1})[b]							—

Abbreviations: BMI, body mass index; CRF, cardiorespiratory fitness; CRP,C-reactive protein; HOMA-IR, homeostasis model assessment of insulin resistance; IL, interleukin; MVPA, moderate-to-vigorous PA; PA, physical activity. Data were adjusted for age, sex and pubertal status. [a]Values were natural log-transformed before analysis. [b]Values were square-root-transformed before analysis. *$P<0.05$, **$P<0.01$, ***$P<0.001$.

Association between HOMA and markers of obesity, fitness and C3 but NOT with physical activity (measured by accelerometry)

Martinez-Gomez D, Eisenmann JC, Wärnberg J, Gomez-Martinez S, Veses A, Veiga OL, Marcos A. Associations of physical activity, cardiorespiratory fitness and fatness with low-grade inflammation in adolescents: the AFINOS Study. Int J Obes (Lond). 2010 Jun 8. [Epub ahead of print]

Table 2 Partial correlations, controlling for age, sex and pubertal status, between body fat measures, insulin resistance markers and adipocytokines (n = 198).

	BMI [a]	% BF [a]	WC [a]	Glucose	Insulin [a]	HOMA	Adiponectin [a]	Leptin [a]
Weight (kg)	0.880***	0.717***	0.792***	0.075	0.130	0.135	−0.159*	0.560***
Body mass index (kg/m^2) [a]	—	0.709***	0.799***	0.129	0.142*	0.155*	−0.196*	0.579***
Body fat (%) [a]		—	0.610***	0.108	0.148*	0.157*	−0.173*	0.495***
Waist circumference (cm) [a]			—	0.114	0.144*	0.154*	−0.256***	0.615***
Glucose (mmol/l)				—	0.217**	0.358***	0.101	0.159*
Insulin (mU/dl) [a]					—	0.846***	−0.020	0.224**
HOMA						—	−0.004	0.237**
Adiponectin (μg/ml) [a]							—	−0.092
Leptin (ng/ml) [a]								—

*$P < 0.05$.
**$P < 0.01$.
***$P < 0.001$, denotes statistical significance.
[a] Values were natural log-transformed before analysis.
[b] Values were square rooted transformed before analysis.

Adiponectin: association with body fat mass but NOT with HOMA or leptin

Leptin: association with body fat mass and HOMA but NOT with adiponectin

Martinez-Gomez D, Eisenmann JC, Gomez-Martinez S, Veses A, Romeo J, Veiga OL, Marcos A. Associations of physical activity and fitness with adipocytokines in adolescents: The AFINOS study. Nutr Metab Cardiovasc Dis.2010

VITAMIN D DEFICIENCY AMONG 42 OBESE CHILDREN AND ADOLESCENTS 5-18 YEARS

	NVD (25OHD > 30 ng/mL)	VDD (25OHD <15 ng/mL)
M/F	8/16	10/8
PP/P	12/12	8/10
25OHD (ng/dl)	37.0±1.1	11.0±0.5****
BMI (Kg/m2)	25.6±0.7	28.3±1.3*
BMISDS	1.804±0.100	2.094±0.130***
W/H	0.59±0.01	0.62±0.10
SBP (mmHg)	121.4±3.3	122.5±3.1
DBP (mmHg)	79.7±2.1	85.2±2.6***
Glc0′ (mg/dl)	85.2±1.8	89.1±1.5**
Ins0′(mUI/l)	13.9±1.2	14.6±2.1
HOMA	2.9±0.2	3.2±0.5**
Matsuda index	4.44±0.67	3.47±0.28**
Adiponectin (AU)	8594.6±578.2	7189.1±383.6***

AU: arbitrary unit; BMI: body mass index; DBP: diastolic blood pressure; F: female; Glc0′: fasting glucose; HOMA: homeostatic model assessment; Ins0′: fasting insulin; M: male; PP: prepubertal: P: pubertal; SBP: systolic blood pressure: * $p = 0.06$; ** $p < 0.05$; *** $p < 0.03$; **** $p < 0.0001$.

*NVD = vitamin D sufficiency; VDD = vitamin D deficiency

Walker, et al. PLoS One. 2014; 9(1):e83685. doi: 10.1371/journal.pone.0083685.





Development, implementation and evaluation of the efficacy of a therapeutic programme for adolescents with overweight and obesity: A comprehensive intervention for education on nutrition and physical activity with the collaboration of psychologists and psychiatrics



MAY, 2007

EVASYON



AUGUST, 2010

Clinical characteristics at baseline and after a weight loss intervention in overweight/obese adolescents

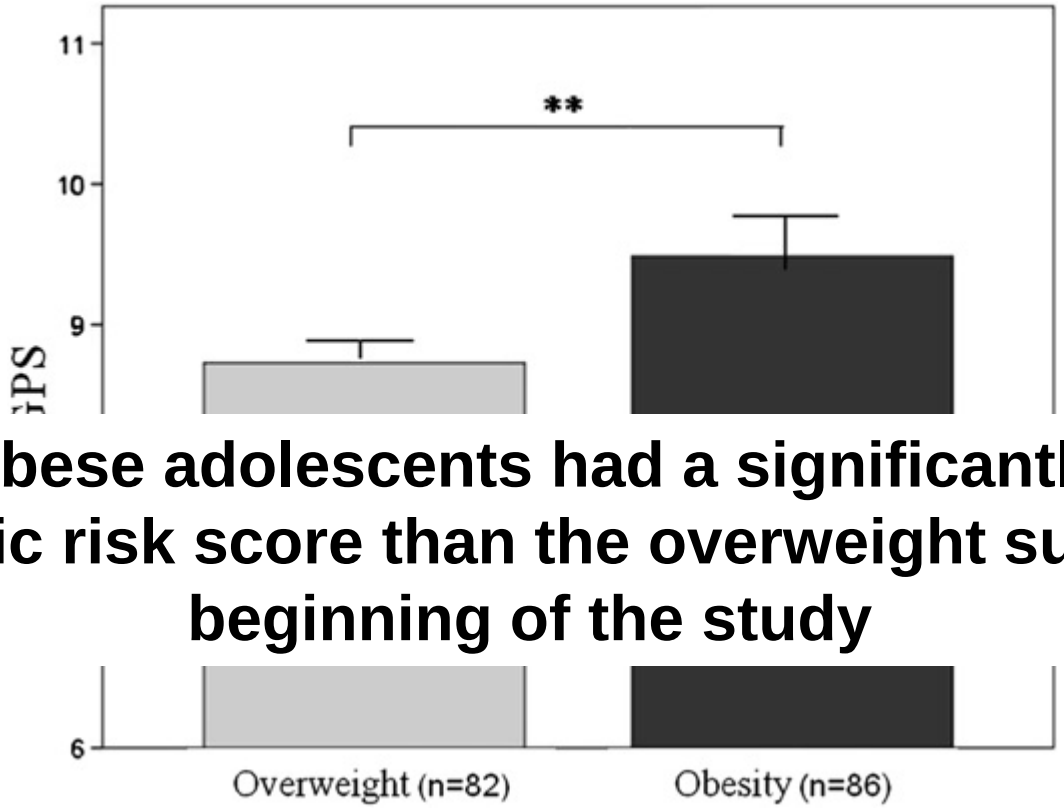
Characteristic	High responders, $n = 12$		Low responders, $n = 12$		P
	Baseline	After 10 wk	Baseline	After 10 wk	
Gender (% males)	58%, $n = 7$		25%, $n = 3$		0.106
Weight (kg)	92.7 ± 4.1	83.3 ± 3.7***	80.1 ± 4.7	80.3 ± 4.7	0.000
BMI-SDS	5.5 ± 0.3	4.0 ± 0.3***	4.2 ± 0.6	4.1 ± 0.6**	0.000
Waist girth (cm)	102.5 ± 3.1	97.4 ± 2.8*	108.1 ± 3.8	108.7 ± 4.2	0.103
Hip girth (cm)	110.4 ± 4.6	105.2 ± 4.3***	80.7 ± 10.0	79.3 ± 10.4	0.015
Waist/hip ratio	0.95 ± 0.07	0.95 ± 0.07	1.48 ± 0.13	1.52 ± 0.13	0.183
Waist/height ratio	0.62 ± 0.02	0.58 ± 0.01*	0.67 ± 0.02	0.67 ± 0.02	0.145
SBP (mmHg)	127.6 ± 4.2	116.1 ± 4.9**	102,6 ± 5,9	96,9 ± 6,6	0.196
DBP (mmHg)	82.9 ± 4.3	69.2 ± 2.1**	77,6 ± 2,5	76,1 ± 4,2	0.064
Fat mass (%)	47.0 ± 2.2	42.6 ± 2.2**	42,3 ± 2,7	41,9 ± 2,5	0.035
Σ7 skinfolds	190.3 ± 7.3	172.1 ± 9.7**	177,1 ± 12,4	181,6 ± 12,4	0.026
Physical activity (counts)	358.4 ± 27.1	440.7 ± 42.0**	407.1 ± 90.7	457.0 ± 59.7	0.589
Glucose	80.0 ± 3.3	79.1 ± 4.0	87.6 ± 3.4	88.2 ± 2.0	0.729
Adiponectin (g/g fat mass)	0.29 ± 0.06	0.38 ± 0.06*	0.09 ± 0.05	0.09 ± 0.05	0.030
Leptin (g/g fat mass)	0.16 ± 0.03	0.07 ± 0.02***	0.24 ± 0.10	0.26 ± 0.12	0.047
Total cholesterol (mg/dl)	149.6 ± 7.0	127.9 ± 6.8***	175.5 ± 12.5	141.5 ± 0.5	0.274
ApoA1 (mg/dl)	112.1 ± 4.8	99.0 ± 5.1***	104.0 ± 26.0	103.0 ± 15.0	0.131
ApoB (mg/dl)	67.0 ± 3.9	60.7 ± 3.5*	55.5 ± 6.5	65.5 ± 3.5	0.016
CRP (mg/dl)	2.7 ± 0.5	1.3 ± 0.2**	1.7 ± 0.5	1.5 ± 0.4	0.219
LAP index	47.2 ± 6.7	41.4 ± 5.9*	61.1 ± 19.0	53.9 ± 17.5	0.730

Values are means ± SE. SBP, systolic blood pressure; DBP, diastolic blood pressure; CRP, C-reactive protein; LAP: lipid accumulation profile. *$P < 0.05$, **$P < 0.01$, ***$P < 0.001$ vs. baseline.

Moleres et al., FASEB, 27, 2013

Genetic predisposition score (GPS)

n = 168
AGE: 12-16



**P = 0.005

Obese adolescents had a significantly higher genetic risk score than the overweight subjects at the beginning of the study

Moleres et al., J. Pediatrics, 2012;161(3):466-470

Variation in biochemical parameters after a 10 wk multidisciplinary treatment according to change in BMI-SDS and stratified by median (GPS = 9 risk alleles)

	GPS <9		GPS ≥9	
	Δ BMI-SDS*	*P*	Δ BMI-SDS*	*P*
Δ Leptin (ng/mL)	5.43 (1.86 to 9.00)	.004	−1.34 (−7.37 to 4.69)	.651
Δ Adiponectin (ng/mL)	−1.37 (−2.89 to 0.16)	.076	−0.71 (−0.55 to 0.43)	.499
Δ Glucose (mg/dL)	6.54 (0.13 to 12.95)	.046	−3.03 (−9.39 to 3.33)	.343
Δ Cholesterol (mg/dL)	13.63 (1.61 to 25.68)	.027	0.95 (−10.08 to 11.99)	.863
Δ Triglycerides (mg/dL)	19.27 (−1.64 to 40.18)	.070	0.18 (−23.65 to 24.01)	.988
Δ LDL-cholesterol (mg/dL)	3.43 (−16.76 to 23.63)	.734	−22.32 (−43.23 to −1.41)	.037
Δ Apolipoprotein A1 (mg/dL)	13.08 (1.55 to 24.61)	.027	−1.07 (−10.70 to 8.56)	.822
Δ Apolipoprotein B (mg/dL)	9.90 (3.08 to 16.72)	.005	4.32 (−1.89 to 10.54)	.166
Δ C-reactive protein (mg/dL)	1.01 (−0.16 to 2.18)	.088	0.42 (−1.05 to 1.88)	.567

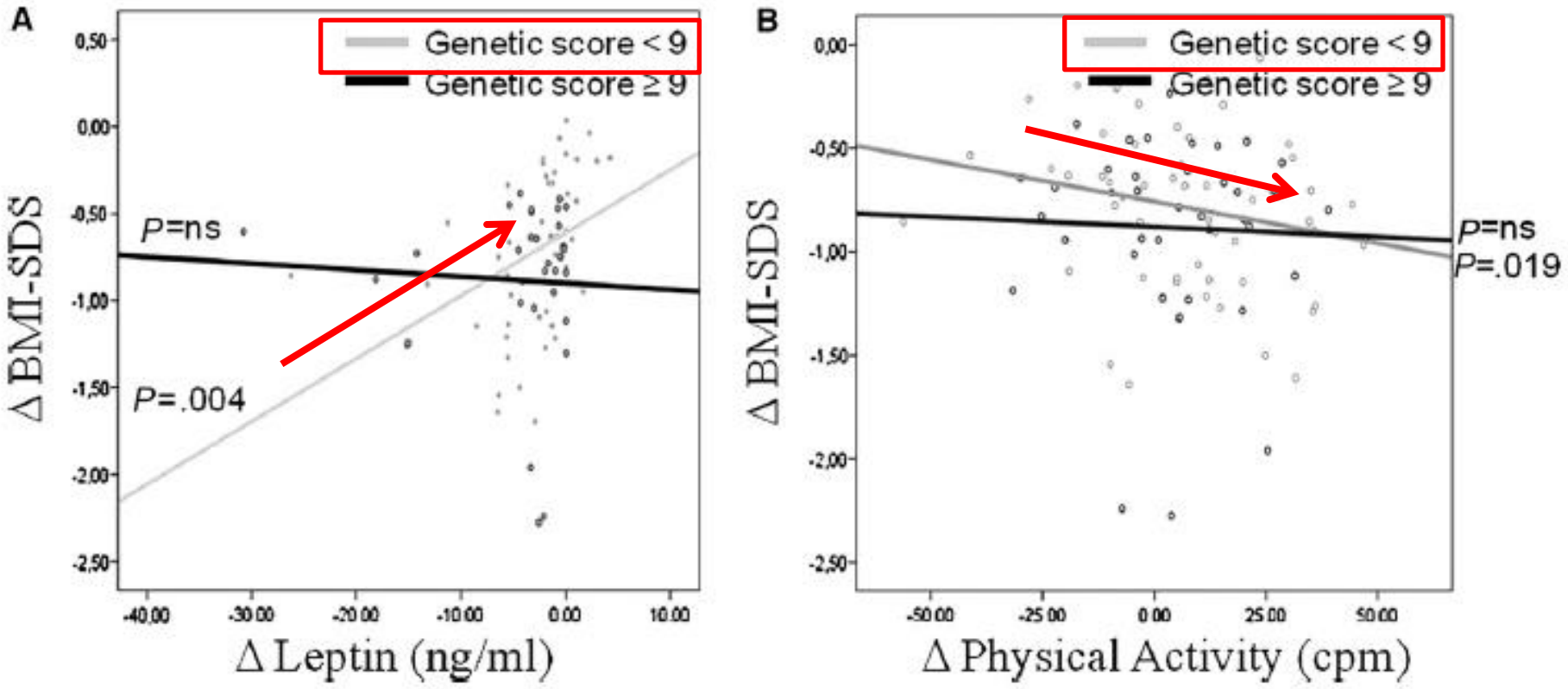
Non-conditional linear regression analyses adjusted for age, sex, and baseline BMI-SDS

After adjusting for baseline BMI-SDS, subjects with a GPS lower than 9 significantly improved their metabolic profile, lowering their leptin, glucose, total cholesterol, and apolipoproteins A1 and B levels as they decreased their BMI-SDS

Moleres et al., J. Pediatrics, 2012;161(3):466-470

Subjects with the lowest GPS showed a significant positive association between BMI and circulating leptin level changes

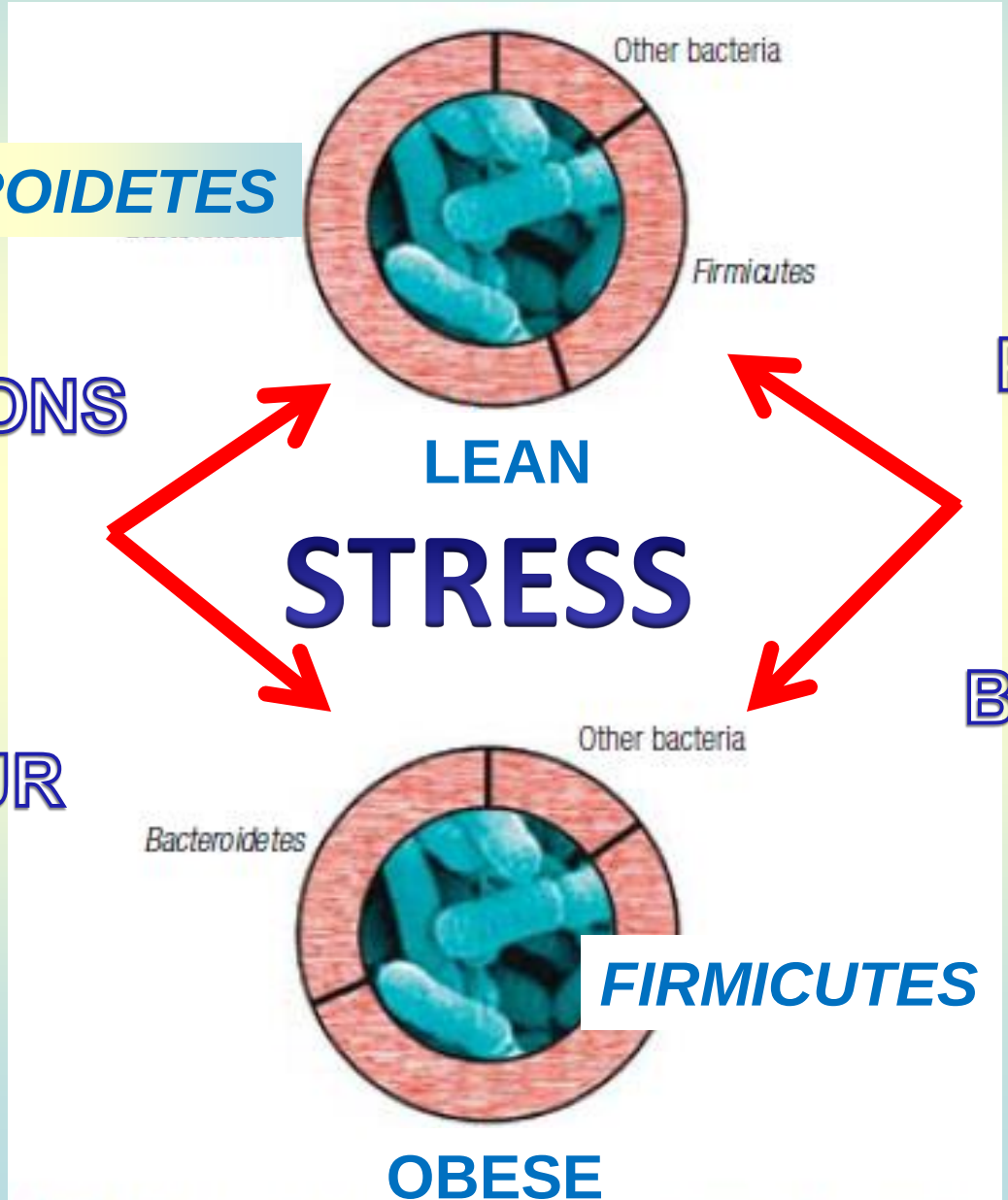
Subjects with the lowest GPS showed a significant negative association between BMI and physical activity level changes



Obese/overweight adolescents with a lower GPS have a higher benefit of weight loss after 10 wk of a multidisciplinary lifestyle intervention

Moleres et al., J. Pediatrics, 2012;161(3):466-470

THE COMPOSITION OF GUT MICROBIOTA OF THE OBESE IS DIFFERENT OF THE LEAN INDIVIDUALS



BACTEROIDETES

FIRMICUTES

WEIGHT FLUCTUATIONS

DIET

FOOD BEHAVIOUR

PHYSICAL ACTIVITY

SLEEP BEHAVIOUR

nature publishing group

ARTICLES

INTERVENTION AND PREVENTION

Interplay Between Weight Loss and Gut Microbiota Composition in Overweight Adolescents

Arlette Santacruz[1], Ascensión Marcos[2], Julia Wärnberg[2,3], Amelia Martí[4,5], Miguel Martin-Matillas[6], Cristina Campoy[6], Luis A. Moreno[7], Oscar Veiga[8], Carlos Redondo-Figuero[9], Jesús M. Garagorri[10], Cristina Azcona[5], Manuel Delgado[11], Miguel García-Fuentes[9], Maria C. Collado[1] and Yolanda Sanz[1]; the EVASYON Study Group

LOW AND HIGH RESPONDERS



WEIGHT LOSS < 2 KG

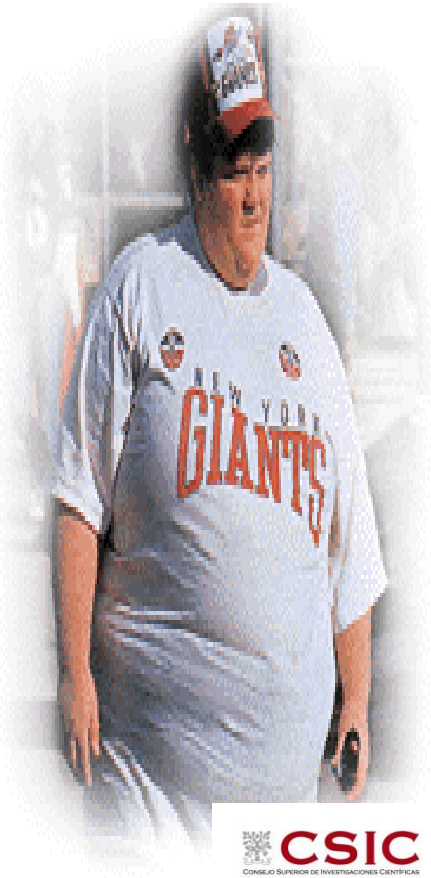
NON-RESPONDERS

INTENSIVE PHASE

2 MONTHS

WEIGHT LOSS > 4 KG

RESPONDERS



LOW RESPONDERS

Table 4 Bacterial counts in fecal samples of low weight–loss (-2.0 kg) group of adolescents, before and after intervention

	Bacterial counts[a] (log cells/g fecal sample), $n = 13$								Mann–Whitney *U*-test
	Before intervention				After intervention				
Bacterial group	Pr[b]	Mean	Median	IQR	Pr[b]	Mean	Median	IQR	*P* value
Total bacteria	13	13.2	12.9	12.8–13.9	13	13.2	13.1	12.8–13.4	0.975
Bacteroides	13	6.2	6.2	5.8–7.0	13	6.3	6.2	5.8–6.9	0.957
Clostridium coccoides	13	10.0	10.0	9.8–10.2	13	9.9	10.0	9.7–10.2	0.978
Clostridium leptum	13	8.2	8.0	7.9–8.5	13	8.4	8.3	7.9–8.8	0.446
Lactobacillus	13	7.9	7.8	7.6–8.1	13	7.9	7.9	7.7–8.1	0.723
Escherichia coli	13	6.7	6.5	6.0–7.7	13	6.6	6.5	6.0–7.1	0.624
Bifidobacterium	13	9.2	9.2	8.8–9.5	13	8.9	9.0	8.4–9.6	0.514
Bifidobacterium longum	13	7.1	7.0	6.8–7.4	13	7.0	6.9	6.3–7.7	0.644
Bifidobacterium breve	13	4.8	4.8	4.4–5.2	13	4.5	4.5	4.3–4.7	0.110
Bifidobacterium bifidum	13	9.1	9.0	8.8–9.4	13	8.9	8.9	8.3–9.7	0.640
Bifidobacterium adolescentis	13	8.1	8.0	7.8–8.4	13	8.0	7.9	7.3–8.7	0.650
Bifidobacterium catenulatum	13	5.8	5.8	5.5–6.2	13	5.5	5.5	5.3–5.7	0.103

[a]Data are shown as medians and interquartile range (IQR) of cell number per gram of fecal samples. [b]Prevalence (Pr) reflects the number of positive amplifications by quantitative real-time PCR from total samples ($n = 13$).

[c]Statistical differences between bacterial counts before and after intervention were calculated by using the Mann–Whitney *U*-test and established at $P < 0.050$.

HIGH RESPONDERS

Table 5 Bacterial counts in fecal samples of high weight–loss (≥ 4.0 kg) group of adolescents, before and after intervention

	Bacterial counts[a] (log cells/g fecal sample), $n = 23$								Mann–Whitney *U*-test
	Before intervention				After intervention				
Bacterial group	Pr[b]	Mean	Median	IQR	Pr	Mean	Median	IQR	*P* value
Total bacteria	23	14.8	14.6	14.0–15.6	23	14.5	14.8	13.1–16.1	0.450
Bacteroides	23	7.5	7.6	6.7–8.2	23	8.6	8.6	8.1–9.3	0.001*
Clostridium coccoides	23	8.7	8.6	8.3–9.0	23	7.9	7.7	7.4–8.5	0.001*
Clostridium leptum	23	9.5	9.6	8.7–9.9	21	9.5	9.7	9.1–10.0	0.666
Lactobacillus	23	6.4	6.4	5.9–6.9	23	6.9	7.0	6.3–7.1	0.007*
Escherichia coli	23	6.3	6.3	5.8–6.8	23	6.4	6.3	6.1–7.0	0.231
Bifidobacterium	23	8.3	8.1	7.7–8.6	23	8.2	8.2	7.4–8.6	0.692
Bifidobacterium longum	23	7.1	7.2	6.3–7.9	23	6.4	6.2	5.3–7.3	0.044*
Bifidobacterium breve	15	3.5	3.3	3.0–3.6	11	3.2	3.1	3.0–3.5	0.237
Bifidobacterium bifidum	19	5.9	5.6	4.5–7.1	17	5.6	5.6	4.3–7.1	0.490
Bifidobacterium adolescentis	23	7.6	7.9	6.8–8.8	23	6.9	7.0	6.0–8.1	0.092
Bifidobacterium catenulatum	22	7.6	7.7	6.7–8.5	23	7.2	7.6	6.3–8.4	0.594

[a]Data are shown as medians and interquartile range (IQR) of cell number per gram of fecal samples. [b]Prevalence (Pr) reflects the number of positive amplifications by quantitative real-time PCR from total samples ($n = 23$).

*Statistical differences between bacterial counts before and after intervention were calculated by using the Mann–Whitney *U*-test and established at $P < 0.050$.

HIGH RESPONDERS

Significant correlations between fecal bacteria counts and weight lost after intervention in high responder adolescents (n=23; >4.0 kg weight lost)



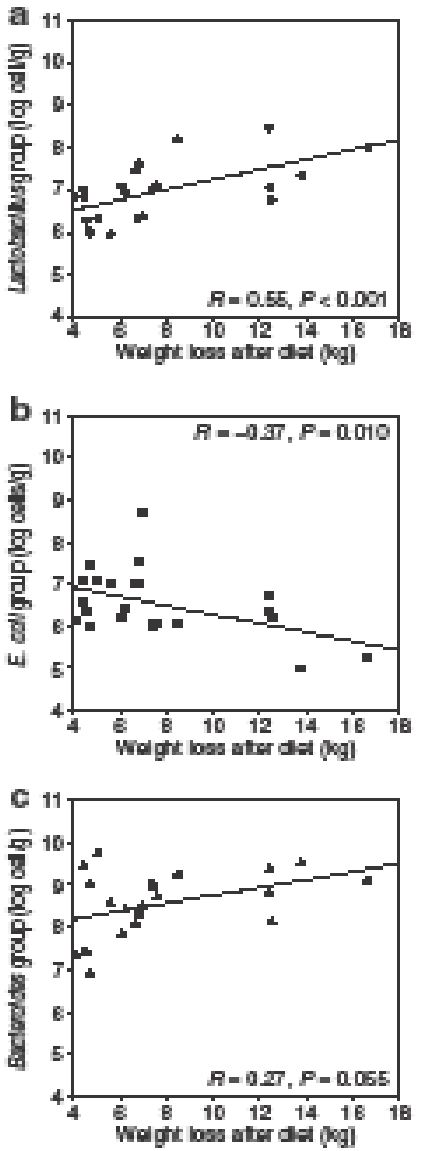


Table 6 Bacterial counts in fecal samples of low and high weight–loss groups of adolescents, before and after intervention

Bacterial group	Low weight–loss group (<2.0 kg) (*n* = 13) Pr[a]	Mean	Median	IQR	High weight–loss group (>4.0 kg) (*n* = 23) Pr	Mean	Median	IQR	Mann–Whitney *U*-test *P* value
Bacterial counts[b] before intervention (log cells/g fecal sample)									
Total bacteria	13	13.2	12.9	12.8–13.9	23	14.8	14.6	14.0–15.6	<0.001*
Bacteroides	13	6.2	6.2	5.8–7.0	23	7.5	7.6	6.7–8.2	0.004*
Clostridium coccoides	13	10.0	10.0	9.8–10.2	23	8.7	8.6	8.3–9.0	<0.001*
Clostridium leptum	13	8.2	8.0	7.9–8.5	23	9.5	9.6	8.7–9.9	<0.001*
Lactobacillus	13	7.9	7.8	7.6–8.1	23	6.4	6.4	5.9–6.9	<0.001*
Escherichia coli	13	6.7	6.5	6.0–7.7	23	6.3	6.3	5.8–6.8	0.123
Bifidobacterium	13	9.2	9.2	8.8–9.5	23	8.3	8.1	7.7–8.6	0.001*
Bifidobacterium longum	13	7.1	7.0	6.8–7.4	23	7.1	7.2	6.3–7.9	0.845
Bifidobacterium breve	13	4.8	4.8	4.4–5.2	15	3.5	3.3	3.0–3.6	0.001*
C. coccoides	13	9.9	10.0	9.7–10.2	23	7.9*	7.7	7.4–8.5	<0.001*
C. leptum	13	8.4	8.3	7.9–8.8	21	9.5	9.7	9.1–10.0	<0.001*
Lactobacillus	13	7.9	7.9	7.7–8.1	23	6.9*	7.0	6.3–7.1	<0.001*
E. coli	13	6.6	6.5	6.0–7.1	23	6.4	6.3	6.1–7.0	0.972
Bifidobacterium	13	8.9	9.0	8.4–9.6	23	8.2	8.2	7.4–8.6	0.008*
B. longum	13	7.0	6.9	6.3–7.7	23	6.4*	6.2	5.3–7.3	0.062
B. breve	13	4.5	4.5	4.3–4.7	11	3.2	3.1	3.0–3.5	<0.001*
B. bifidum	13	8.9	8.9	8.3–9.7	17	5.6	5.6	4.3–7.1	<0.001*
B. adolescentis	13	8.0	7.9	7.3–8.7	23	6.9	7.0	6.0–8.1	0.063
B. catenulatum	13	5.5	5.5	5.3–5.7	23	7.2	7.6	6.3–8.4	0.036*

[a]Prevalence (Pr) reflects the number of positive amplifications by quantitative real-time PCR from total samples (*n* = 13 or 23). [b]Data are shown as medians and interquartile range (IQR) of cell number per gram of fecal samples.
*Statistical differences between bacterial counts for each group (high- and low-weight adolescent groups) before and after intervention were calculated by using Mann–Whitney *U*-test and established at $P < 0.050$.

Gut microbiota composition is more important to achieve weight loss than expected

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EVASYON

Richness of Human Gut Microbiome correlates with Metabolic Markers

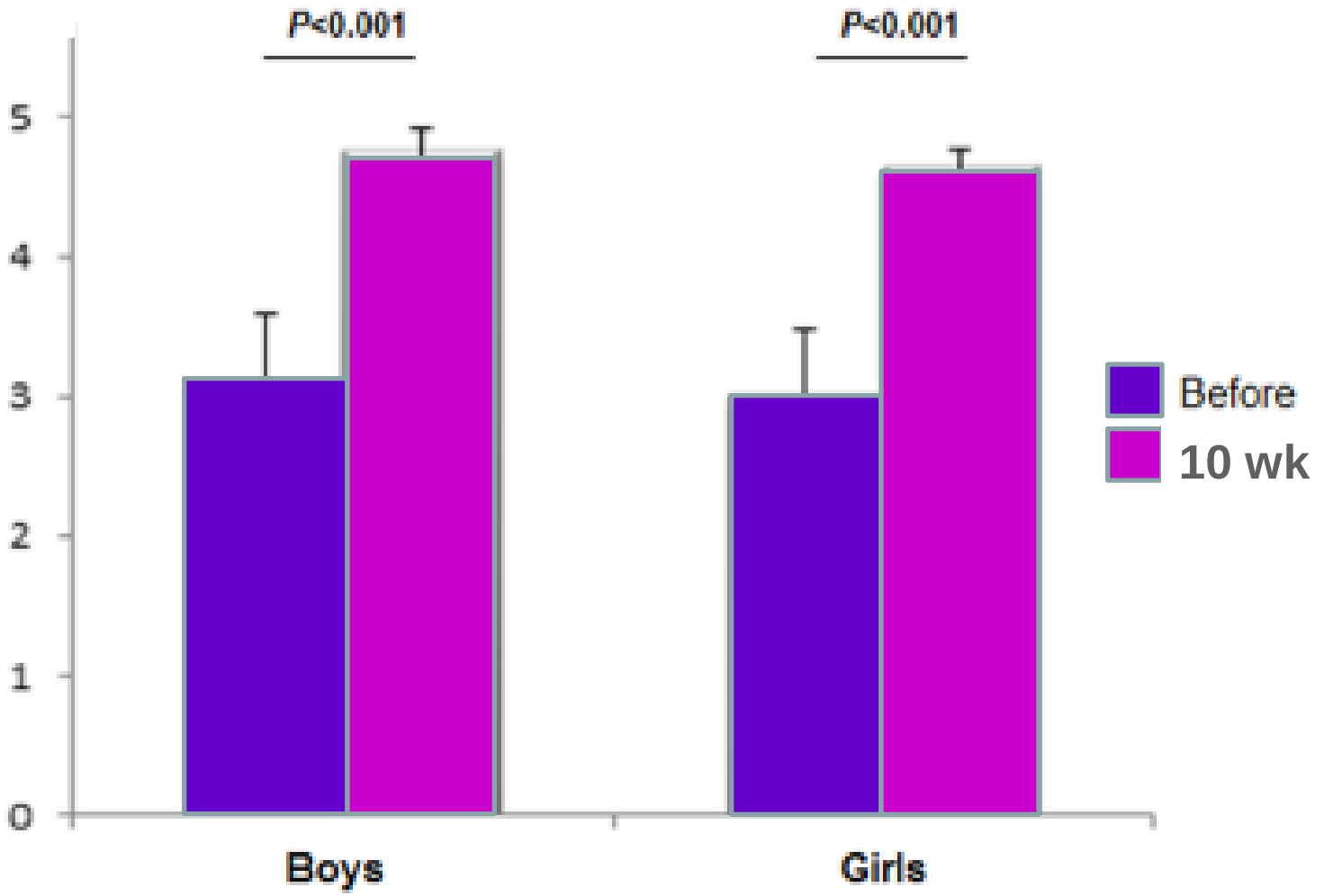
	LGC	HGC	p
N (men/women)	68 (23/45)	224 (113/111)	
Age (yrs)	56 ± 7.5	57 ± 7.3	0.86
BMI (kg/m^2)	32 (29 - 34)	30 (23 - 33)	0.035
Weight (kg)	95 (75 - 100)	86 (71 - 100)	0.019
Fat %	37 (29 - 42)	31 (25 - 39)	0.0069
S-Adiponectin (mg/l)	7.5 (5.5 – 12.9)	9.6 (6.7 – 13.7)	0.006
B-leucocytes (10^9/l)	6.4 (5.2 - 7.8)	5.6 (4.8 - 6.9)	0.0021
P-CRP (mg/l)	2.3 (1.1 - 5.7)	1.4 (0.6 - 2.7)	0.00088
S-FIAF (µg/l)	88 (72 - 120)	78 (60 - 100)	0.0047

LGC is characterized by more marked overall adiposity, insulin resistance and dyslipidaemia and a more pronounced inflammatory phenotype than HGC

Le Chatellier et al, Nature 2013


OBESITY HAS BEEN DEFINED
AS A PROCESS OF AGING
WHAT ABOUT TELOMERES?

TELOMERE LENGHT



Garcia-Calzon S et al. PLoS ONE 2014;9(2)





SLEEP QUALITY AND QUANTITY





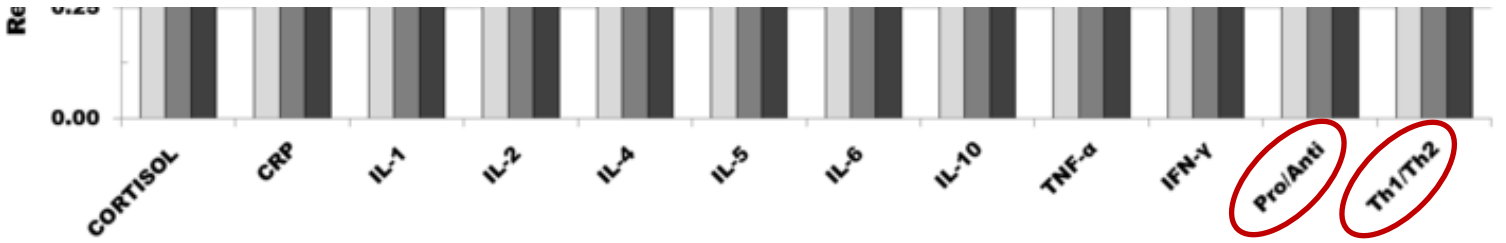


Healthy Lifestyle in Europe by Nutrition in Adolescence tion image



SLEEP TIME IN ADOLESCENTS

Adolescents reporting 8-<9 hours of sleep per night showed higher average values of serum cytokines, but a lower pro-inflammatory profile



(*) Asterisks indicate significant differences between sleep categories as analyzed by ANCOVA, adjusting for gender, center, Tanner stage, and standardized body mass index (*$P < 0.05$, **$P < 0.01$).

Perez de Heredia et al., Sleep medicine 10.1016/j.sleep.2014.04.010

MESSAGES TO TAKE HOME



PREVENTION

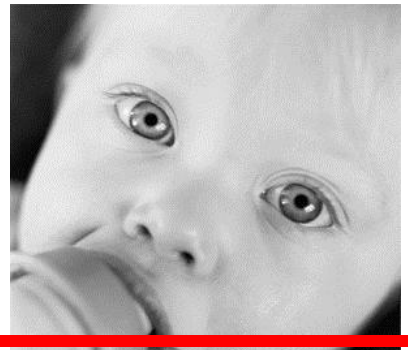






CONFOUNDING FACTORS: AGE, SEX, TANNER STATE, NUTRITIONAL STATUS, FOOD BEHAVIOUR, PHYSICAL ACTIVITY, FITNESS, SEDENTARY HABITS, SLEEP





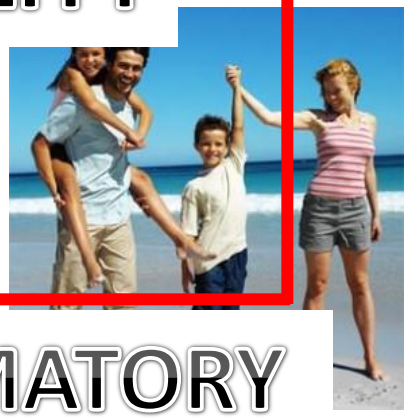




PROMOTING LIFE QUALITY







BY PREVENTING INFLAMMATORY







MECHANISMS ALONG LIFE



CSIC
Consejo Superior de Investigaciones Científicas



12th European Nutrition Conference

FENS 2015

Berlin | Germany | October 20 - 23

Nutrition and health throughout life-cycle – Science for the European consumer

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María Nieves García-Casal
Presidenta del Comité Organizador

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NUTRICIÓN PARA EL DESARROLLO SOSTENIBLE

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SLAN
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International Society for Immunonutrition



PROF. SAVINO

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Esther Nova



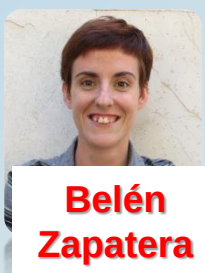
L.Esperanza Díaz



Sonia Gómez



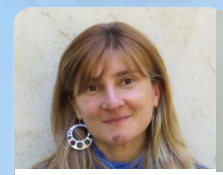
Ana M. Veses



Belén Zapatera



Ascensión Marcos



Aurora Hernández



Ruth Serrano



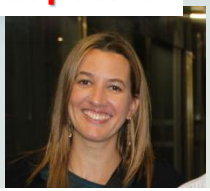
Alina Gheorghe



Noemí Redondo



Andreu Prados



Ana Elegido



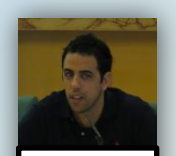
Julia Wärnberg



Fátima Pérez de Heredia



Tamara Pozo



David Martínez-Gómez



