儿童肥胖早期预防

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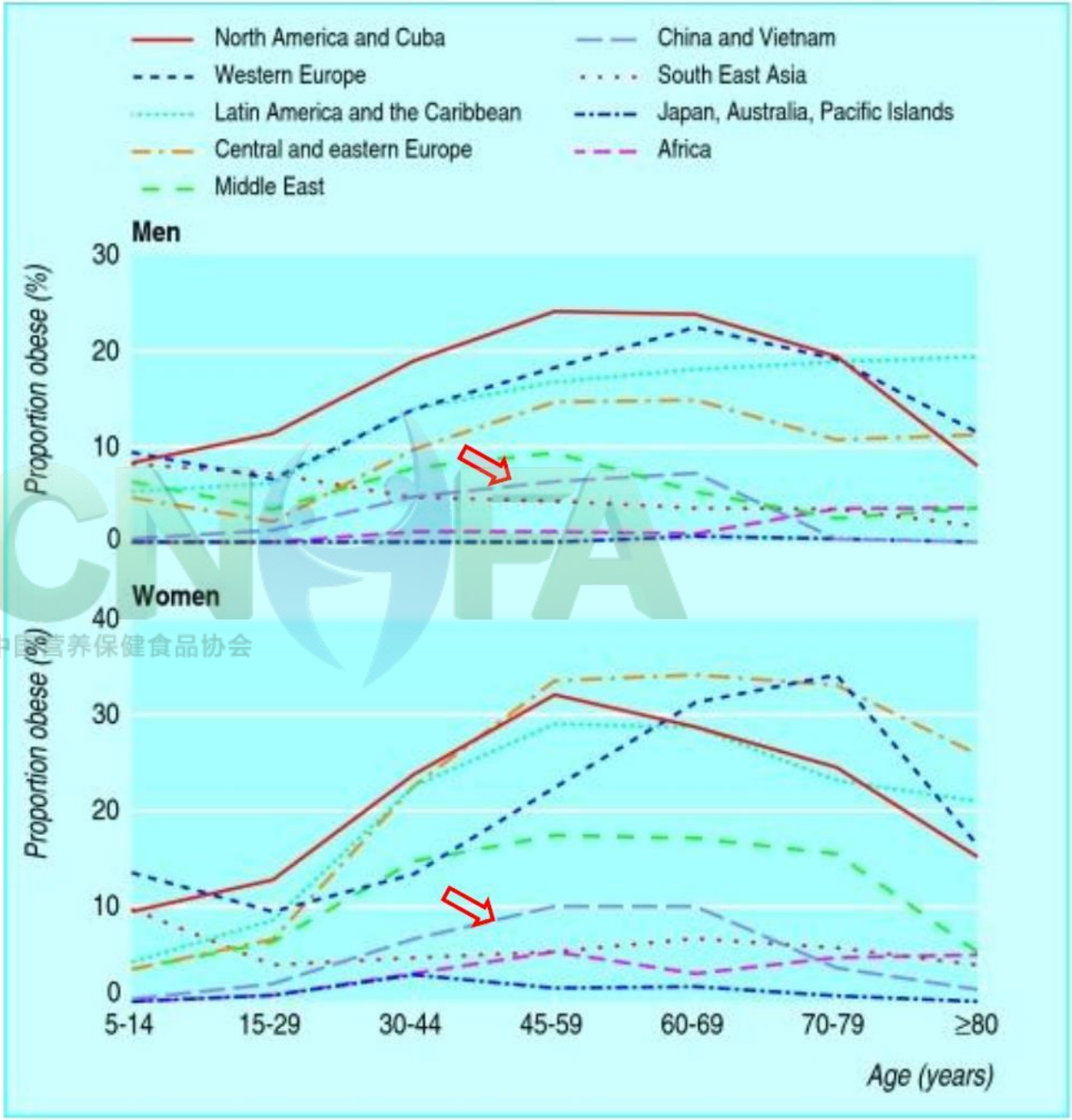
内 容

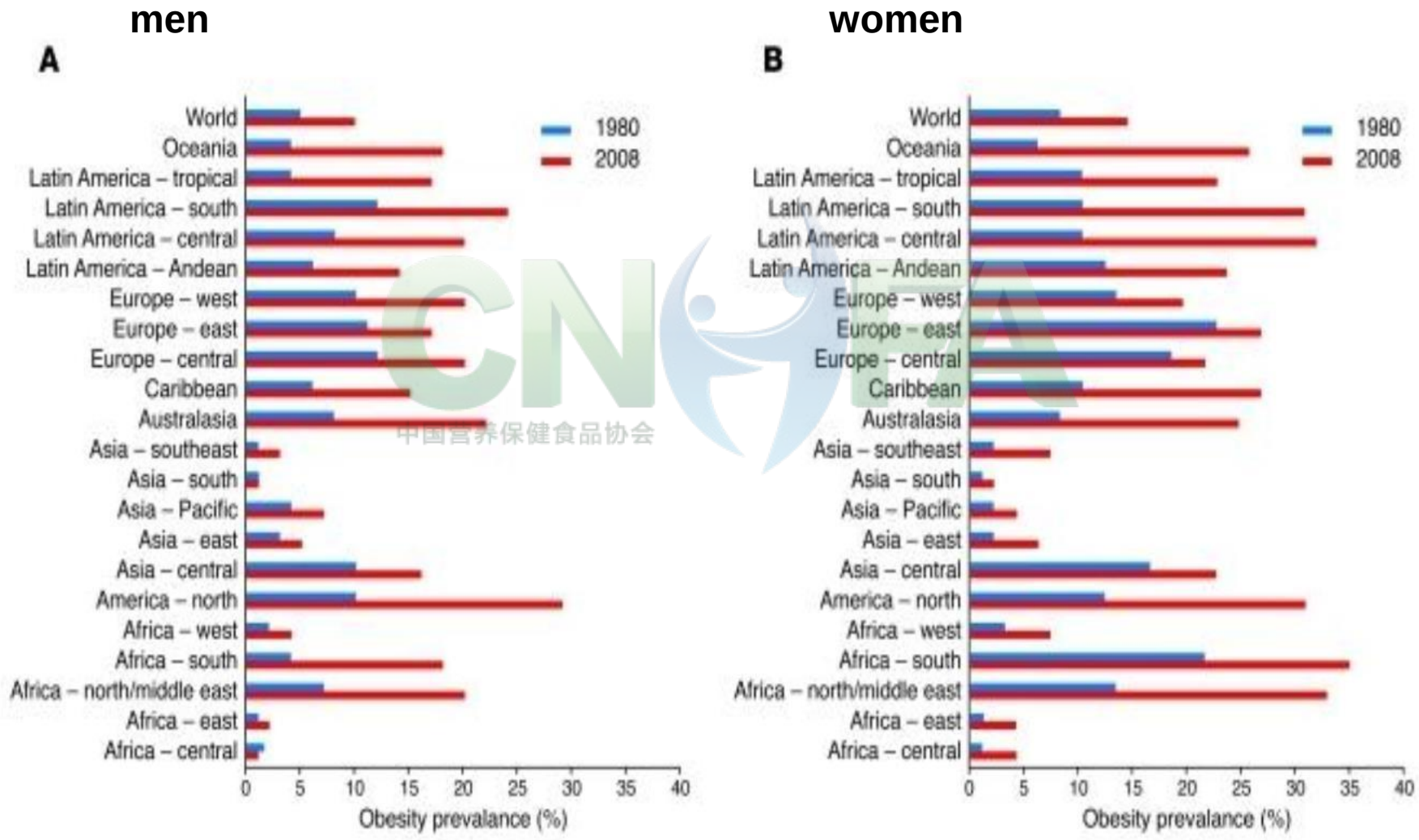
- 肥胖流行趋势
- 脂肪细胞发育分化
- 肥胖病因与高危因素
- 肥胖并发症
- 肥胖诊断
- 肥胖防治

肥胖全球流行趋势



Adapted from Haslam D, James WP. Lancet 2005;366:

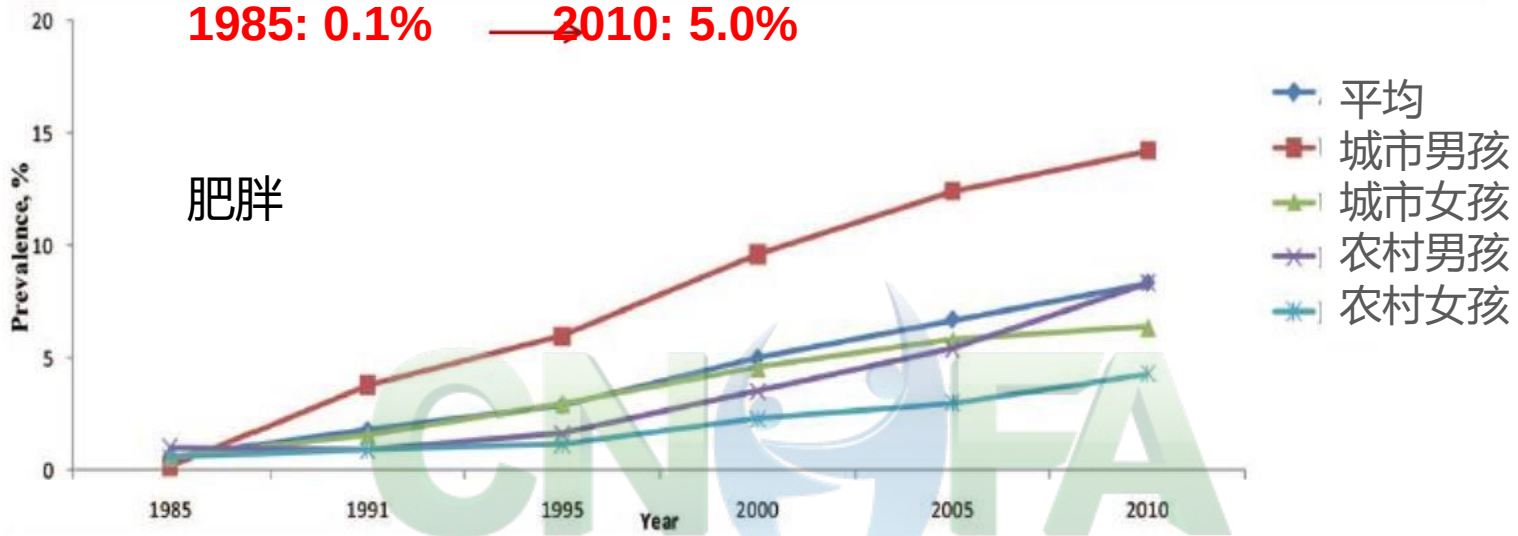
1980至2008年间全球成人肥胖流行变化

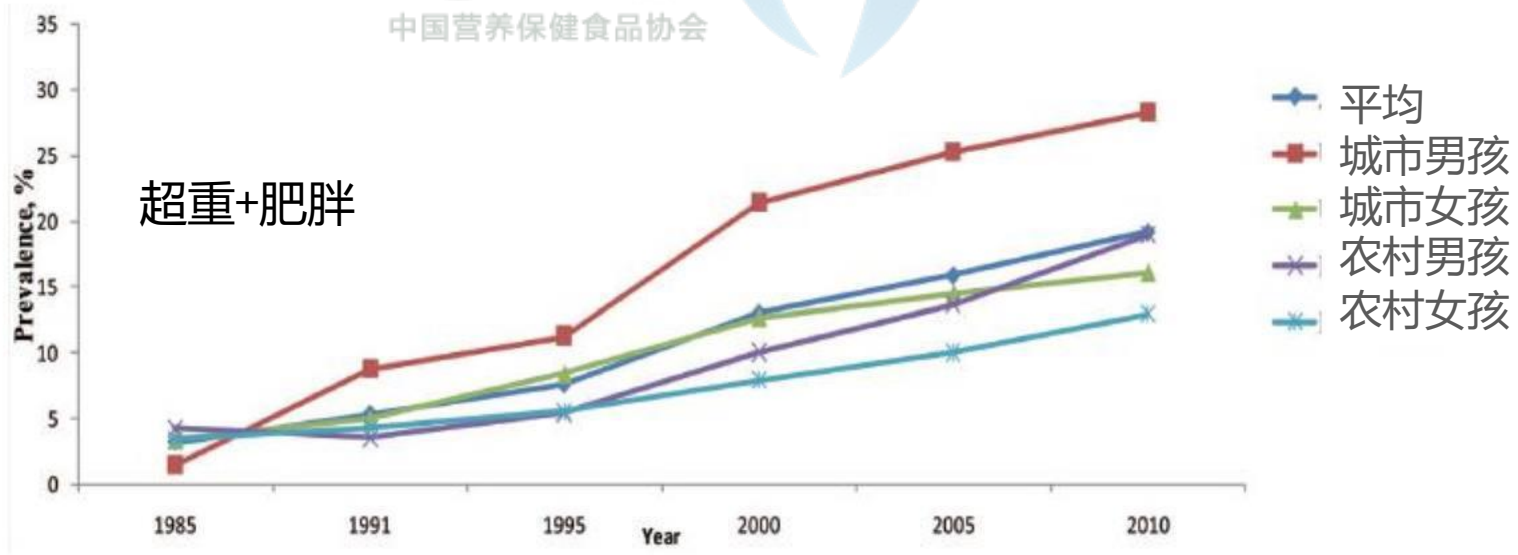


Lancet. 2011;377(9765):557–567

中国儿童青少年肥胖流行趋势

1985: 0.1%　　2010: 5.0%





PLoS One. 2014 Aug 20;9(8):

北京地区肥胖流行情况（1985–2013）

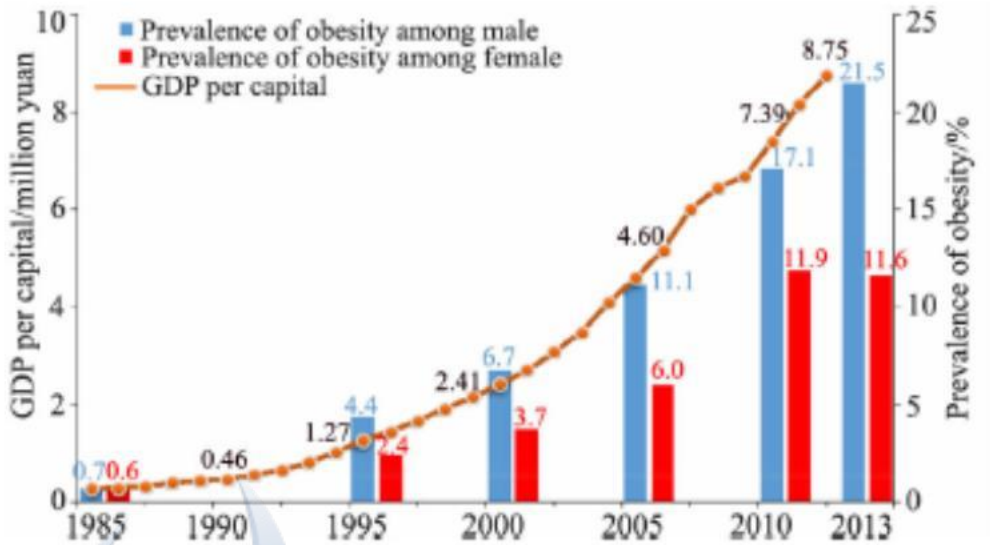


图4　1985 至2013 年北京学龄儿童肥胖率随 GDP 的变化趋势

Fig 4　Trend of prevalence of obesity with GDP among school-age children in Beijing，1985 – 2013

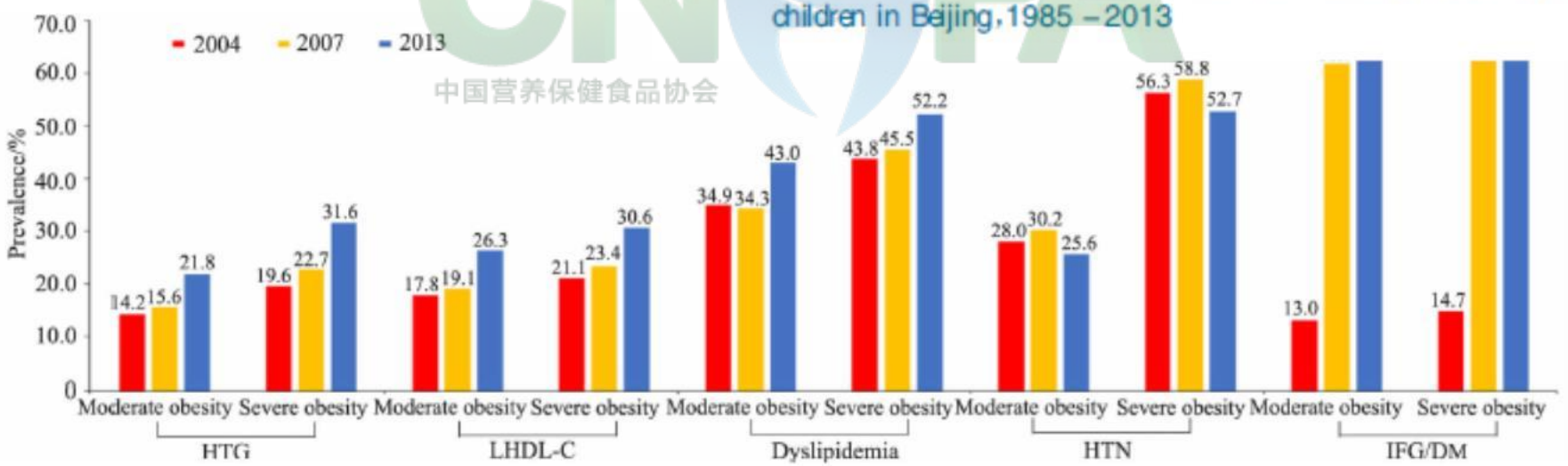
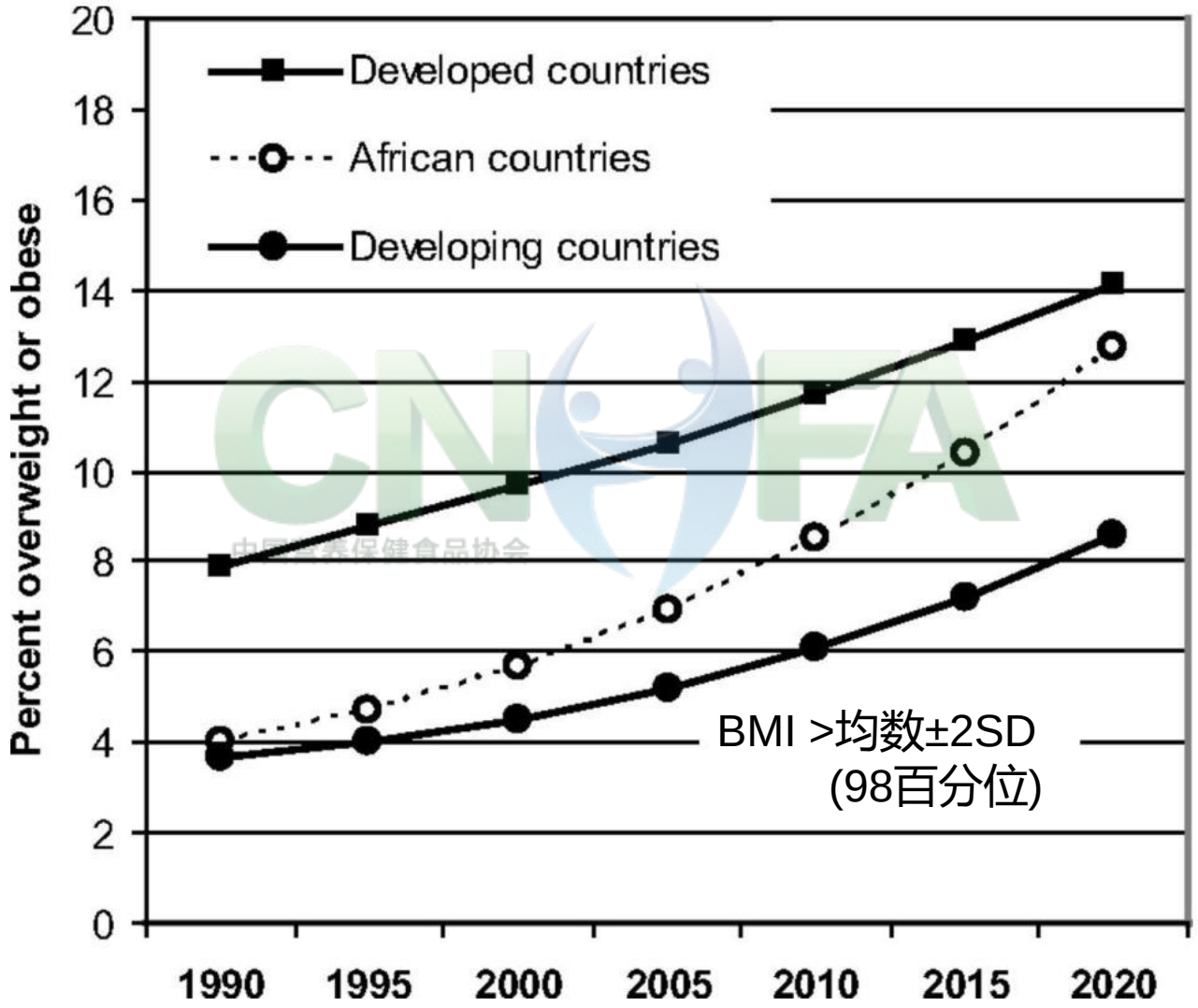


图8　2004 至2013 年北京肥胖学龄儿童代谢异常检出率

Fig 8　The prevalence of metabolic abnormalities among obese school-age children in Beijing，2004 – 2013

中国循证儿科杂志 2014 年10 月第9 卷第5 期

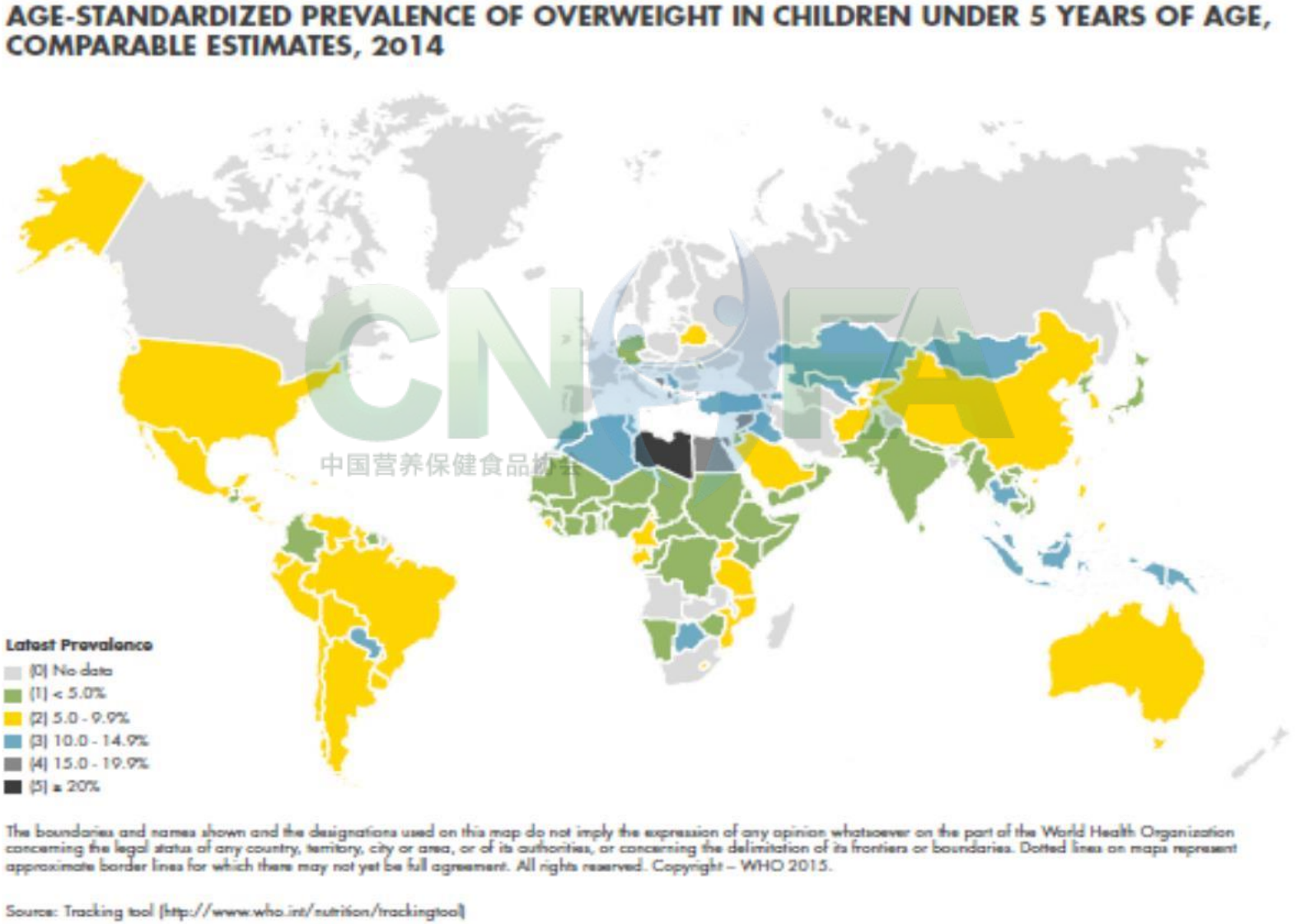
学龄前儿童超重、肥胖流行趋势及预测



American Heart Association

Lakshman R et al. Circulation. 2012;126:1770-1779

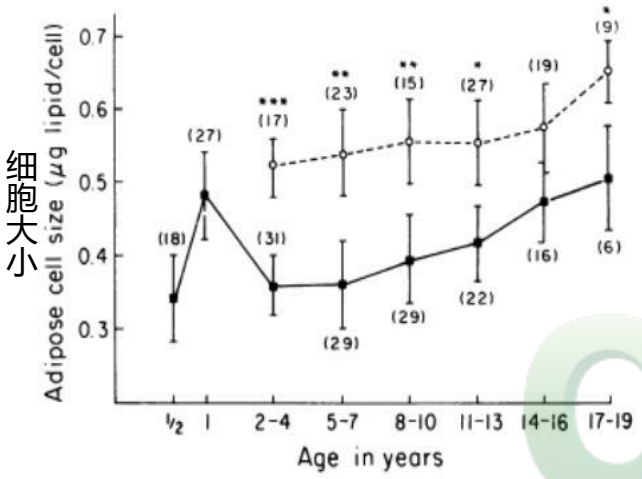
5岁以下儿童超重肥胖全球检出率（2014）

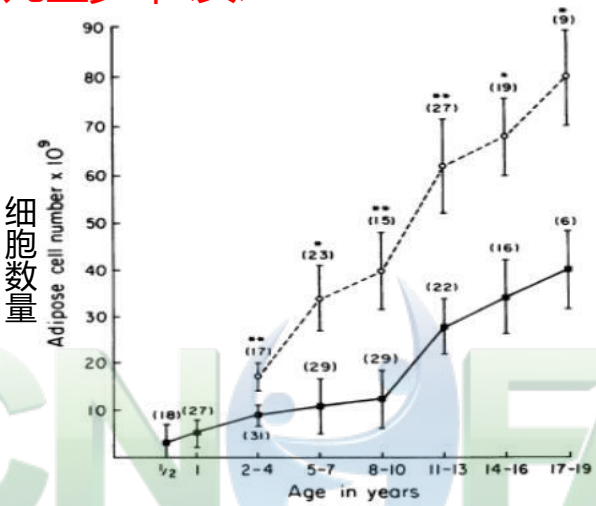


脂肪细胞发育分化

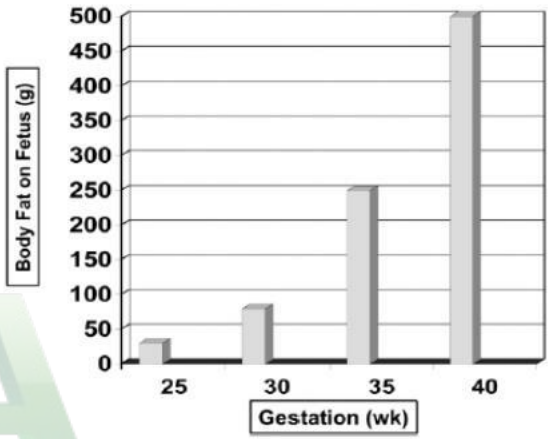
生长发育过程中脂肪组织的变化

儿童少年(女)

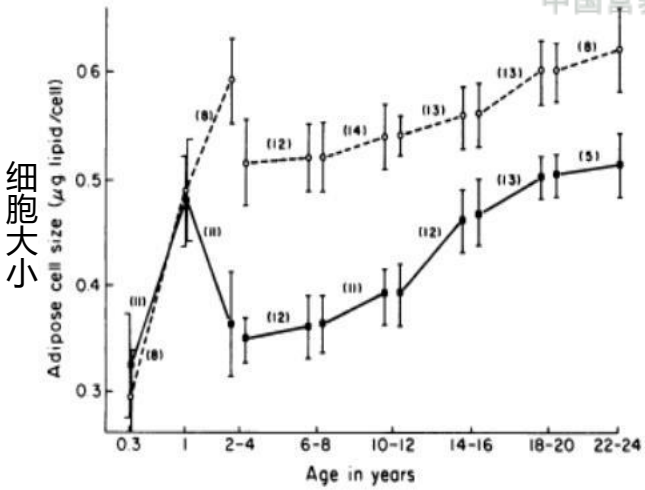


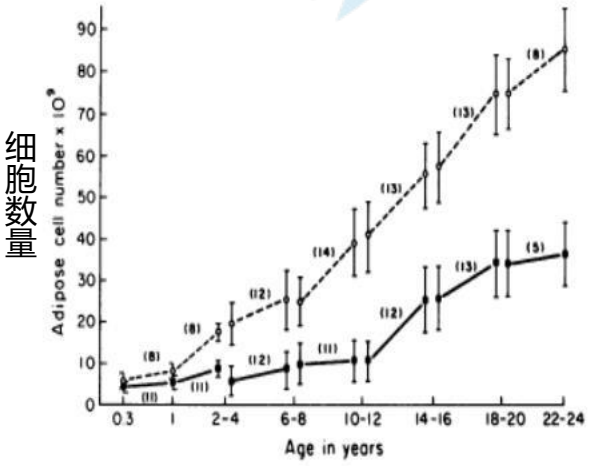


胎儿

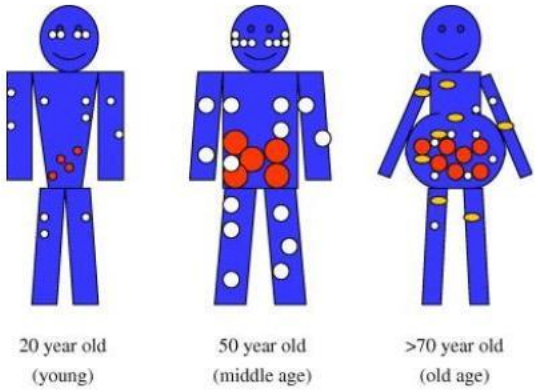


儿童少年(男)



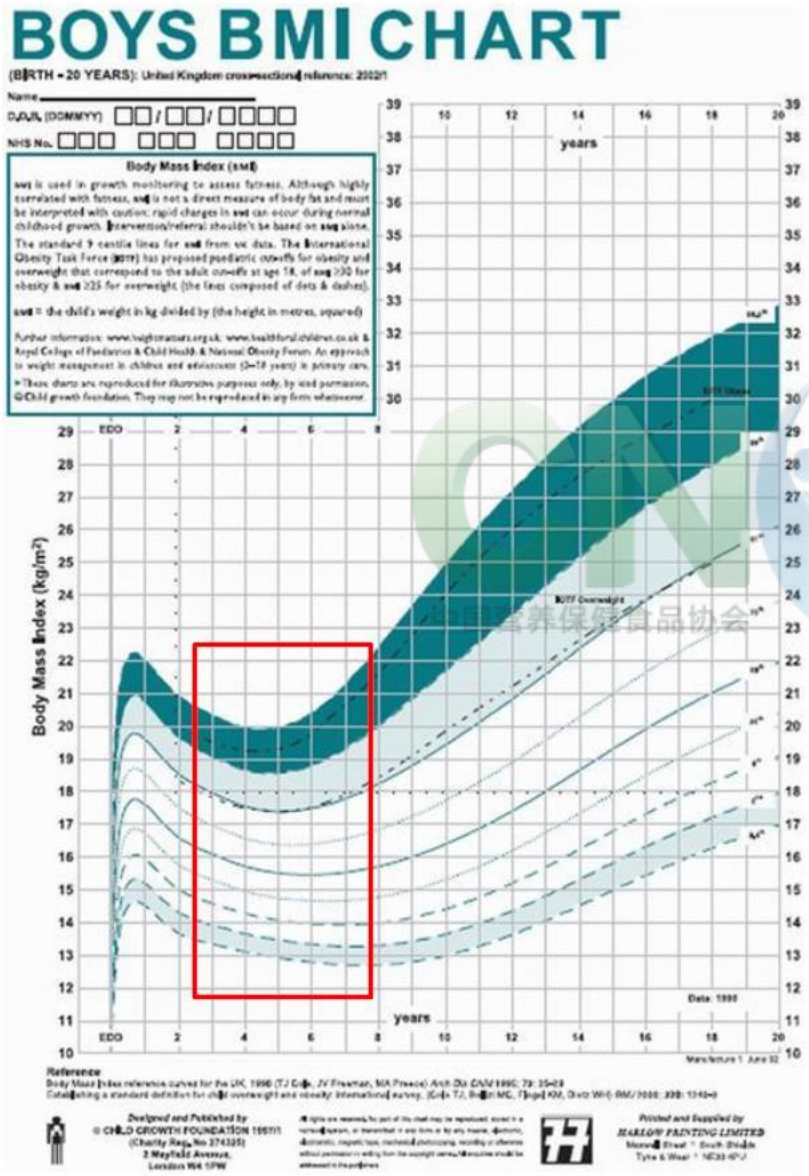


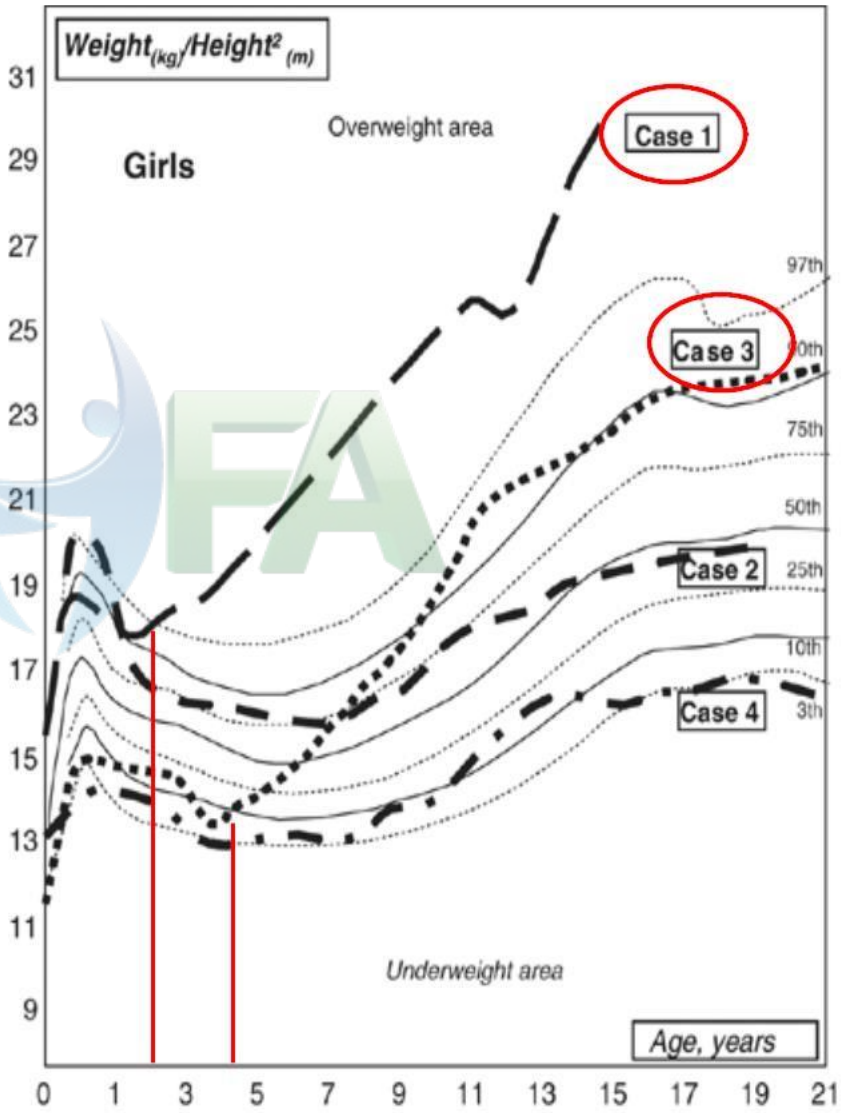
成年



J. Clin. Invest. 1979; 63: 239-246

脂肪重聚(adiposity rebound)

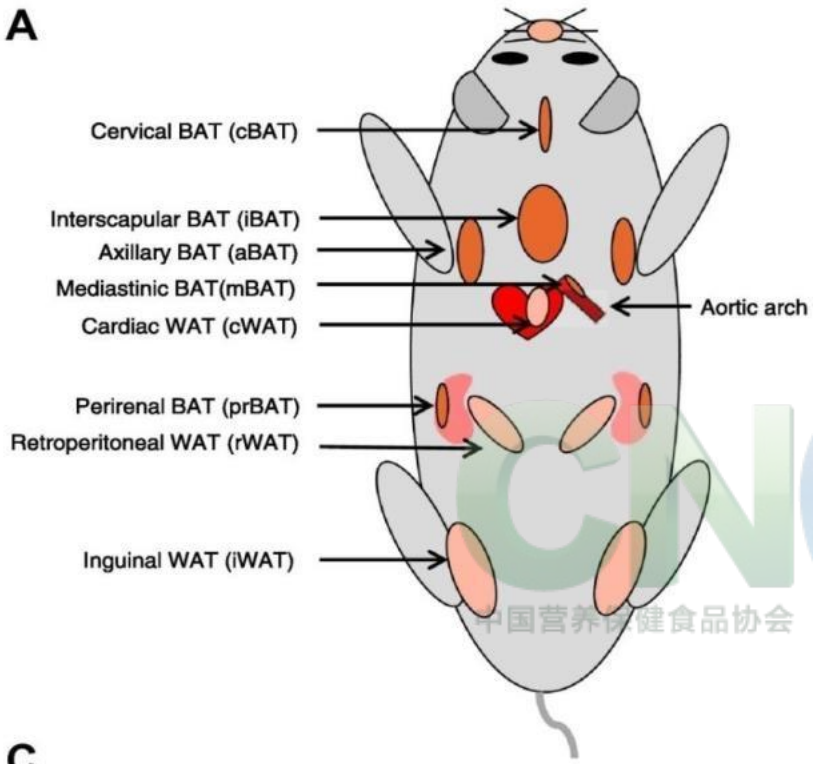


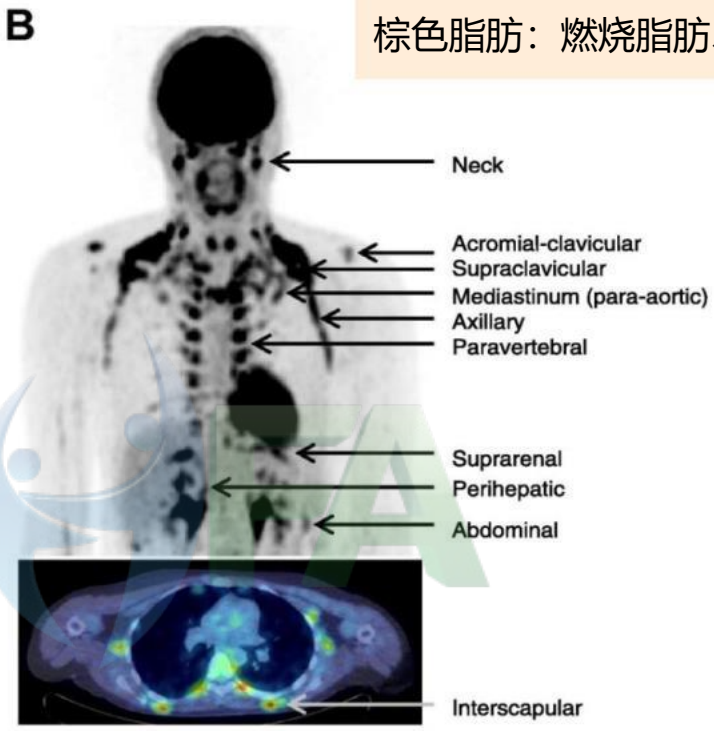


棕色脂肪的机体分布

白色脂肪：储存能量、机械缓冲

棕色脂肪：燃烧脂肪、维持体温





颈部

肩甲下

腋窝

腹股沟

性腺周围

内脏周围

C

Rodent BAT and beige depots	Specific markers
Classical BAT	Zic1, Lhx8 (Waldén et al., 2012; Sharp et al., 2012) Ebf3, Eva1, Fbxo31 (Wu et al., 2012)
Beige depots (cWAT, rWAT, iWAT)	Hoxc9, Shox2 (Waldén et al., 2012) Tbx1, Tmem26, CD137 (Wu et al., 2012) Fgf21, Car4, Cited1 (Sharp et. al, 2012)

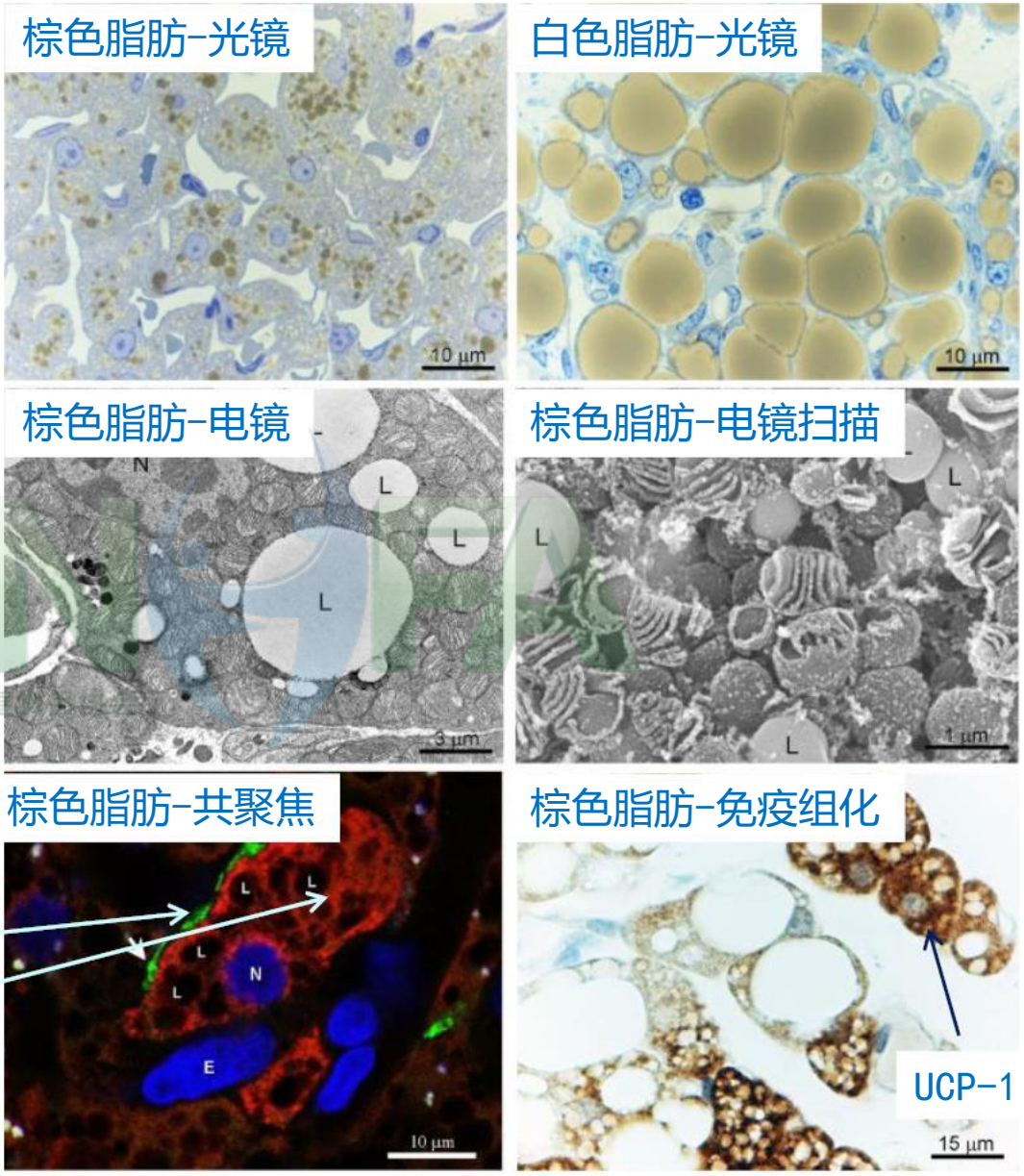
D

Human BAT and beige depots	Specific markers
Classical BAT: not (yet) identified	-
Beige depots: - Supraclavicular BAT*, ** - Mediastinum* - Retroperitoneal* - Intraabdominal* - Mesenteric*	Tmem26, CD137, Tbx1 (Wu et al., 2012, only supraclavicular) Hoxc8, Hoxc9, Cited1, Fgf21, CD137, Tmem26 (Sharp et al., 2012, all depots)

It has been estimated that fully activated BAT in humans can contribute to 5% of the basal metabolic rate

Mol Cell Endocrinol. **2013 Oct 15;379(1-2):43-50**

棕色与白色脂肪的组织学特点

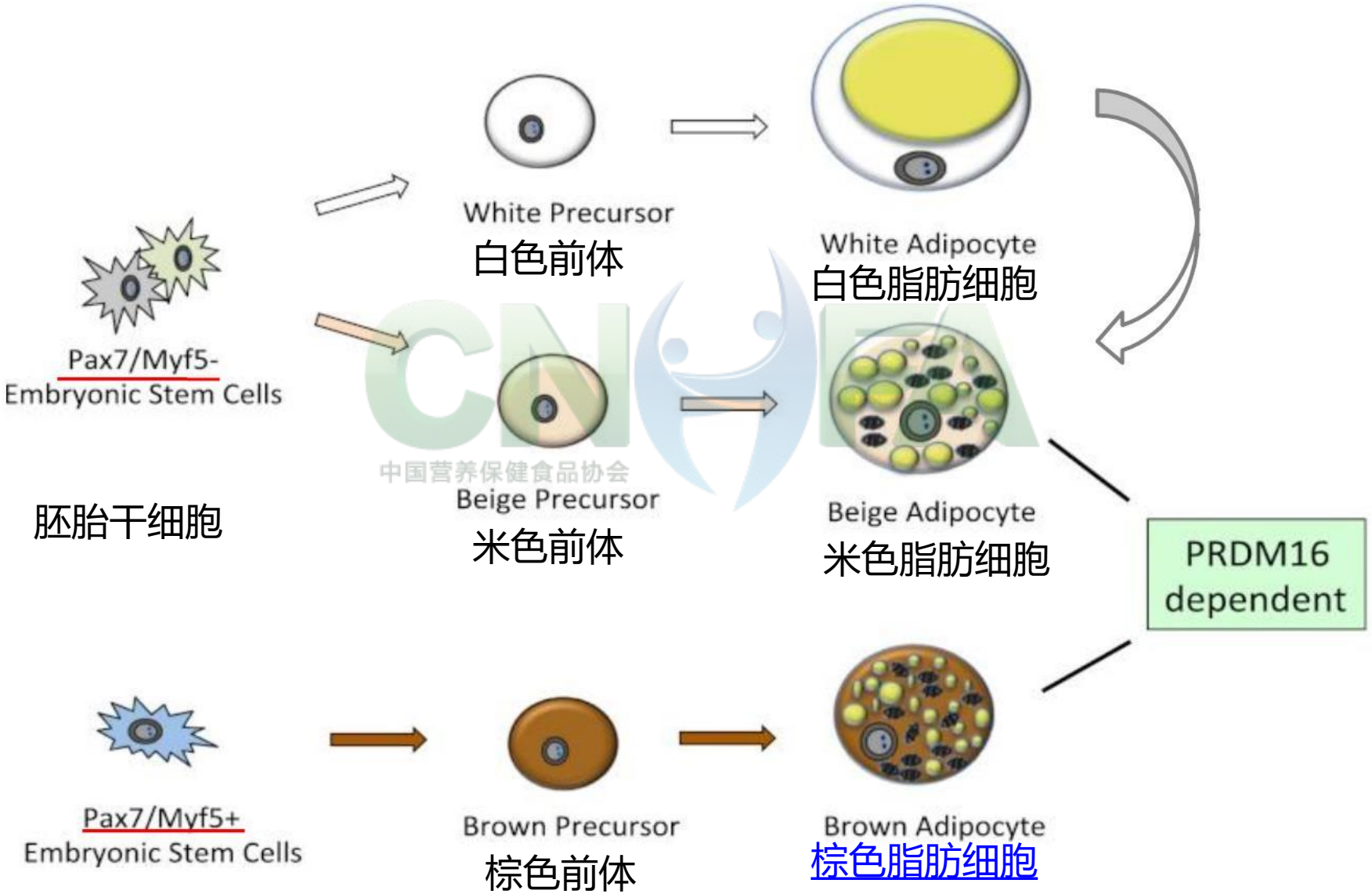


绿色-交感神经

红色-UCP-1R

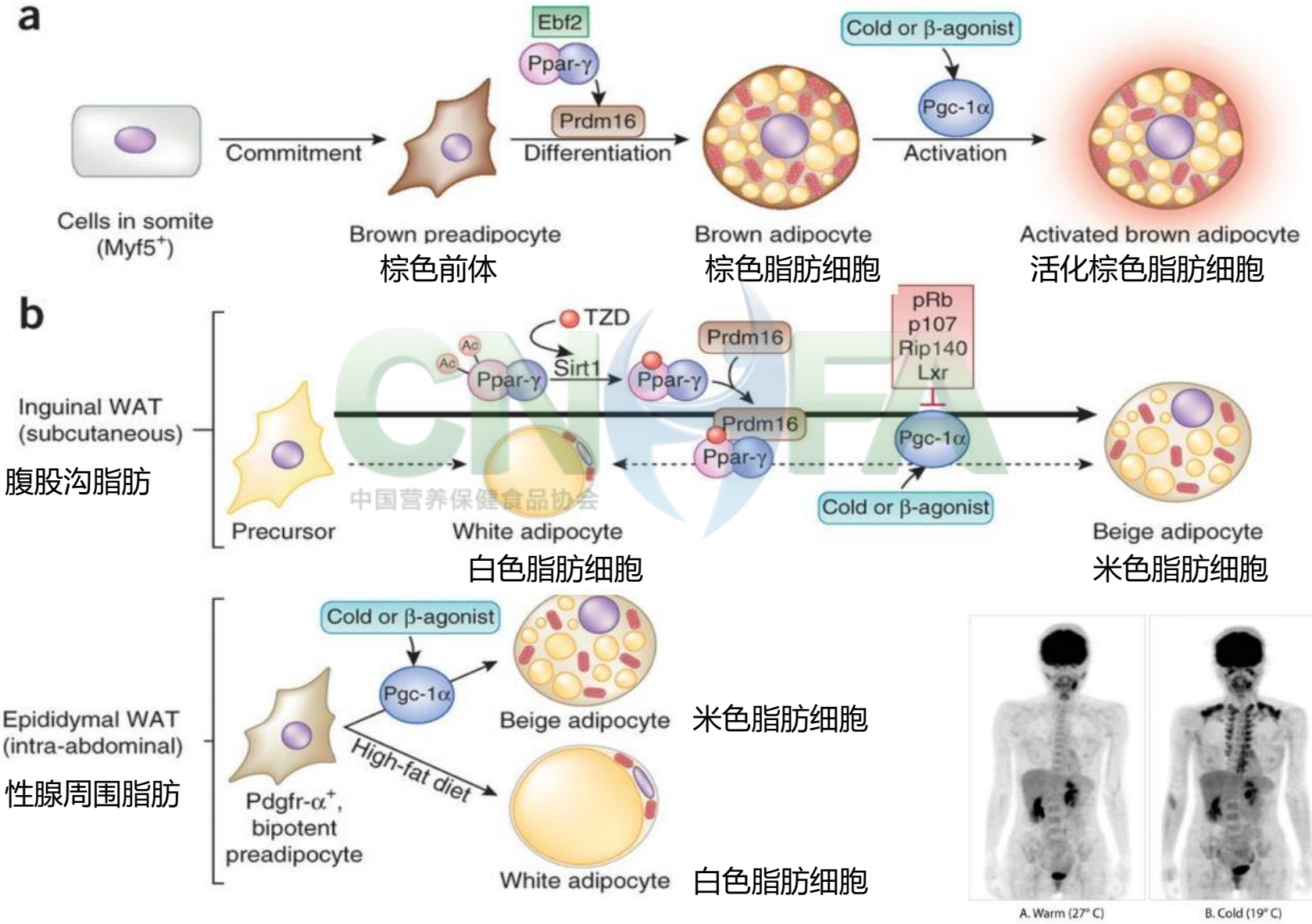
obesity reviews (2012) 13 (Suppl. 2), 83–96

脂肪细胞发育起源



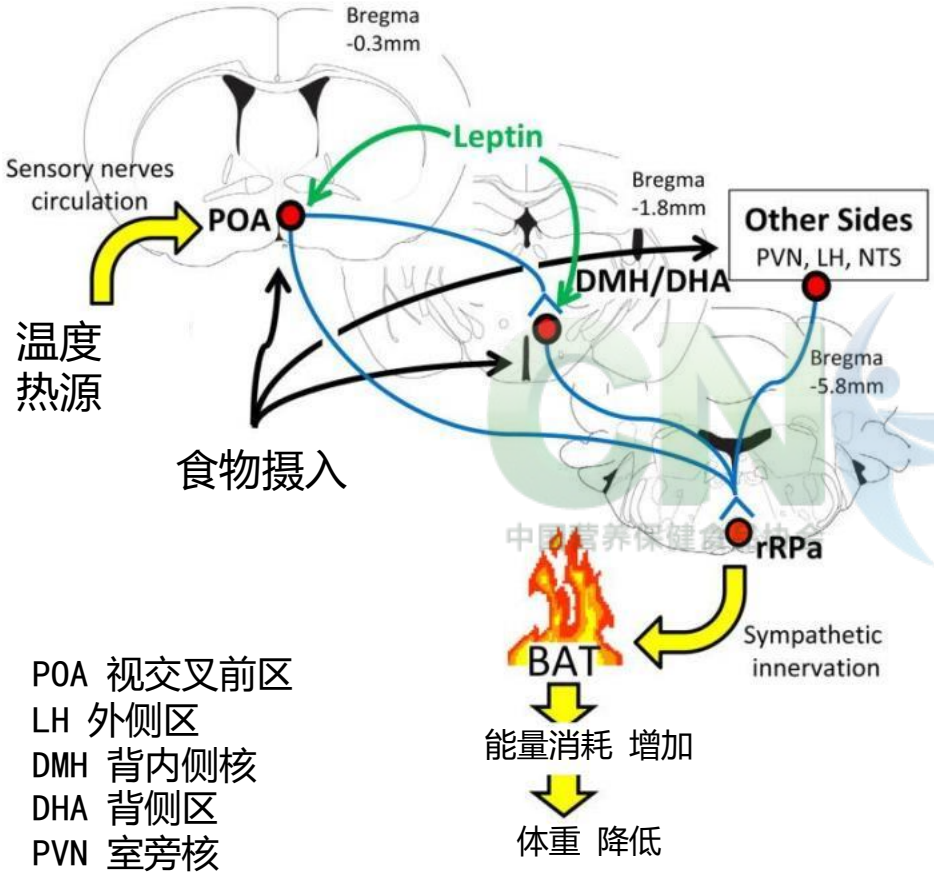
Genes Dev. 2013 Feb 1;27(3):234-50.

白色脂肪细胞可米色化而发挥脂肪燃烧功能

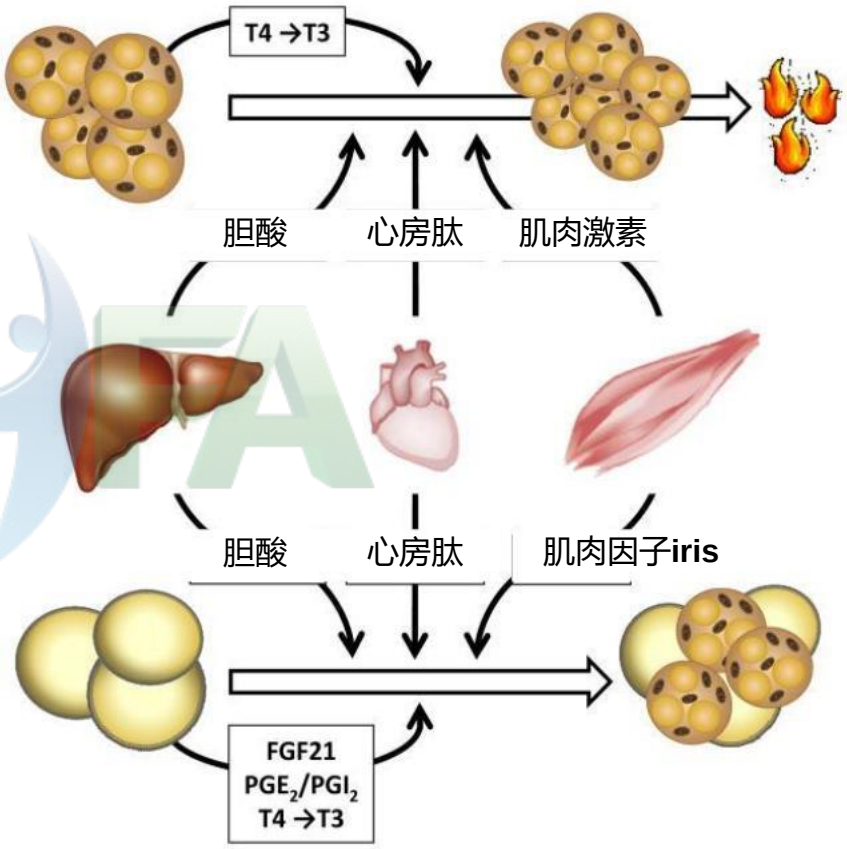


Nature Medicine Volume: 19, Pages: 1252–1263 (2013)

脂肪燃烧产热的中枢与外周调控

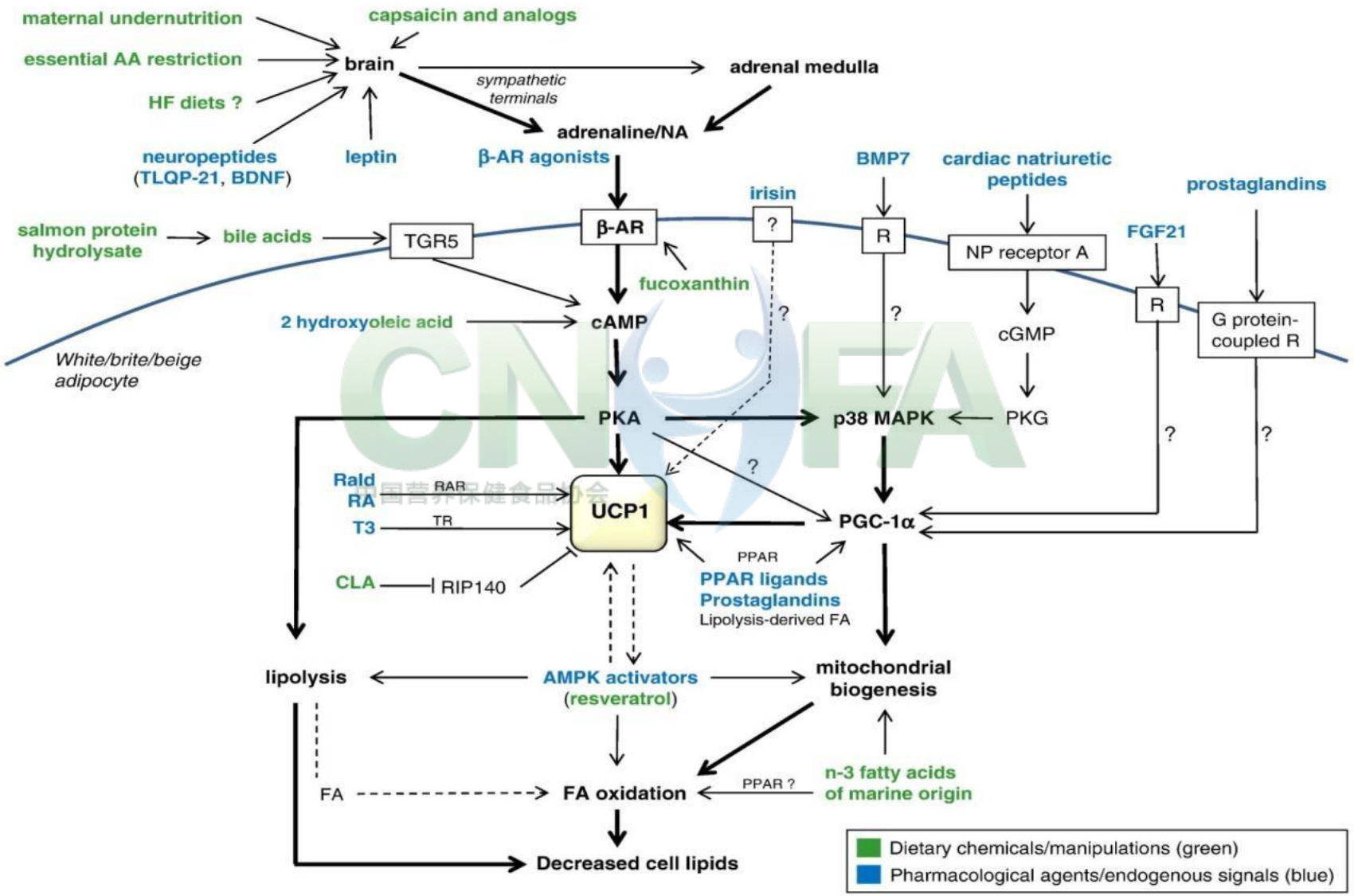


POA 视交叉前区
LH 外侧区
DMH 背内侧核
DHA 背侧区
PVN 室旁核
NTS延髓孤束核
ARC 弓状核
rRPa 苍白核



Endocrinol Metab Clin North Am. Mar 2013; 42(1): 89–107.

影响棕色脂肪细胞产热的食物、药物等因子



Biochimica et Biophysica Acta (BBA) - Molecular and Cell Biology of Lipids, 2013; 1831(5): 969 - 985

促使白色脂肪转化的药物和内源性信号因子

因子/信号	BAT激活	WAT棕色化
B肾上腺素能激活剂	+	+
瘦素	+	+
TLQP-21	+	++
脑源性神经营养因子	+	++
前列腺素	−	+
心房肽	+	+
PPARγ 配体	+	+
PPARα 配体	+	+
视黄醇	+	+
甲状腺素	+	+
AMPK 激活剂	−	?
Irisin	−	+
纤维生长因子**-21**	+	++
骨形成蛋白**-7**	+	?

Biochimica et Biophysica Acta (BBA) - Molecular and Cell Biology of Lipids, 2013; 1831(5): 969 - 985

促使白色脂肪转化的食物营养素和活性因子

膳食成分	BAT 激活	WAT 棕色化	Observations
蛋氨酸减少	+	+	
亮氨酸减少	+	?	UCP1 was not measured, but other changes reported in are consistent with WAT browning.
母亲营养低下	−	+	Transient phenomenon, as UCP1-positive multilocular adipocytes disappear shortly after weaning (around postnatal day 21)
高脂饮食	+	− in mice? + in rats?	Most studies in mice indicate down-regulation of *Ucp1* in WAT after HFD, whereas the two studies identified in rats indicate up-regulation.
辣椒素	+	+	
岩藻黄质	+	++	
蓖麻油酸	−	+	
大马哈鱼蛋白水解物(SHP)	+	+	When substituting for casein as the dietary protein source, SHP elevates plasma bile acid levels in the rat
共轭亚油酸	−	+	
n − 3 脂肪酸	+	?	n − 3 PUFA feeding induced mitochondrial oxidative metabolism without inducing *Ucp*1 in WAT of mice
白藜芦醇	+	?	*In vivo* data supporting a WAT browning effect is lacking. It may enhance WAT oxidative metabolism without inducing *Ucp1*.
扇贝粉	−	+	

Biochimica et Biophysica Acta (BBA) - Molecular and Cell Biology of Lipids, 2013; 1831(5): 969 - 985

肥胖病因及高危因素

儿童病理型（内源性endogenous）肥胖相关疾病

综合征	特征性临床表现
Alström 综合征	性腺功能低下、视神经变性、耳聋、糖尿病
Bardet-Biedl综合征	视神经变性、并指（趾）、多指（趾）、性腺功能低下、精神发育迟滞、常染色体隐性遗传
Carpenter综合征	并指（趾）、多指（趾）、颅缝早闭、精神发育迟滞
Cohen综合征	轻度儿童期开始肥胖、身材矮小、肌张力减退、精神发育迟滞、小头、视功能下降
Cushing综合征	肾上腺增生或垂体瘤
染色体9q 34缺失	早发型肥胖、精神发育迟滞、头型宽短、一字眉、下颌前突、行为和睡眠障碍
ENPP1 基因突变	位于染色体6q、胰岛素抵抗、儿童期肥胖
Fröhlich综合征	下丘脑瘤
高胰岛素血症	胰岛细胞增生、胰腺瘤、低血糖、Mauriac 综合征
瘦素及瘦素受体基因突变	罕见、早发严重肥胖、不育 (低促性腺激素型性腺功能减退症)、瘦素治疗有效
MC4受体基因突变	早发严重肥胖、身高增长快速、食欲亢进、高胰岛素血症、纯合子较杂合子严重、相对常见
脊髓发育不良	脊柱裂
Prader-Willi综合征	新生儿肌无力、出生后正常生长、手和脚小、精神发育迟滞、性腺功能低下、15号染色体部分缺失、 食欲亢进而发生严重肥胖、生长激素释放肽ghrelin水平异常升高。
促阿片-黑素细胞皮质素原缺乏	肥胖、红头发、肾上腺功能不全、高胰岛素原血症
假性甲状旁腺功能低下	低血钙、皮下组织钙化
Turner综合征	卵巢发育不良、淋巴水肿、颈蹼、X单染色体
黑色棘皮症(acanthosis nigricans)	特定的好发部位如腋窝、颈部等，出现污褐色到灰色的色素性、乳头瘤病样角化性皮损；糖耐量和胰岛素异常

肥胖及其并发症相关基因

基因	全称	染色体位置	研究报道数	P值
ACE	Angiotensin I-converting enzyme (peptidyl-dipeptidase A) 1	17q24.1	6	0.05–0.0023
ADIPOQ	Adiponectin, C1Q and collagen domain containing	3q27	11	0.05–0.001
ADRB2	Adrenergic, beta-2-, receptor, surface	5q31–q32	20	0.05–0.0001
ADRB3	Adrenergic, beta-3-, receptor	8p12–p11.2	29	0.05–0.001
DRD2	Dopamine receptor D2	11q23.2	5	0.03–0.002
GNB3	Guanine nucleotide binding protein (G protein), beta polypeptide 3	12p13.31	14	0.05–0.001
HTR2C	5-hydroxytryptamine (serotonin) receptor 2C	Xq24	10	0.05–0.0001
IL6	Interleukin 6 (interferon, beta 2)	7p21	6	0.03–0.003
INS	Insulin	11p15.5	7	0.05–0.0002
LDLR	Low density lipoprotein receptor (familial hypercholesterolaemia)	19p13.2	5	0.04–0.001
LEP	Leptin (obesity homologue, mouse)	7q31.3	10	0.05–0.003
LEPR	Leptin receptor	1p31	16	0.04–0.0001
LIPE	Lipase, hormone-sensitive	19q13.2	5	0.05–0.002
MC4R	Melanocortin 4 receptor	18q22	8	0.04–0.002
NR3C1	Nuclear receptor sub-family 3, group C, member 1 (glucocorticoid receptor)	5q31	10	0.05–0.001
PLIN	Perilipin	15q26	5	0.05–0.0008
PPARG	Peroxisome proliferative activated receptor, gamma	3p25	30	0.05–0.001
RETN	Resistin	19p13.2	5	0.048–0.001
TNF	Tumor necrosis factor (TNF superfamily, member 2)	6p21.3	9	0.05–0.004
UCP1	Uncoupling protein 1 (mitochondrial, proton carrier)	4q28–q31	10	0.05–0.001
UCP2	Uncoupling protein 2 (mitochondrial, proton carrier)	11q13.3	11	0.05–0.001
UCP3	Uncoupling protein 3 (mitochondrial, proton carrier)	11q13	12	0.049–0.0005

瘦素与肥胖

ob/ob

1994年 Friedman 小组成功克隆肥胖基因（**ob**基因），标志着对肥胖的研究进入了分子时代；随后发现**ob**基因的表达产物瘦素**(leptin)**具有广泛生物学功能。

单纯型肥胖时脂肪组织表达分泌瘦素增多、血浆瘦素水平升高，瘦素抵抗。

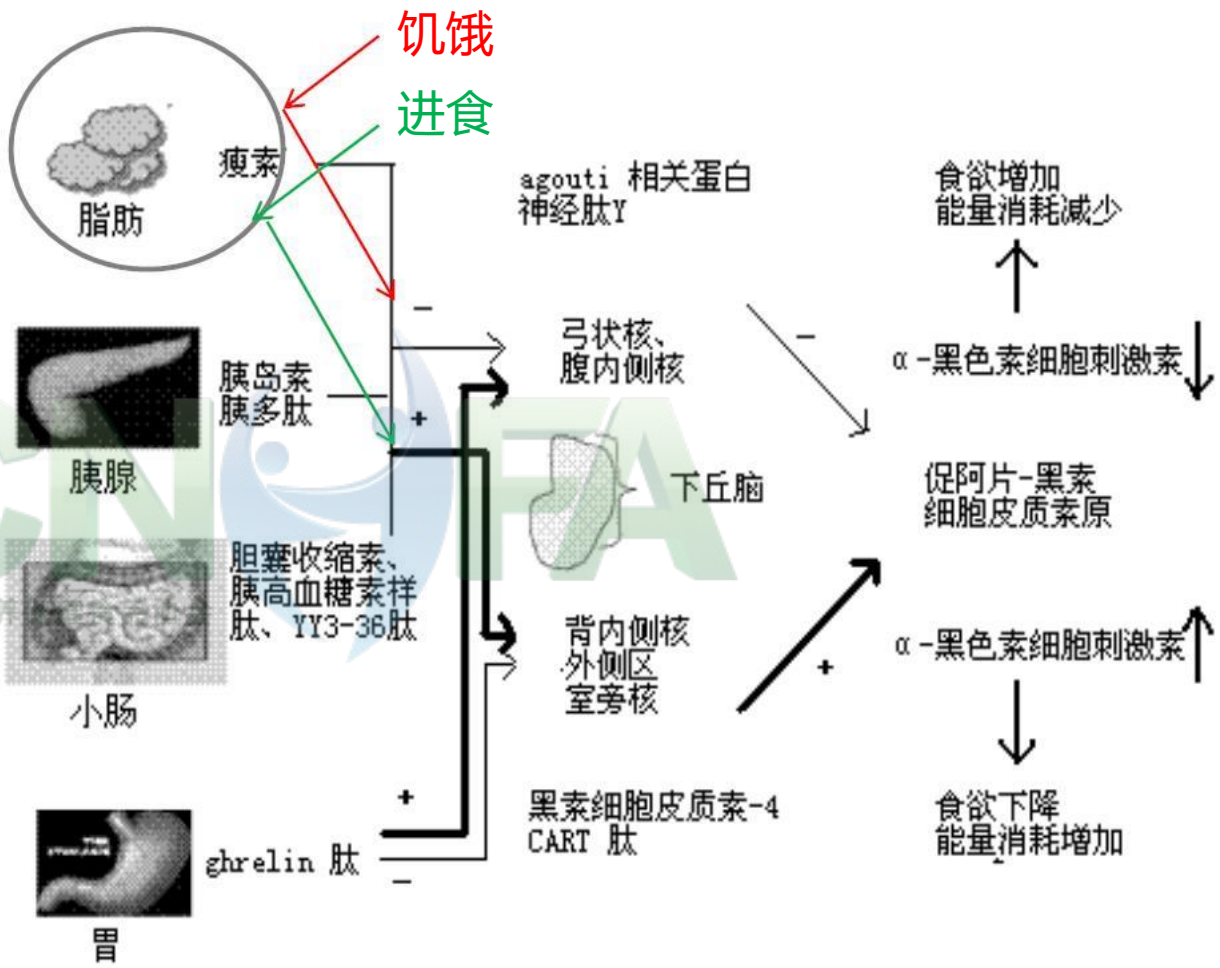
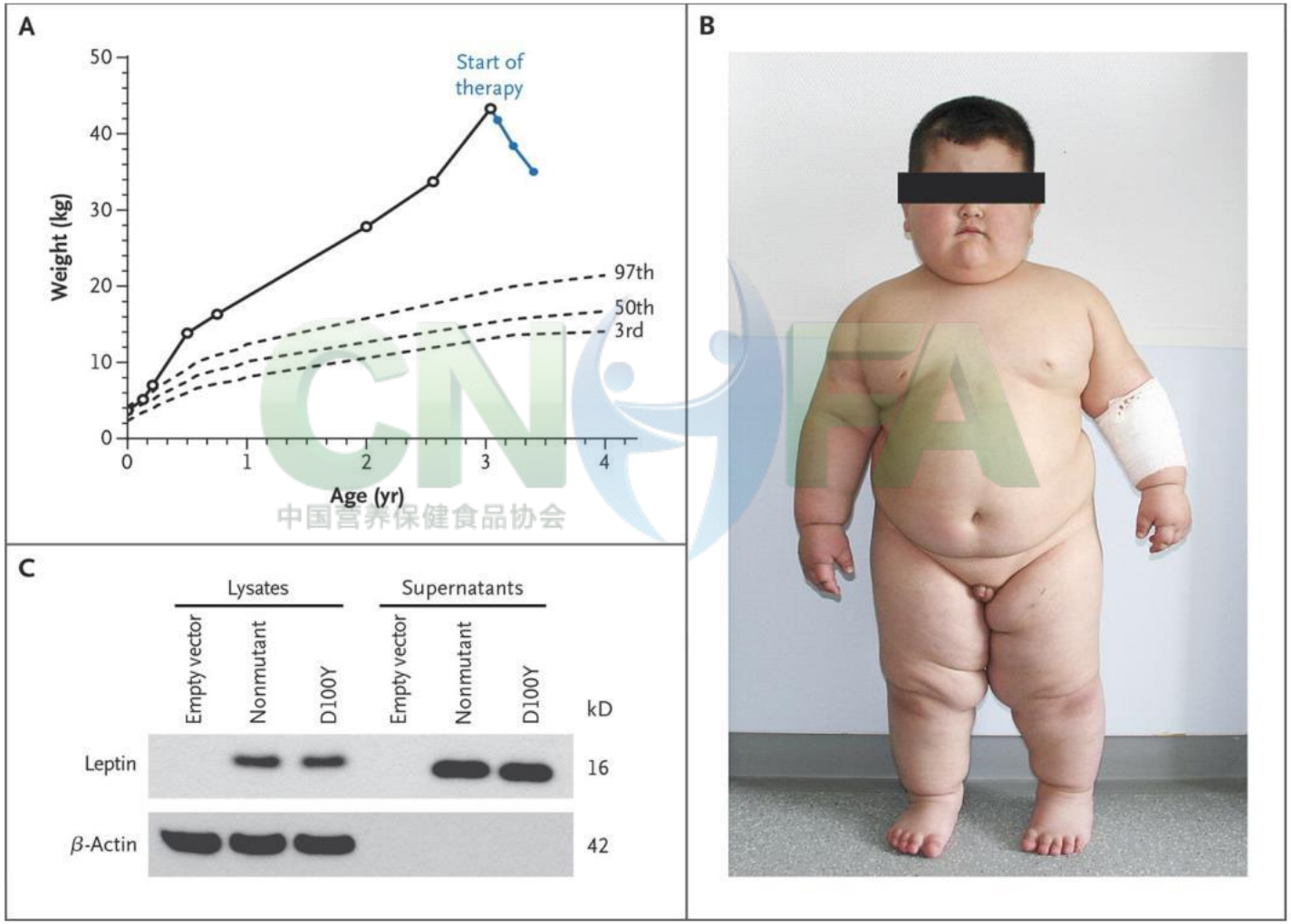


图 1. 体重的神经内分泌分子调控机制

A Boy with a Novel Mutation in the Leptin Gene
(瘦素基因突变)



Wabitsch M et al. N Engl J Med 2015;372:48-54.

儿童单纯型(特发性idiopathic)肥胖

环境因素 ⇌ 遗传因素

- 膳食平衡失调：高糖、高脂摄入过量
- 体力活动减少
- 心理行为异常

儿童期躯体、情感和性虐待，情感忽视、躯体忽视，家庭功能不良，幼儿园小伙伴关系，学校同学关系；

睡眠时间少

- 肠道微生态异常
- 生命早期不良营养状态

-- 父母均肥胖，子女患肥胖的几率为**80%**；

-- 父母中一方肥胖，子女肥胖的几率为**40%**，其中母亲肥胖的儿童患肥胖的概率是非肥胖母亲儿童的**2.5**倍；

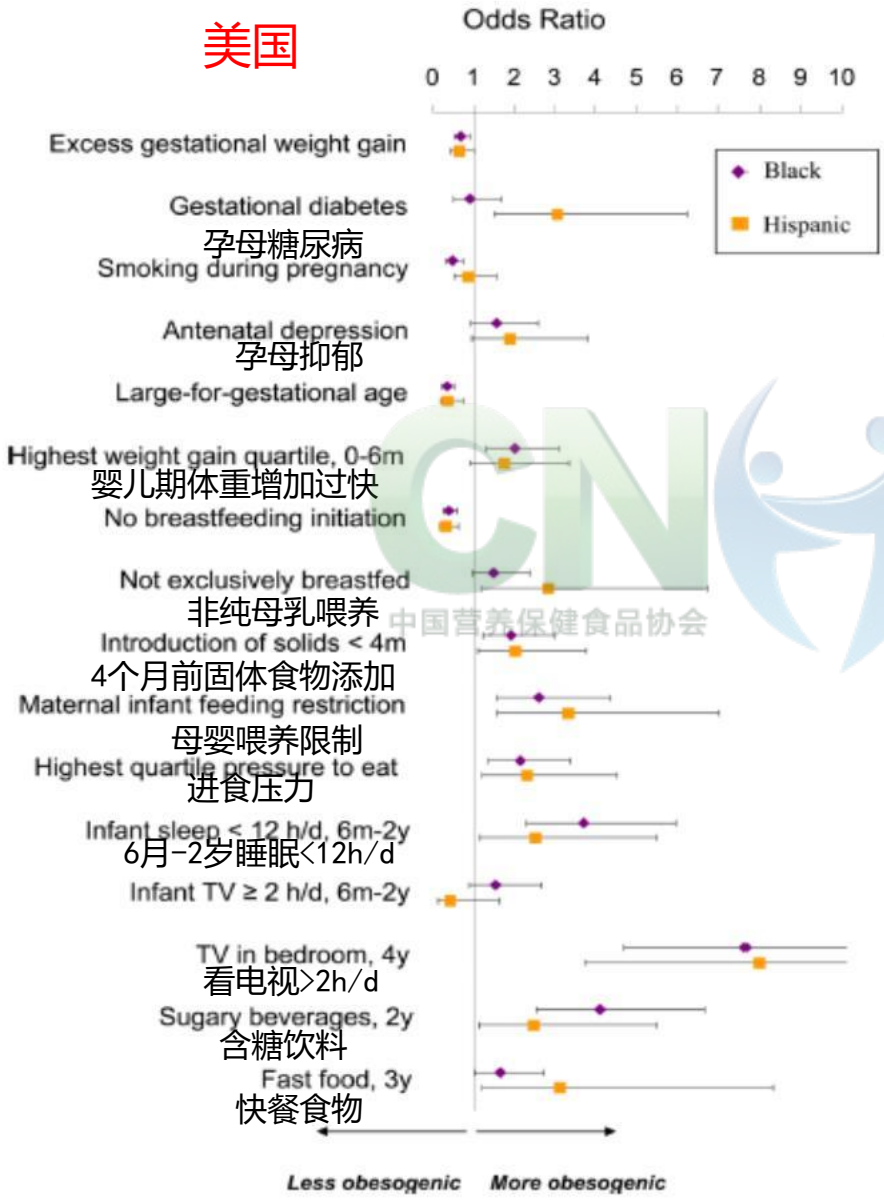
-- 父母均正常，子女肥胖的几率则降为**7%**。

多基因参与肥胖发生：能量摄入基因、能量消耗基因、脂肪细胞储存脂肪基因、肥胖并发症相关基因

表观遗传

肥胖发生高危因素

美国



深圳

父亲肥胖

母孕期体重增加>15 kg

出生体重>4 kg

不健康零食>1次/周

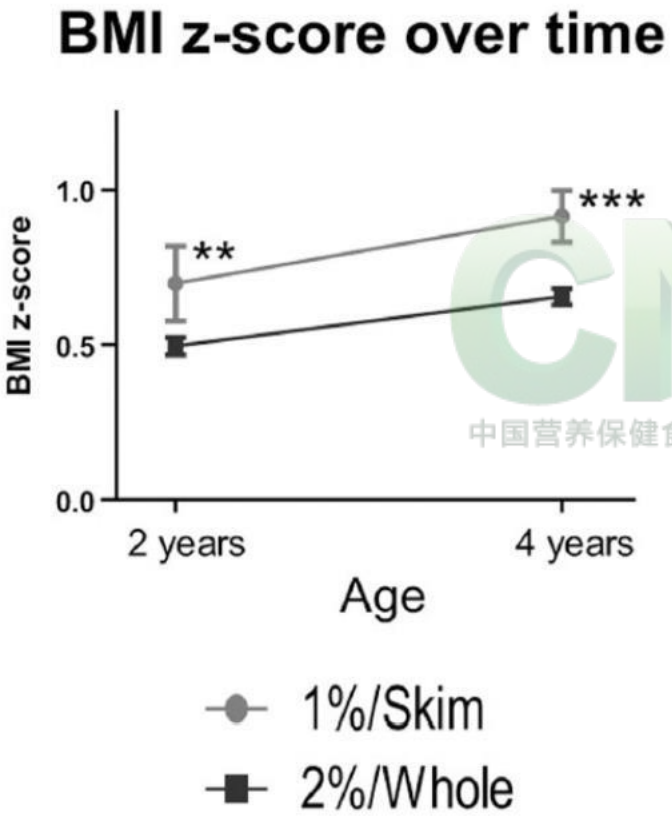
看电视>2 小时/天

中南大学学报, 2010; 35(1):11

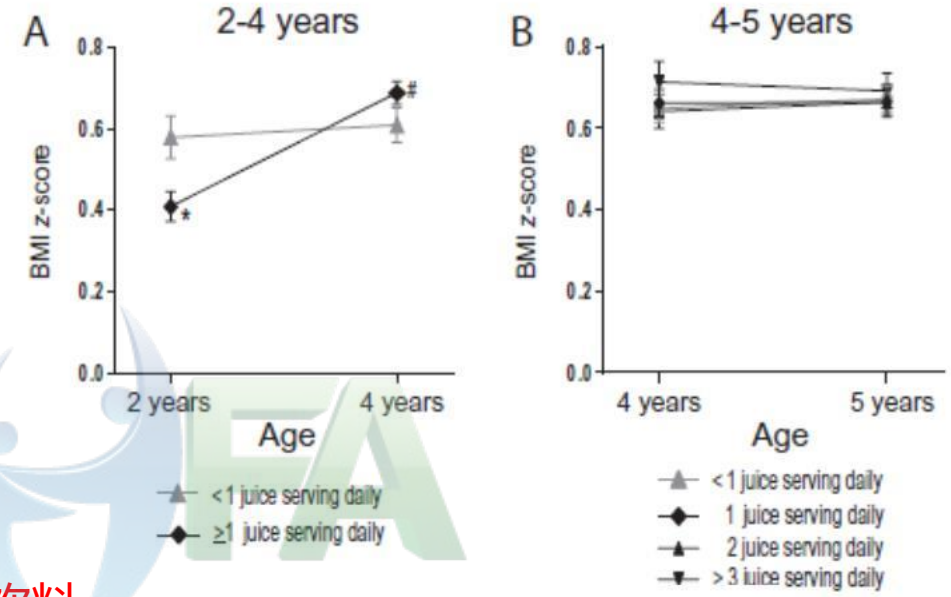
Pediatrics. 2010 April ; 125(4): . doi:10.1542/peds.2009-2100.

低脂奶与过量糖摄入增加肥胖风险

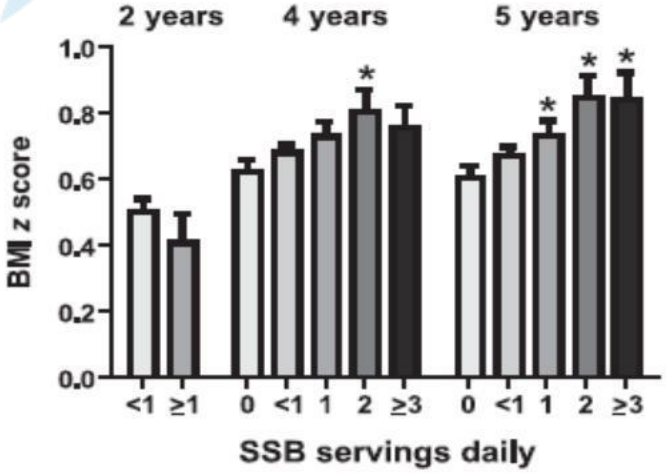
低脂奶



果汁



加糖饮料

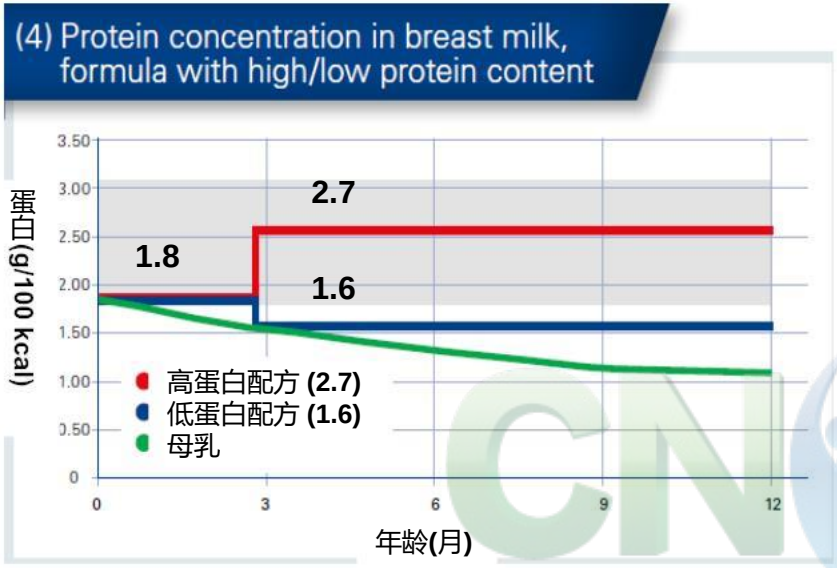


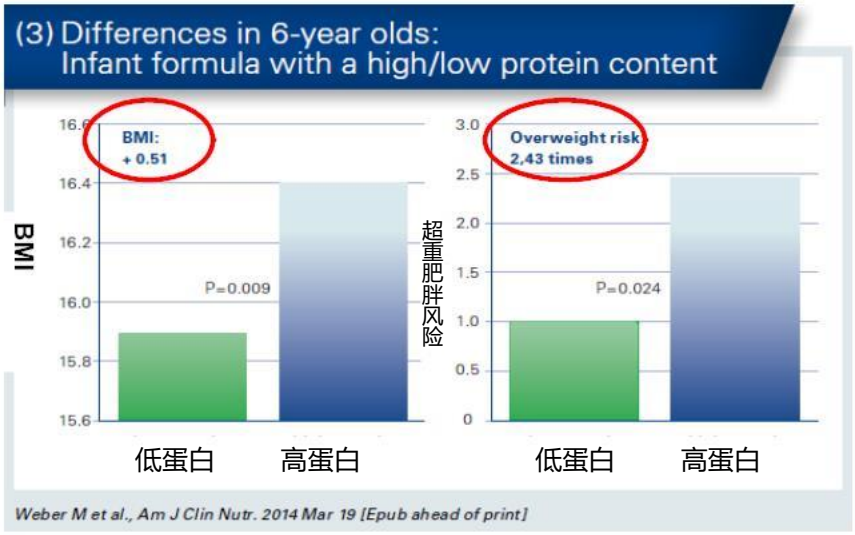
Arch Dis Child. 2013 May;98(5):335-40.

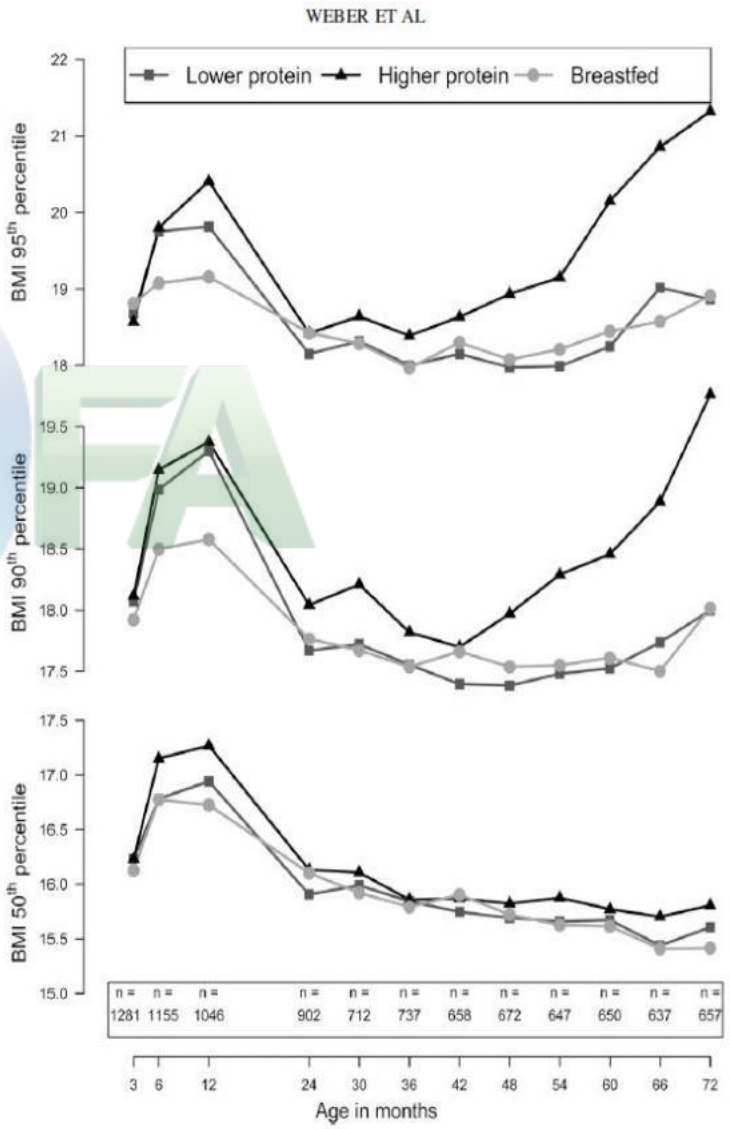
Pediatr Obes. 2016 Jun;11(3):221-7.

Pediatrics 2013;132:413–420

婴儿期高蛋白配方奶粉增加6岁肥胖发生风险

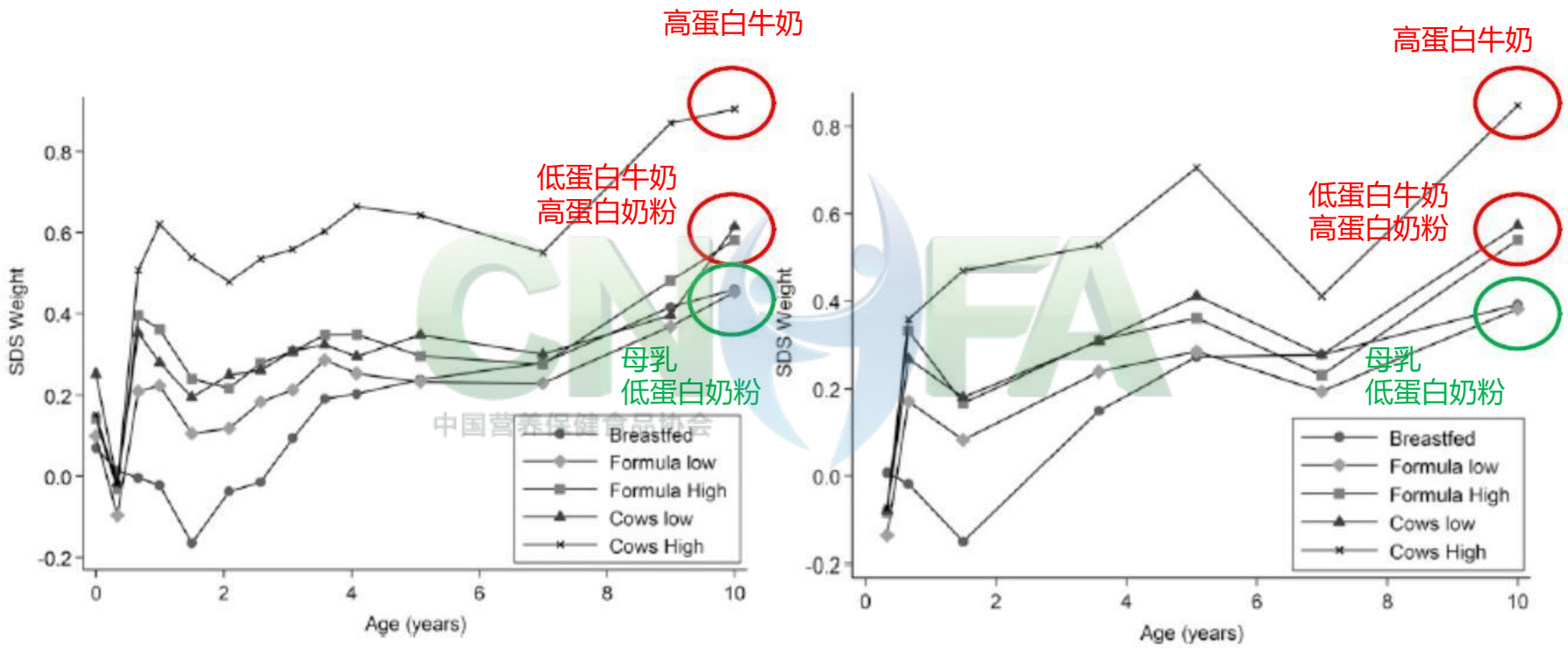






Am J Clin Nutr 2014;99:1041–51.

婴儿期高蛋白配方奶粉增加儿童期肥胖发生风险



婴儿8个月前喂养鲜奶和高蛋白配方奶粉，10岁时体重要比低蛋白配方奶粉和母乳喂养者显著升高

Am J Clin Nutr 2015;102:1096–103.

蛋白质：高蛋白配方奶粉支链氨基酸促进脂肪生成

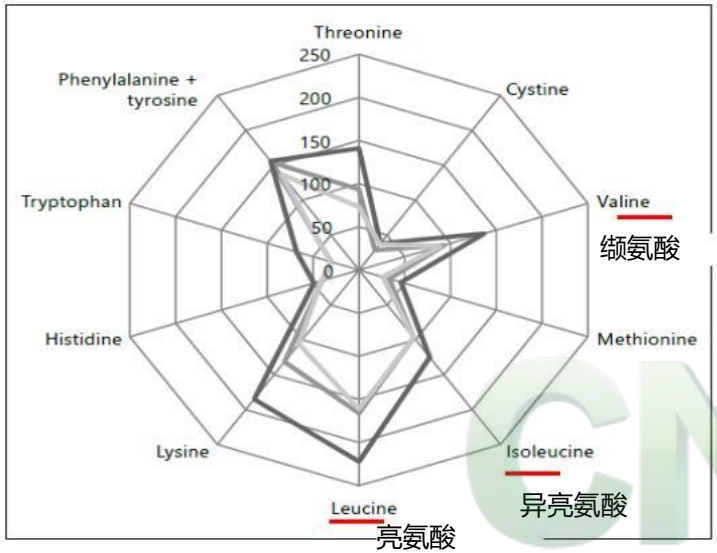
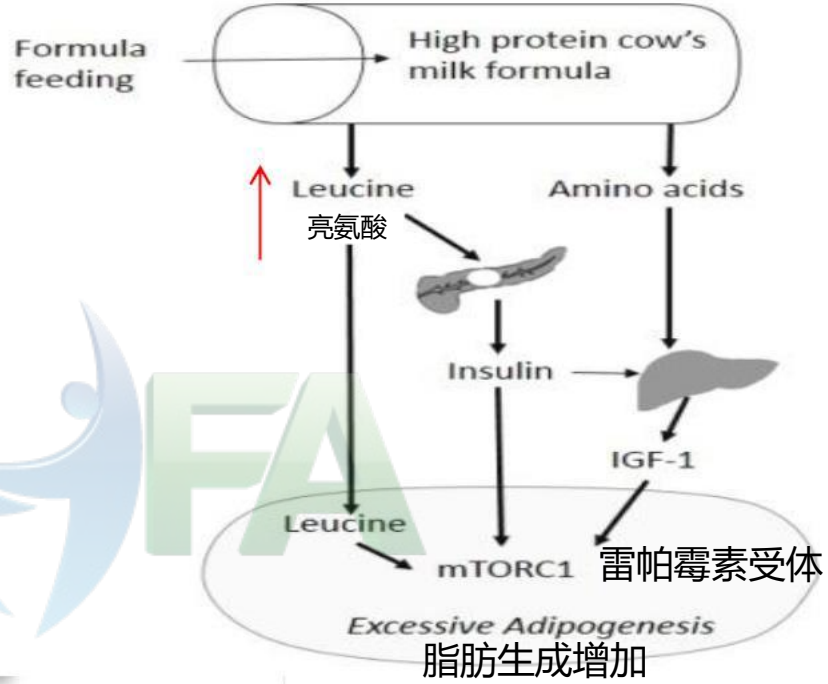
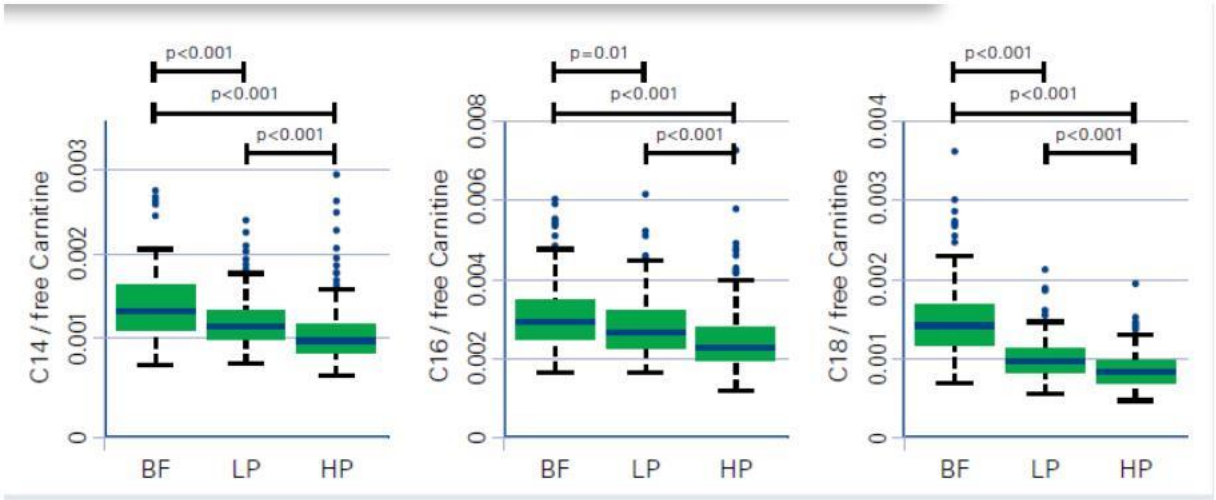


Fig. 2. Concentrations of essential amino acids (mg/100 kcal). Dark line = High-protein formula (2.7 g/100 kcal) [8]; grey line = low-protein formula (1.65 g/100 kcal) [8]; light-grey line = mature breast milk (59–135 days) [23].





高蛋白降低乙酰化肉碱与游离肉碱的比值，抑制脂肪酸的β氧化

Nutr Metab Insights. 2015; 8 (Suppl 1): 49–56
J Clin Endocrinol Metab, 2015, 100(1): 149–158

维生素D与肥胖发生 ？

-- 肥胖状态下维生素D水平降低；体重减轻10%后可使其水平升高，并且改善了胰岛素抵抗状态；

-- 同样剂量维生素D补充，肥胖者血浆D水平较正常低57%；

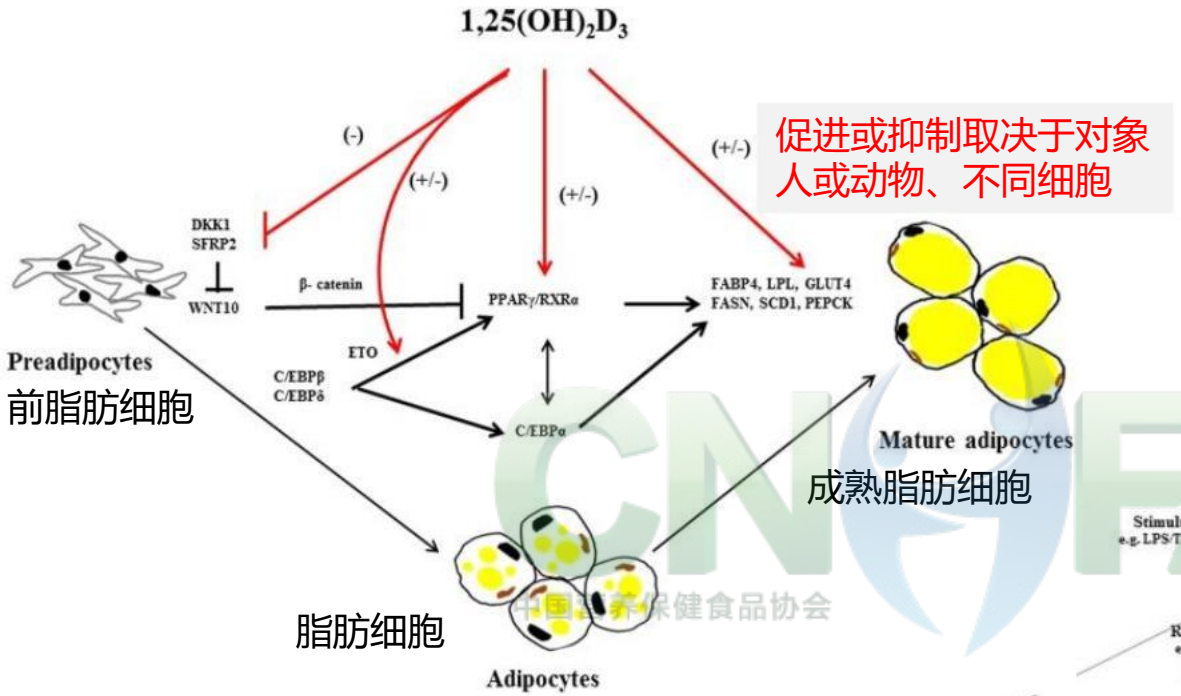
-- 维生素D受体基因敲除小鼠抵抗饮食诱导肥胖发生；

-- 维生素D受体过表达可促使脂肪聚集；

-- 维生素D对脂肪细胞增殖分化具有促进或抑制作用；

-- 维生素D可抑制炎性因子生成。

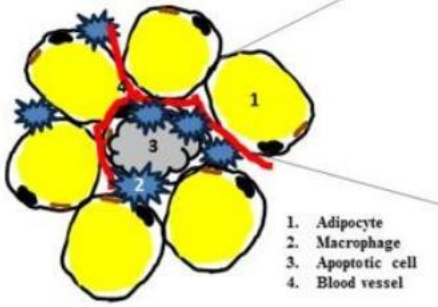
维生素D与脂肪细胞

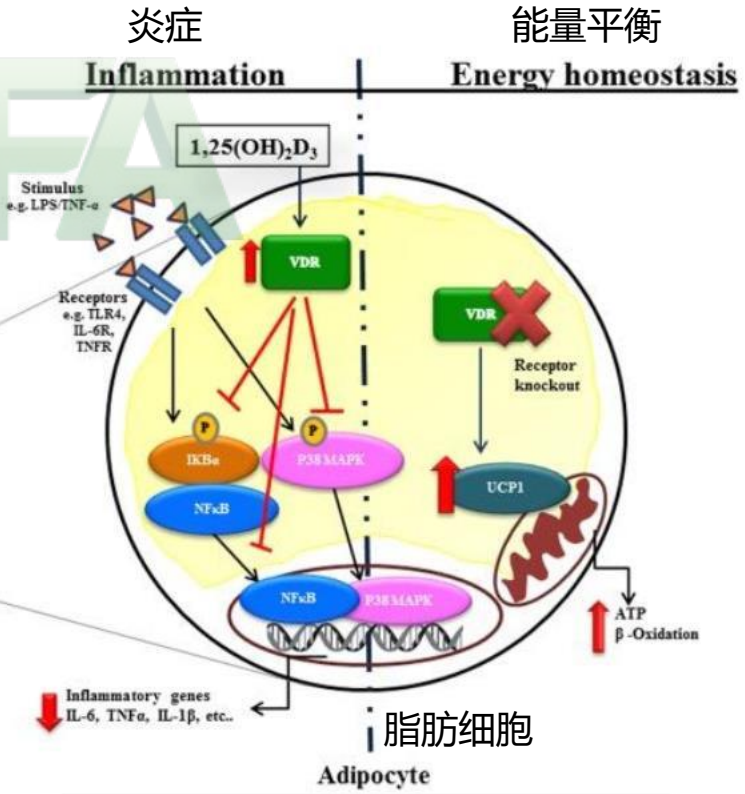


促进或抑制取决于对象人或动物、不同细胞

对成熟脂肪细胞炎症和能量的影响

对脂肪细胞分化的影响



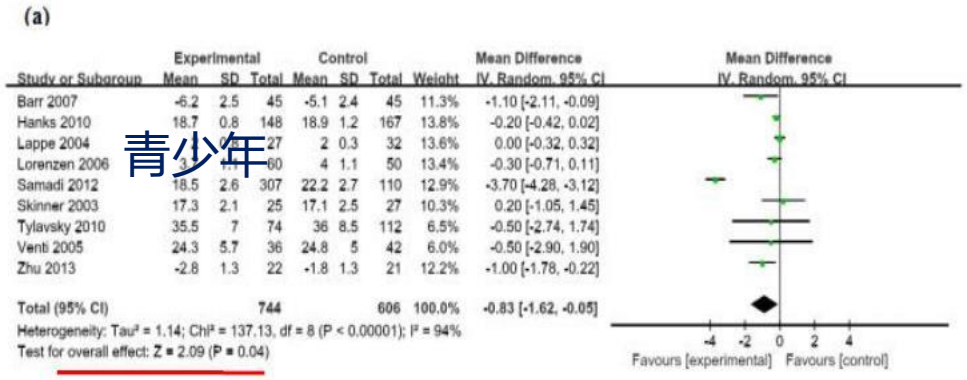


抑制炎性因子表达，促进β-氧化

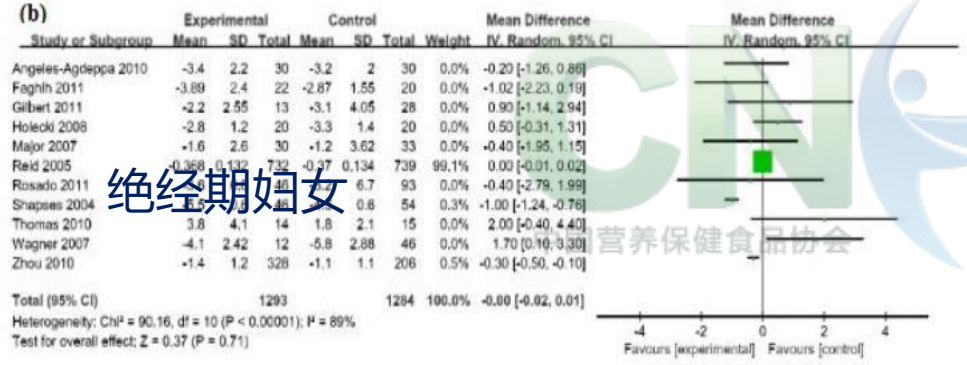
Front Physiol. 2014; 5: 228 .

钙摄入抑制青少年、成年人以及BMI正常者体重增加

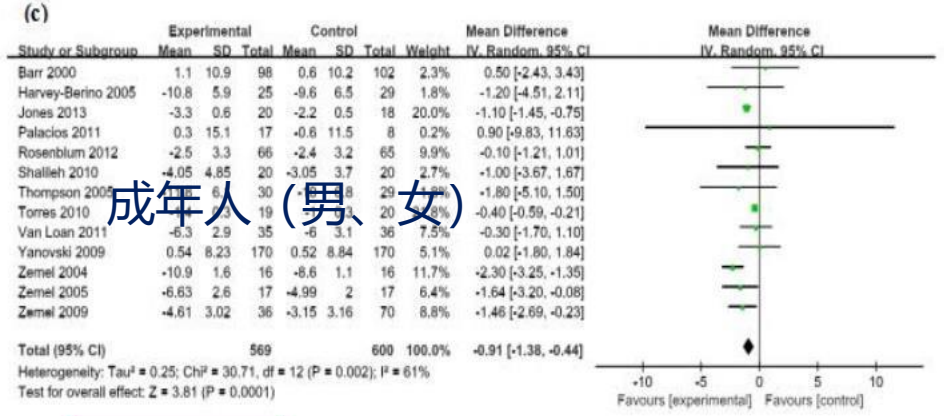
青少年



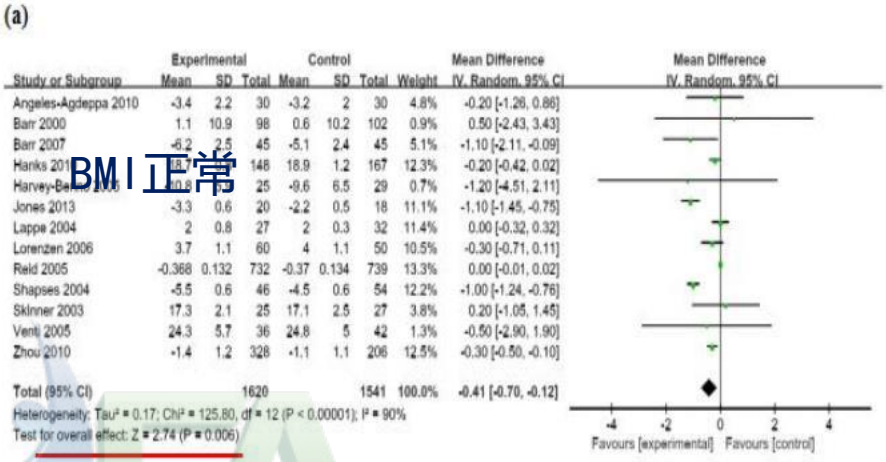
绝经期妇女



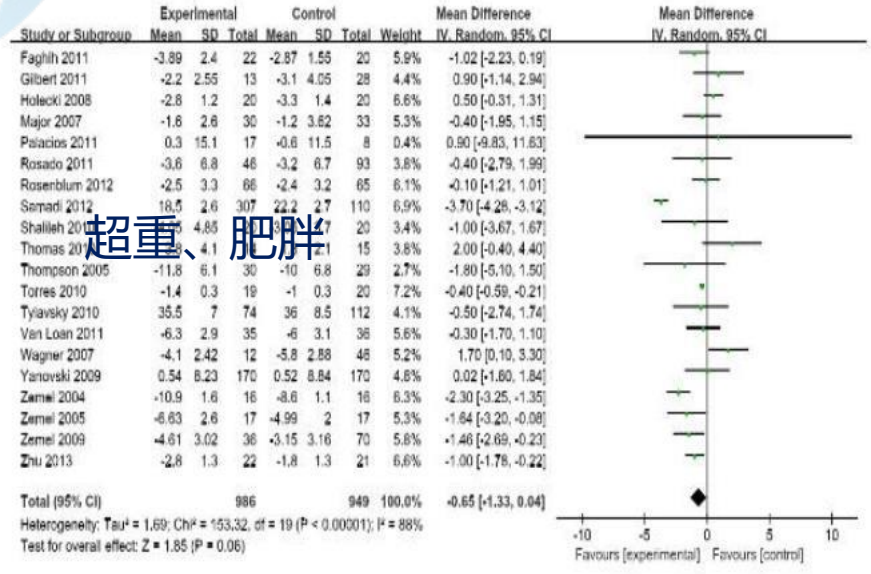
成年人（男、女）



BMI正常



超重、肥胖



肠道菌群与肥胖

- 应用低剂量抗菌素喂养家禽、家畜，以提高生长速度，已有50余年的历史。
- 关于肠道菌群与肥胖发生和能量代谢的关系，在近10年才得到发现与重视。

  --**Backhed 2004**年首先发现无菌小鼠不易肥胖；被定植普通小鼠肠道菌后，则出现肥胖。
- 人体肠道中定植着种类和数量极其庞大的细菌，其数量是人体细胞总数的10倍以上，赋予人类自身所没有的功能；它们与宿主长期共存，共同进化，为人体不可或缺的 微生物器官”。
- 主要组成：厚壁菌门、拟杆菌门、变形菌门、放线菌门、梭杆菌门、疣微菌门等，其中厚壁菌门和拟杆菌门占菌群总量的90%。
- 肥胖时厚壁菌门增加而拟杆菌门减少。

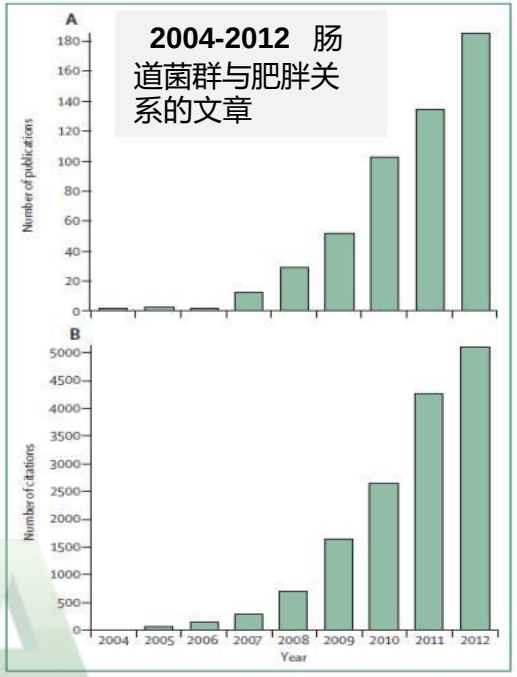
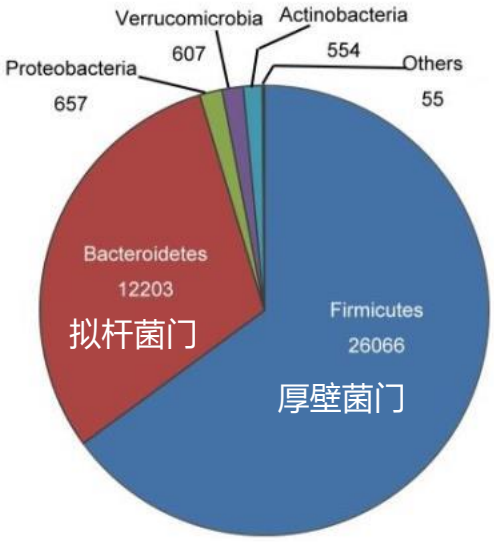


Figure 1: Published articles and citations on the topic of microbiota and obesity



肠道菌群发育与健康

RESEARCH ARTICLE SUMMARY

Gut Microbiota from Twins Discordant for Obesity Modulate Metabolism in Mice

READ THE FULL ARTICLE ONLINE
http://dx.doi.org/10.1126/science.1241214

Cite this article as V. K. Ridaura et al., Science 341, 1241214 (2013). DOI: 10.1126/science.1241214

Vanessa K. Ridaura, Jeremiah J. Faith, Federico E. Rey, Jiye Cheng, Alexis E. Duncan, Andrew L. Kau, Nicholas W. Griffin, Vincent Lombard, Bernard Henrissat, James R. Bain, Michael J. Muehlbauer, Olga Ilkayeva, Clay F. Semenkovich, Katsuhiko Funai, David K. Hayashi, Barbara J. [illegible] Wu

FIGURES IN THE FULL ARTICLE

Fig. 1. Reliable replication of human donor

REVIEW

nature

Home | News & Comment

Functional interactions between the gut microbiota and host metabolism

Valentina Tremaroli[1,2] & Fredrik Bäckhed[1,2,3]

The link between the microbiota, and the development of cardiovascular disease and metabolic syndromes, such as [illegible] coming clearer. However, the complexity of the microbial community, the functional [illegible] well understood. [illegible] and humans are helping to show what effect the gut microbiota [illegible] metabolism [illegible] from food and modulating dietary or the host-derived [illegible] host metabolism. [illegible] increased knowledge of the mechanisms involved in the inter-[illegible] the microbiota [illegible] we will be in a better position to develop treatments for metabolic disease.

RELATED ITEMS IN SCIENCE

A. W. Walker, J. Parkhill, Fighting obesity with bacteria. *Science* 341, 1069–1070 (2013). DOI: 10.1126/science.1243787

[illegible] were correlated with differences in fermentation of short-chain [illegible] metabolism of branched-chain amino acids (increased in Ob), and [illegible] bile acid species (increased in Ln and correlated with down-regulation of host farnesoid receptor signaling). Cohousing Ln and Ob mice prevented development of increased adiposity and body mass in Ob cage mates and transformed their microbiota's metabolic profile to a leanlike state. Transformation correlated with invasion of members of Bacteroidales from Ln into Ob microbiota. Invasion and phenotypic rescue were diet-dependent and occurred with the diet representing the lower tertile of U.S. consumption of saturated fats and upper tertile of fruits and vegetables but not with the diet representing the upper tertile of saturated fats and lower tertile of fruit and vegetable consumption. These results reveal that transmissible and modifiable interactions between diet and microbiota influence host biology.

A

B

Cohousing Ln and Ob mice prevents adiposity phenotype in Ob cage mates (Ob*). (A) The adiposity change after 1[illegible]

肠道菌群紊乱与肥胖、糖尿病等慢病密切相关

稳态失衡 → 炎性肠病、感染；过敏性疾病；肥胖、代谢综合征、糖尿病、脂肪肝；自闭症、ADHD、阿尔茨海默病

门
（科 / 属）

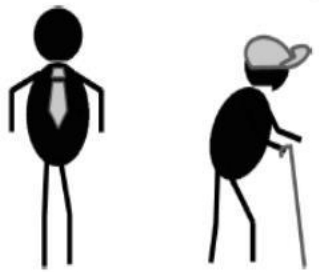
放线菌门
(*Bifidobacterium*)
变形菌门
(*Enterobacteriaceae*)
厚壁菌门
(*Clostridiaceae, Blautia, Faecalibacterium, Lactobacillus*)
拟杆菌门
(*Bacteroides*)

Inter-and intra-individual variations:
Genetic background
Diet-geographical habits
Health status
Physiological status

Infancy | Adultness | Elderly

New-born 6 mo 3 yr

Inter-and intra-individual variations:
Delivery mode
Feeding (breast *vs* formula)
Health status



World J Gastroenterol 2014; 20(41): 15163

婴儿期抗菌素应用增加肥胖发生风险

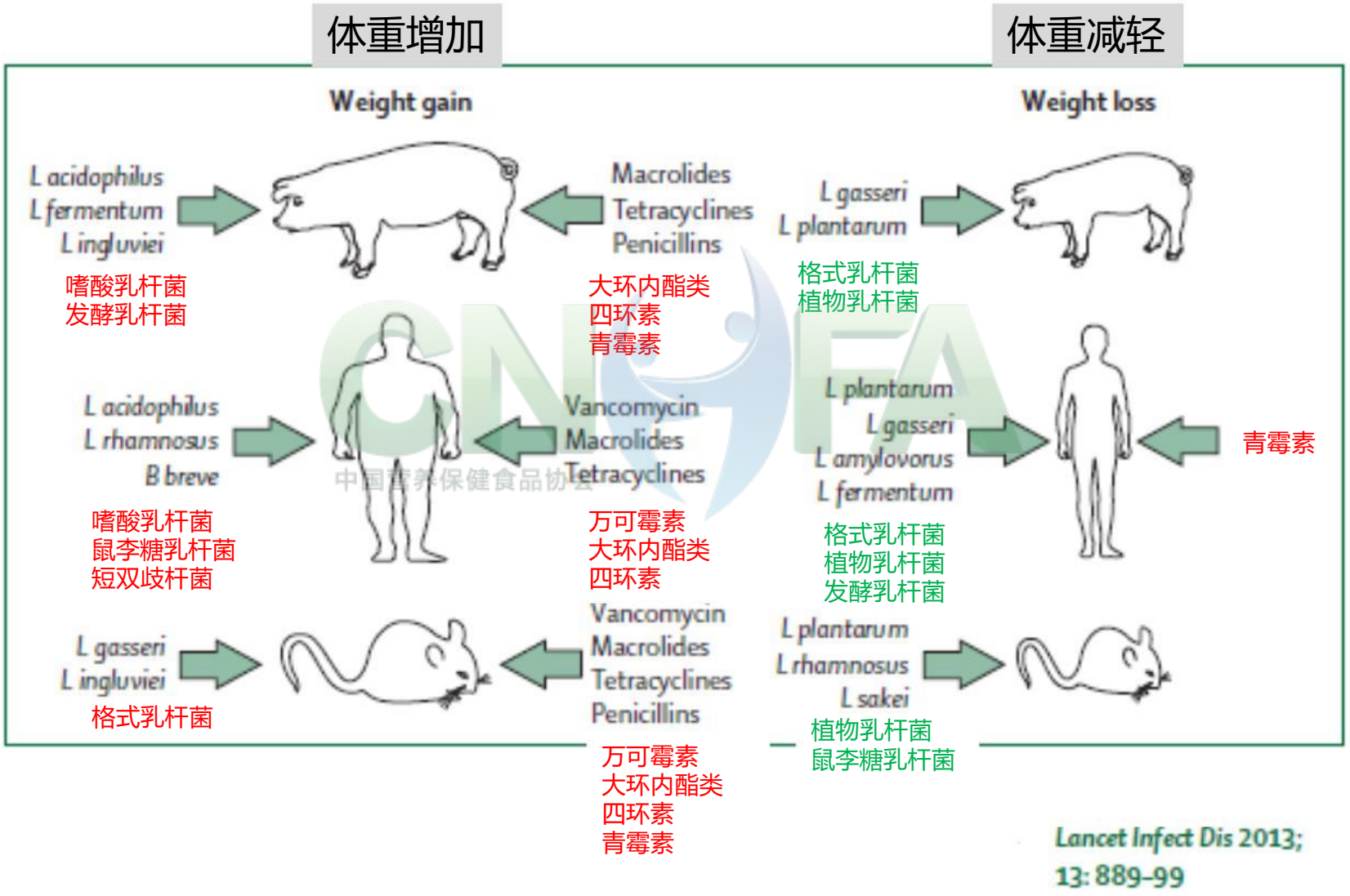
Table 5 Multivariable model assessing interaction variable of time of first antibiotic and number of antibiotic prescriptions with obesity

Exposure	Multivariable Analysis	
	No./Total(%)	OR, (95%CI)
No antibiotic exposures	345/6590 (5.2)	1.00
1-2 prescriptions with first exposure between 0-12 months	259/4279 (6.1)	1.18 (0.995-1.39)
3 or more prescriptions with first exposure between 0-12 months	377/4989 (7.6)	1.48 (1.27- 1.72)
1-2 prescriptions with first exposure between 12-24 months	210/4141 (5.1)	0.96 (0.81- 1.15)
3 or more prescriptions with first exposure between 12-24 months	67/828 (8.1)	1.60 (1.22-2.10)

出生后0-12个月或者12-24个月内，3次或以上抗菌素暴露，4岁时肥胖风险增加

Gastroenterology (2016), doi: 10.1053/j.gastro.2016.03.006.

益生菌、抗菌素应用与肥胖发生



Lancet Infect Dis 2013;
13: 889-99

可用于食品的菌种（卫办监督发〔2010〕65号）

	名称	拉丁学名
一	双歧杆菌属	*Bifidobacterium*
1	青春双歧杆菌	*Bifidobacterium adolescentis*
2	动物双歧杆菌（乳双歧杆菌）	*Bifidobacterium animalis*（*Bifidobacterium lactis*）
3	两歧双歧杆菌	*Bifidobacterium bifidum*
4	短双歧杆菌	*Bifidobacterium breve*
5	婴儿双歧杆菌	*Bifidobacterium infantis*
6	长双歧杆菌	*Bifidobacterium longum*
二	乳杆菌属	*Lactobacillus*
1	嗜酸乳杆菌	*Lactobacillus acidophilus*
2	干酪乳杆菌	*Lactobacillus casei*
3	卷曲乳杆菌	*Lactobacillus crispatus*
4	德氏乳杆菌保加利亚亚种（保加利亚乳杆菌）	*Lactobacillus delbrueckii* subsp. *Bulgaricus*（*Lactobacillus bulgaricus*）
6	发酵乳杆菌	*Lactobacillus fermentium*
7	格氏乳杆菌	*Lactobacillus gasseri*
8	瑞士乳杆菌	*Lactobacillus helveticus*
9	约氏乳杆菌	*Lactobacillus johnsonii*
10	副干酪乳杆菌	*Lactobacillus paracasei*
11	植物乳杆菌	*Lactobacillus plantarum*
12	罗伊氏乳杆菌	*Lactobacillus reuteri*
13	鼠李糖乳杆菌	*Lactobacillus rhamnosus*
14	唾液乳杆菌	*Lactobacillus salivarius*
三	链球菌属	*Streptococcus*
1	嗜热链球菌	*Streptococcus thermophilus*

注：1.传统上用于食品生产加工的菌种允许继续使用。名单以外的、新菌种按照《新资源食品管理办法》执行。

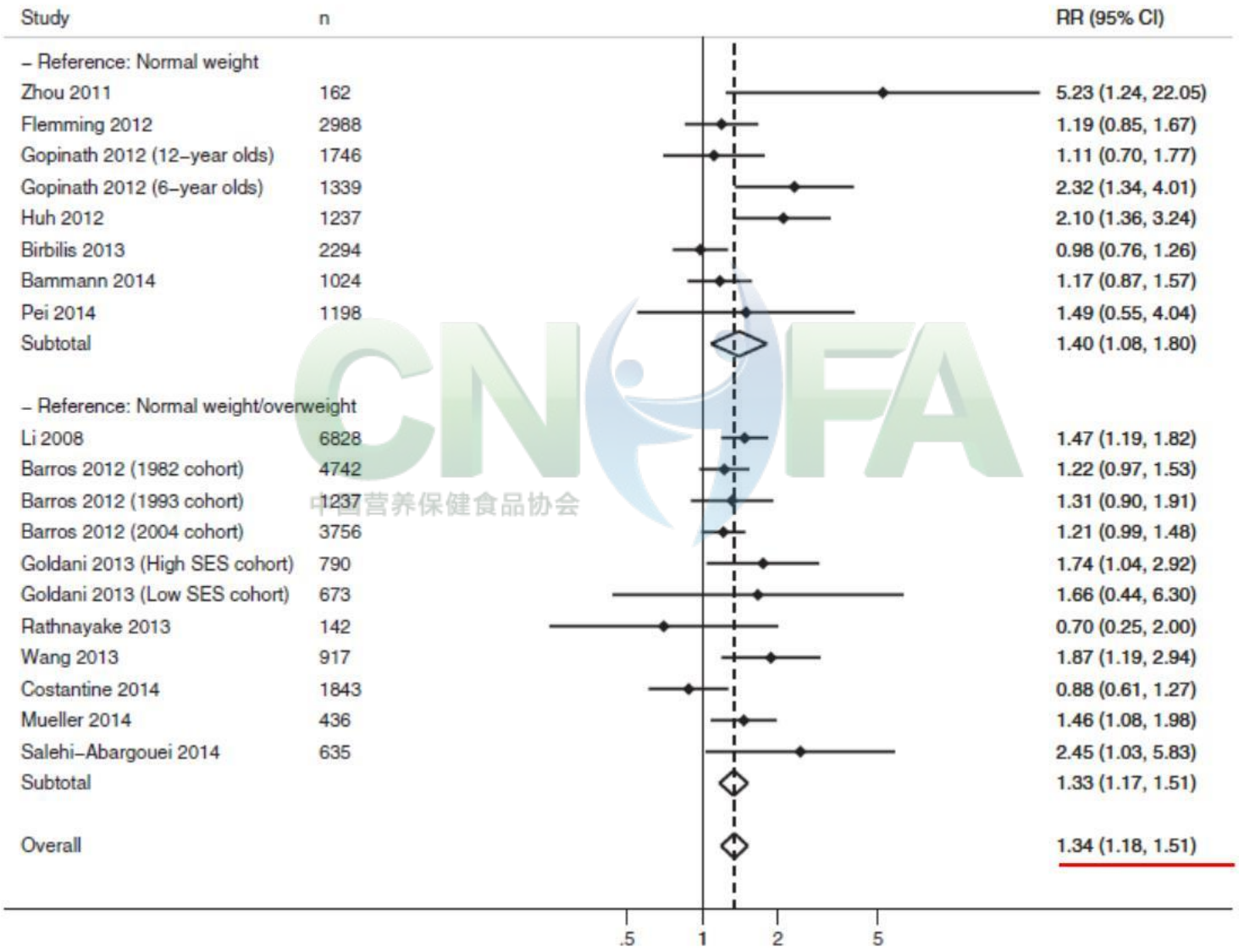
2.可用于婴幼儿食品的菌种按现行规定执行，名单另行制定。

标准的制定，更多的基于对肠道致病菌抑制，对营养低下、腹泻、过敏性疾病等改善方面的研究证据；那么这些有益菌是否会增加肥胖发生的风险，亟待研究。

可用于婴幼儿食品的菌种（2011. 10；2016. 06）

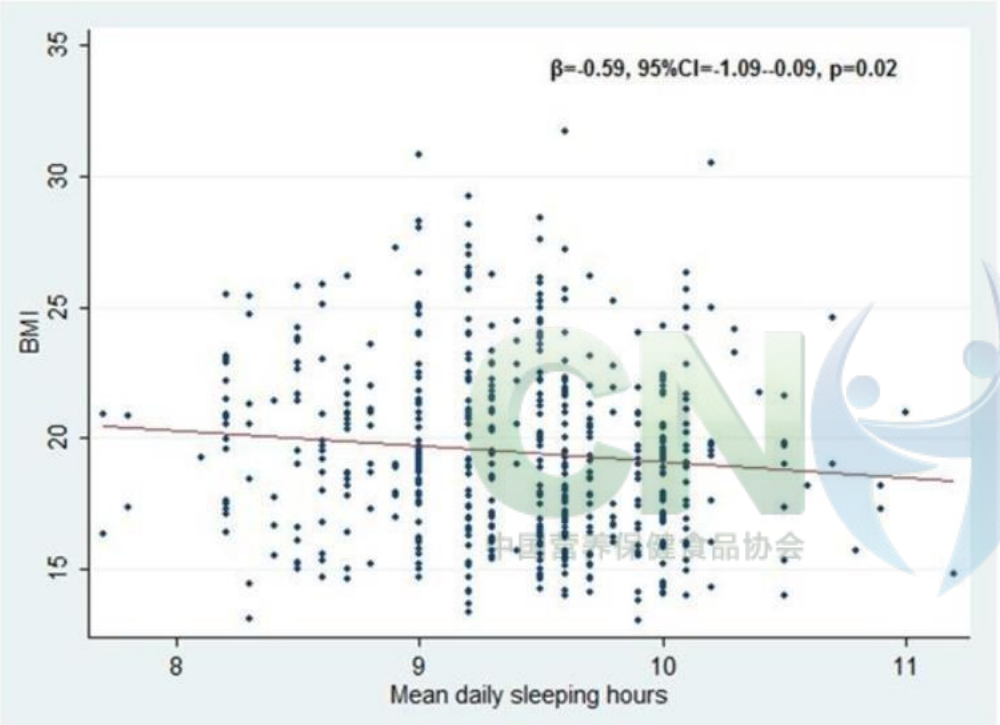
菌种名称	拉丁学名	菌株号
嗜酸乳杆菌*	*Lactobacillus acidophilus*	NCFM
动物双歧杆菌	*Bifidobacterium animalis*	Bb-12
乳双歧杆菌	*Bifidobacterium lactis*	HN019 Bi-07
鼠李糖乳杆菌	*Lactobacillus rhamnosus*	LGG HN001
短双岐杆菌	*Bifidobacterium breves*	M-16V
发酵乳杆菌	*Lactobacillus fermentum*	CECT5716

剖宫产增加儿童期肥胖风险34%

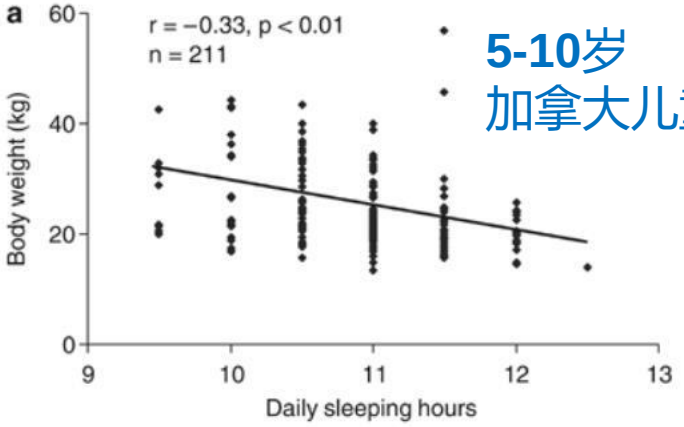


obesity reviews (2015) 16, 295–303

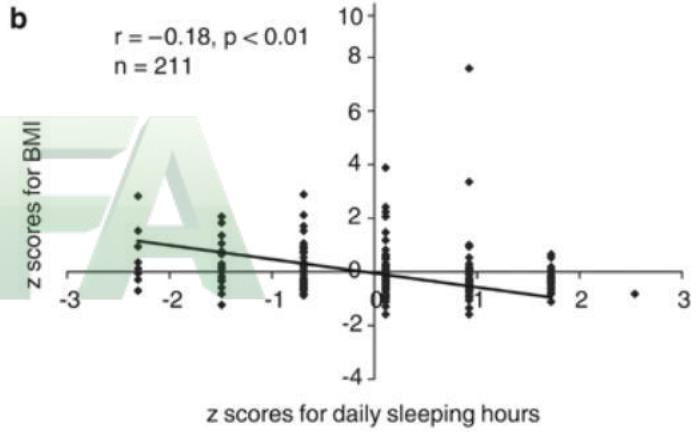
睡眠与肥胖的关系

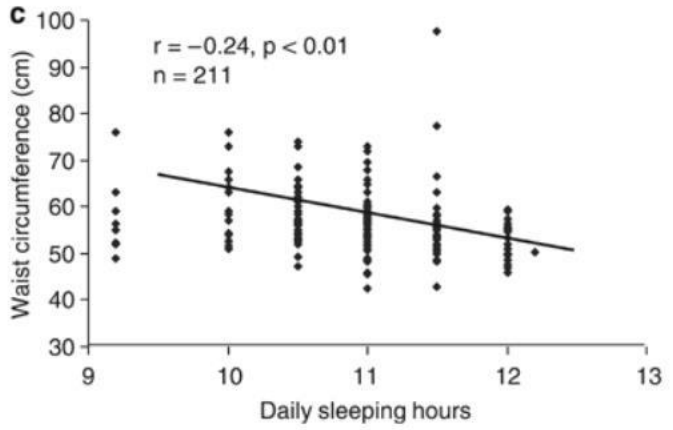


10岁意大利儿童



5-10岁
加拿大儿童

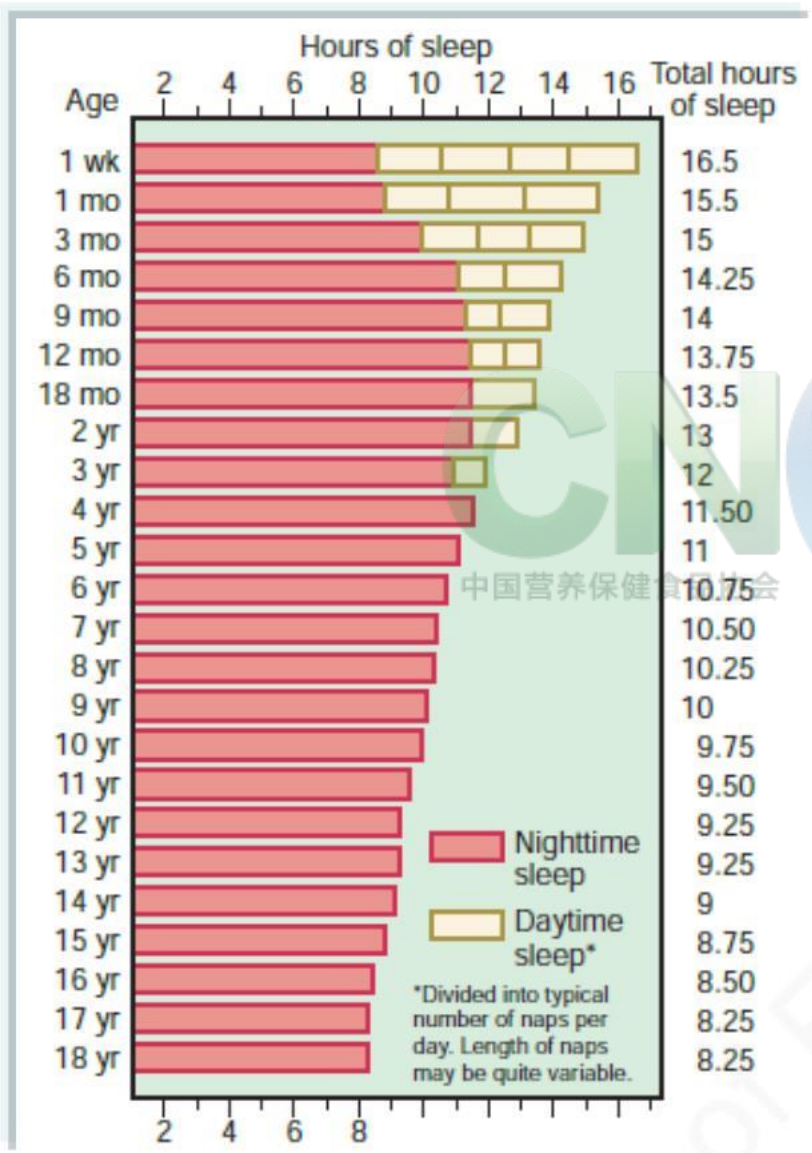




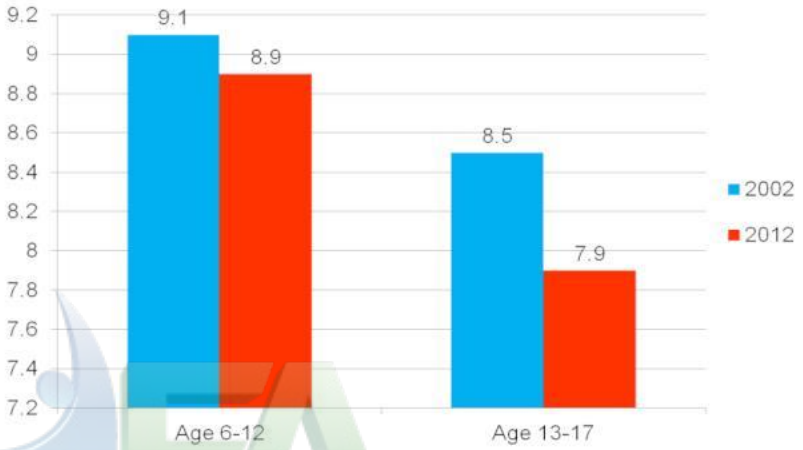
缺乏睡眠肥胖风险增加56-89%

Int J Obes (Lond). 2006 Jul;30(7):1080-5
PLoS One. 2013; 8(6): e66680.

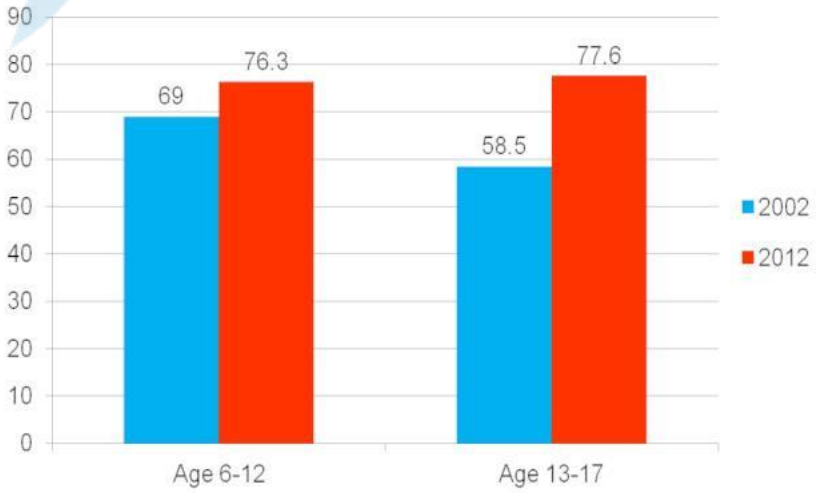
正常睡眠时间要求



中国儿童睡眠时间(h)

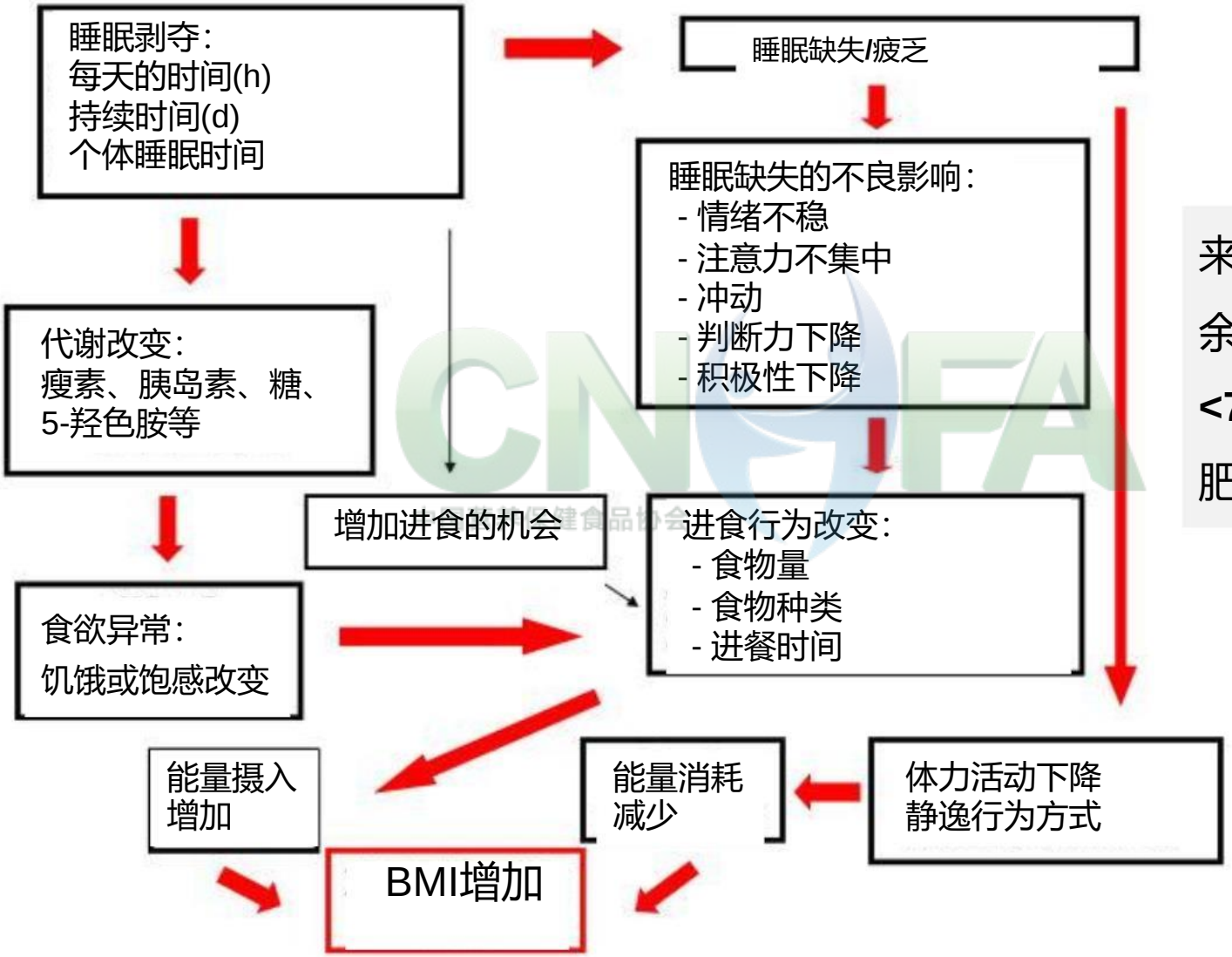


儿童睡眠不足率(%)



< 10 h **< 9 h**

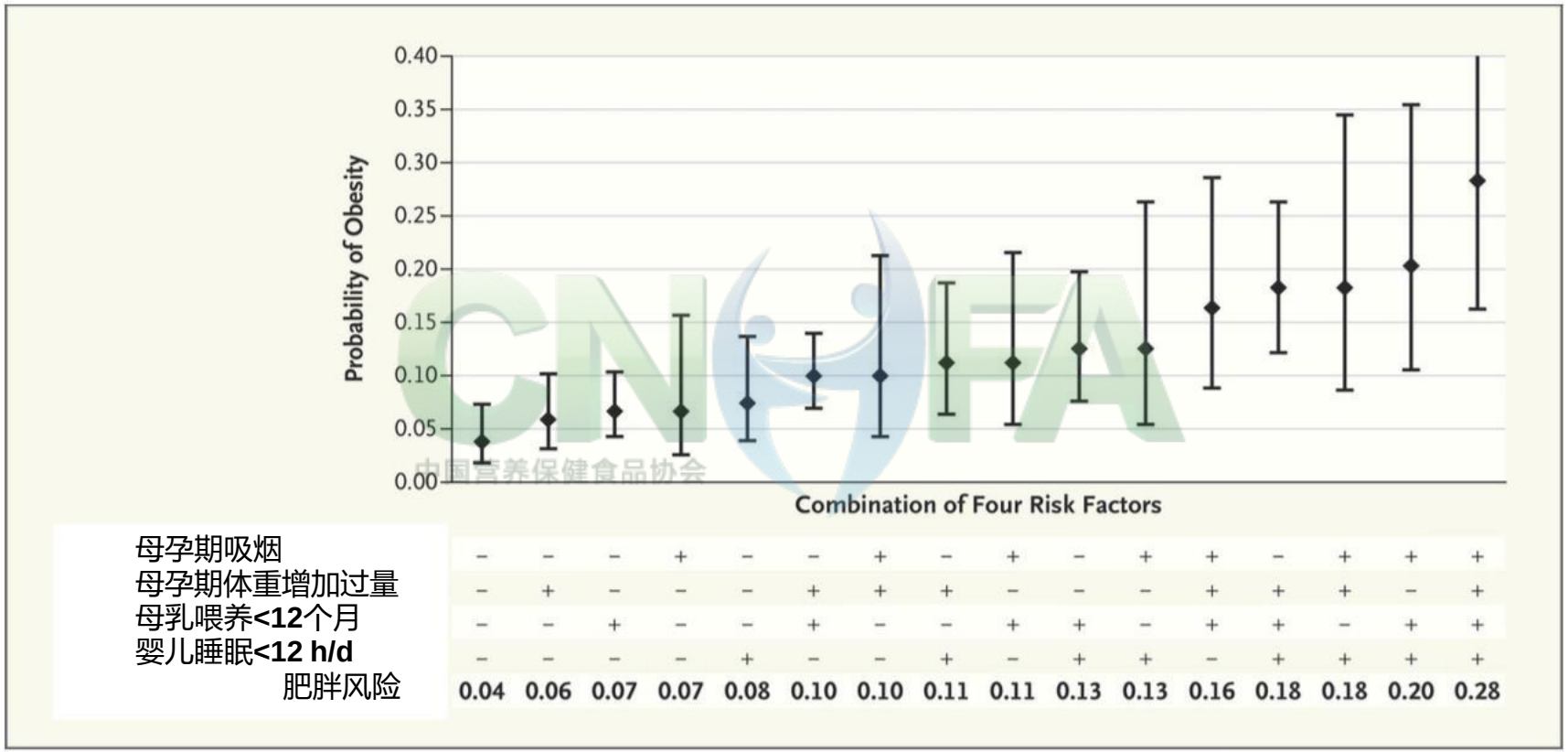
睡眠异常增加肥胖发生风险的可能机制



来自16个国家30余项研究：睡眠**<7 h/d或>12 h/d**，肥胖风险增加

Pediatr Clin North Am. Jun 2011; 58(3): 715–733.

出生前后四种高危因素预测7–10岁儿童肥胖发生风险



Gillman MW, Ludwig DS. N Engl J Med 2013;369:2173-2175.

婴儿期高危因素预测3岁儿童肥胖发生风险

婴儿期高危因素分值预测3岁儿童肥胖发生风险

Quintile	Risk Scores	Risk of Overweight, %	Risk Category
1	0–15	4.1–11.1	Very low risk
2	16–19	11.8–14.2	Low risk
3	20–24	15.1–19.1	Medium risk
4	25–37	20.2–37.2	High risk
5	38–59	38.9–73.8	Very high risk

Risk scores for the validation cohort ($n = 1715$). Categories of risk given in quintiles corresponding to predicted risk cutoffs.

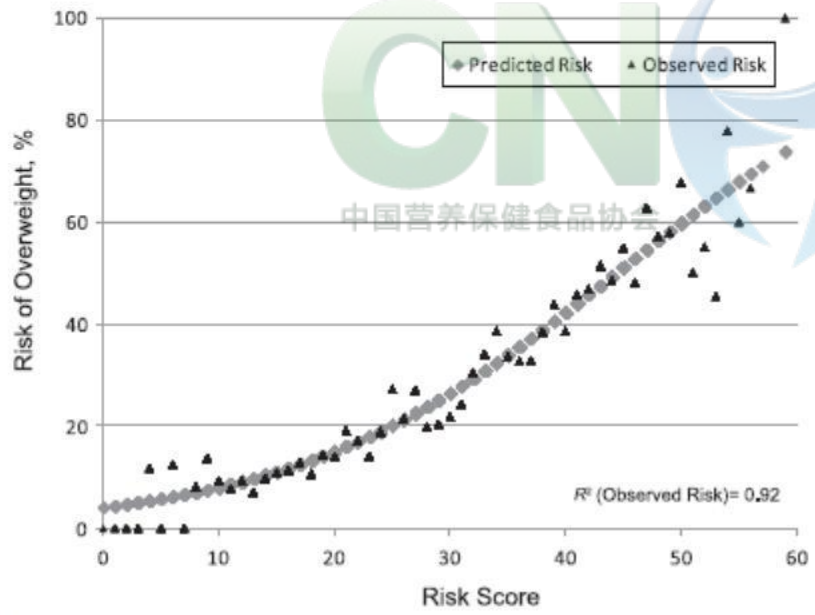


FIGURE 1
Observed and predicted risk of overweight at 3 years by total risk scores for the derivation cohort ($n = 8299$).

Pediatrics 2013;132:e414–e421

高危因素分值计算

危险因素	β Coefficient	评分
性别		
男	Ref	0
女	0.1366	2
出生体重		
<2.93 kg	Ref	0
2.93 to <3.24 kg	0.0741	1
3.24 to <3.49 kg	0.2114	3
3.49 to <3.81 kg	0.3612	5
≥3.81 kg	0.4859	7
婴儿期快速体重增长		
No (≤0.67 SD ΔWFA z score)	Ref	0
Yes (>0.67 SD ΔWFA z score)	1.4239	19
母亲孕期体重增长		
<18.5 kg/m^2	Ref	0
18.5 to <25 kg/m^2	0.5658	8
25 to <30 kg/m^2	0.8560	12
≥30 kg/m^2	1.0906	15
父亲**BMI**		
<18.5 kg/m^2	Ref	0
18.5 to <25 kg/m^2	0.0824	1
25 to <30 kg/m^2	0.4495	6
≥30 kg/m^2	0.6832	9
母亲吸烟		
No	Ref	0
Yes	0.2884	4
婴儿期母乳喂养		
No	0.2199	3
Yes	Ref	0

WFA, weight-for-age.

肥胖并发症

心理-行为问题

心血管系统

- 高血压
- 血脂异常
- 左心室肥厚
- 早期动脉粥样硬化

呼吸系统

- 阻塞性睡眠呼吸暂停（OSA）
- 哮喘
- 肥胖低通气综合征（OHS）

消化系统

- 非酒精性脂肪性肝病（NAFLD）
- 胆囊疾病

泌尿系统

- 微量白蛋白尿（MA）

内分泌和代谢异常

- 糖耐量低减（IGT）
- 2型糖尿病
- 对生长、青春期发育及生殖功能的影响
  - 假性肢大（ pseudoacromegaly）
  - 肾上腺功能初现（adrenarche）提前
  - 男性青春期乳房发育
  - 多囊卵巢综合征（PCOS）
- 高尿酸血症
- 代谢综合征（MS）/胰岛素抵抗综合征（IRS）

皮肤及相关改变

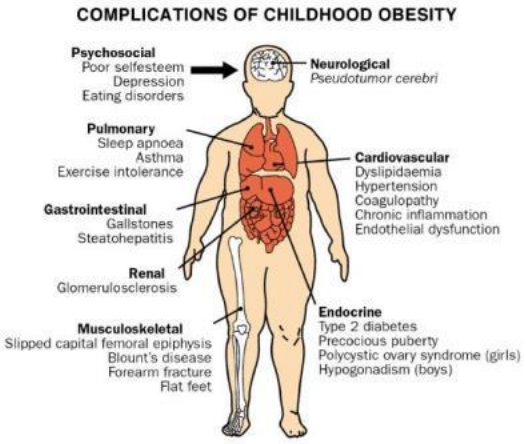
- 黑棘皮症（AN）

神经系统

- 假性脑瘤（pseudotumor cerebri）

骨骼系统

- 股骨头骨骺滑脱
- 胫骨内翻（Blount's 病）



Lancet 2002, 360: 473–82

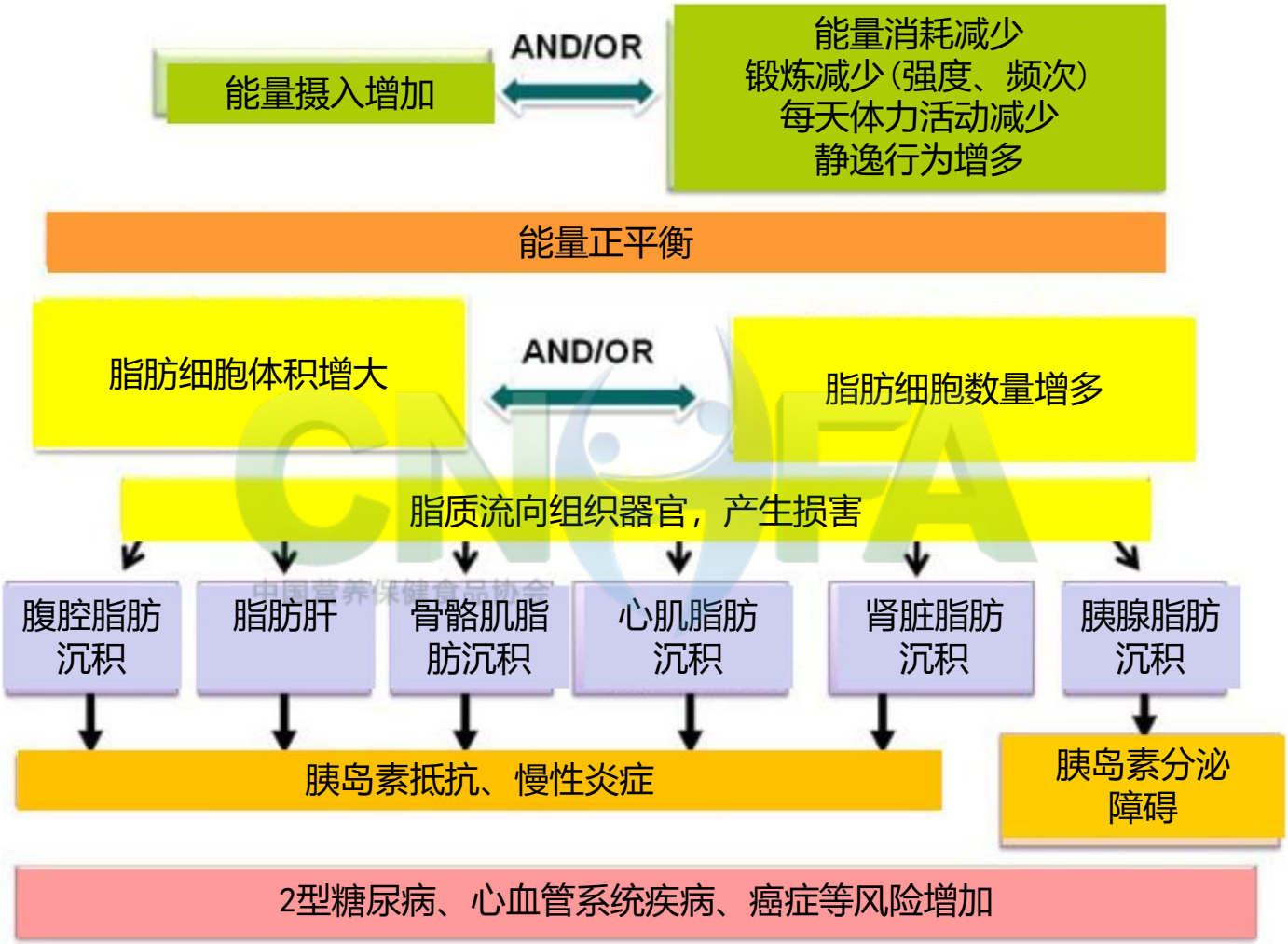
AN Stage	Photo Example of AN Stage	
1		Clearly present on close visual inspection. Not visible to the casual observer. Extent not measurable.
2		Mild. Limited to the base of the skull, does not extend to lateral margins of the neck. (<3 inches in breadth)
3		Moderate. Extending to the lateral margins of the neck (posterior border of the sternocleomastoid (usually 3-6 inches), should not be visible when client viewed from the front.
4		Severe. Extending anteriorly (>6 inches), visible when client viewed from the front.

黑棘皮症

易发胰岛素抵抗和糖尿病

Pediatrics. 2016;137(2):e20151766

肥胖引发相关疾病的机制



慢性炎症 **-- TNF**与肥胖 **–** *Science* 1993; 259(5091): 87

代谢炎症 **(Metaflammation)** – 低度、慢性、全身炎症 -- *Nature* 2006; 444(7121): 860

Diabetes & Metabolism, Volume 40, Issue 1, 2014, 16 - 28

肥胖引发相关疾病的机制

体重增加 –脂肪细胞增大

正常体重

游离脂肪酸水平低
瘦素↓
脂联素↑
抗炎细胞因子↑
致炎细胞因子↓
（**TNF-α,IL-6, CCL2/MCP-1**）
M2样巨噬细胞↓

超重

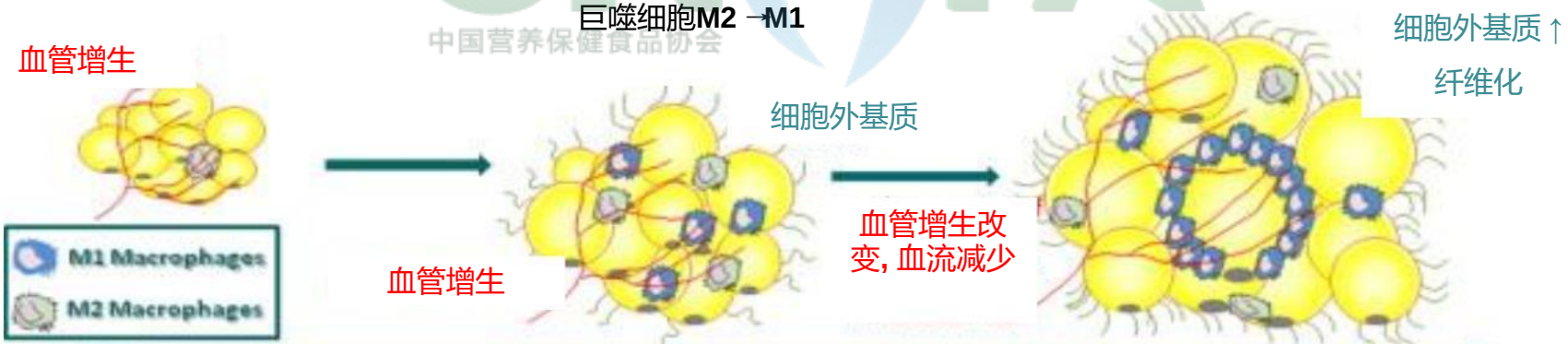
瘦素↑游离脂肪酸↑
脂联素↓
CCL2/MCP-1↑
TNF-α,IL-6, IL-8, IL-1β, PAI-1, TGF-β↑

环氧化酶**(COX), NO,** 基质金属硫
蛋白酶系统**(MMP-2/-9/-11)**激活
早期免疫细胞浸润
巨噬细胞**M2** →**M1**

肥胖

内皮细胞和脂肪细胞功能障碍
胰岛素抵抗 **– 2**型糖尿病

低氧、纤维化，游离脂肪酸↑
抗炎细胞因子↓
致炎细胞因子↑↑
免疫细胞浸润↑ **M1**巨噬细胞↑
皇冠样结构



脂肪细胞肥大，死亡
内质网应激，炎症

有限的脂肪细胞扩张能力
肝脏、肌肉、脂肪组织胰岛素敏感性降低

苹果型’和 梨型’肥胖

代谢损害　　代谢保护

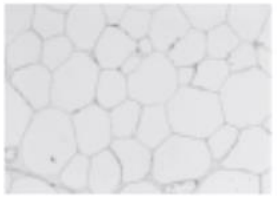
BMJ. Sep 23, 2006; 333(7569): 640–642

决定健康肥胖与高危肥胖的因素

健康肥胖 9-34%

Healthy obesity

皮下脂肪分布



低巨噬细胞侵润
脂肪细胞小
健康型细胞因子

腹部脂肪分布

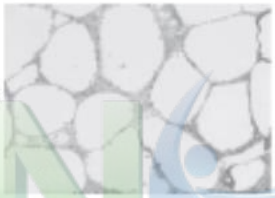
脂肪组织炎症

胰岛素敏感性
体力活动
炎症反应
肌肉
性别
棕色脂肪
氧化应激

高危肥胖

High-risk obesity

内脏脂肪分布

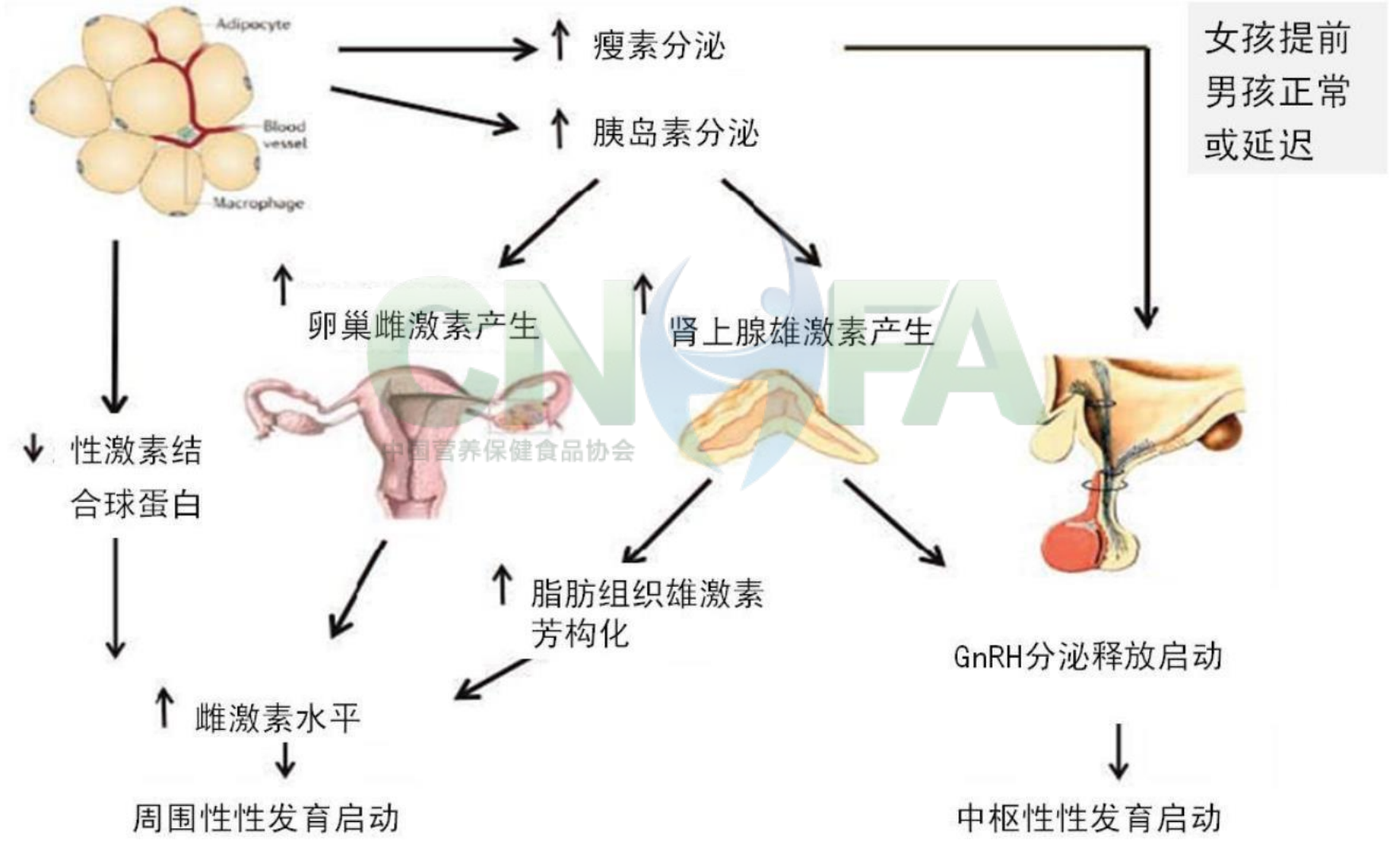


高巨噬细胞侵润
脂肪细胞大
致动脉粥样硬化
型细胞因子

	健康肥胖	高危肥胖
Parameters of fat mass, fat distribution		
Body fat	↔	↔
Waist circumference	↔	↔
SC fat area	↔	↔
Visceral fat area	Normal	↑↑
Liver fat content	Normal	↑↑
Parameters of glucose and lipid metabolism		
Insulin sensitivity (clamp)	↔	↓↓
Fasting plasma glucose	Normal	↑
HbA1c	Normal	↑
Fasting plasma insulin	↔	↑↑
Total cholesterol	↔	↔
HDL-cholesterol	Normal	↓
LDL-cholesterol	↔	↔
Triglycerides	Normal	↑
Free fatty acids	↔	↑↑
Liver function enzymes (GPT, GOT)	Normal	↑
Adipokines and circulating mediators of inflammation		
Leptin	↔	↔
Adiponectin	↔	↓↓
C-reactive protein	Normal	↑
Interleukin-6	↔	↔
MCP-1	↔	↔
Progranulin	↔	↑↑
Chemerin	↔	↑↑
Fetuin-A	↔	↑↑
Retinol binding protein 4	↔	↑↑
Parameters of adipose tissue biology		
Macrophages in visceral fat	↔	↑↑
Macrophages in SC fat	↔	↔
Omental mRNA expression of *HIF-1, MIF, Csf-1*	↔	↑↑
Omental mRNA expression of *Adiponectin, sirt-1, TRAP*	↔	↓↓

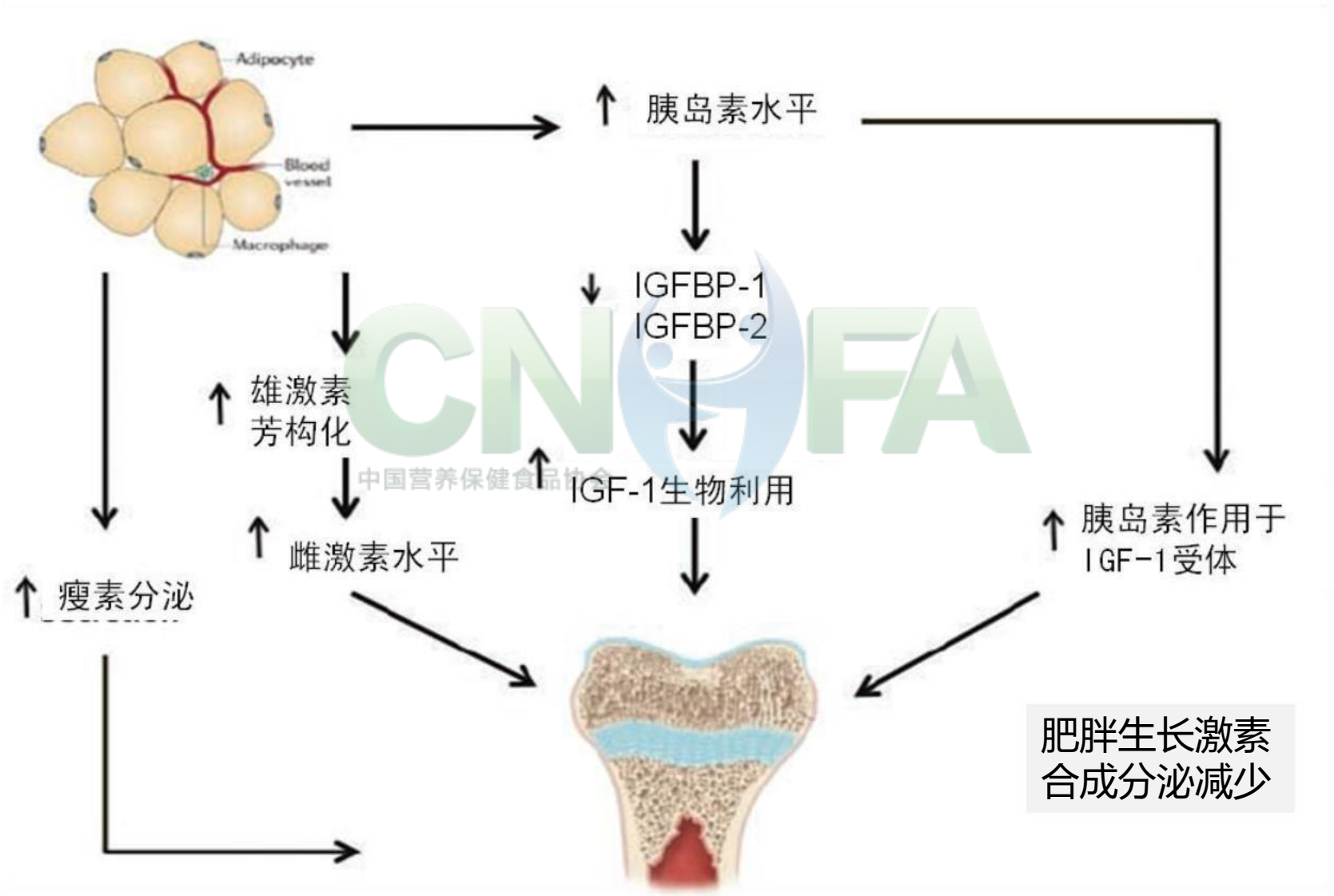
Curr Opin Endocrinol Diabetes Obes 2012, 19:341–346

肥胖儿童青春期启动提前的病理生理



Pediatric Reports 2012; 4:e35

肥胖儿童体格发育的非生长激素依赖



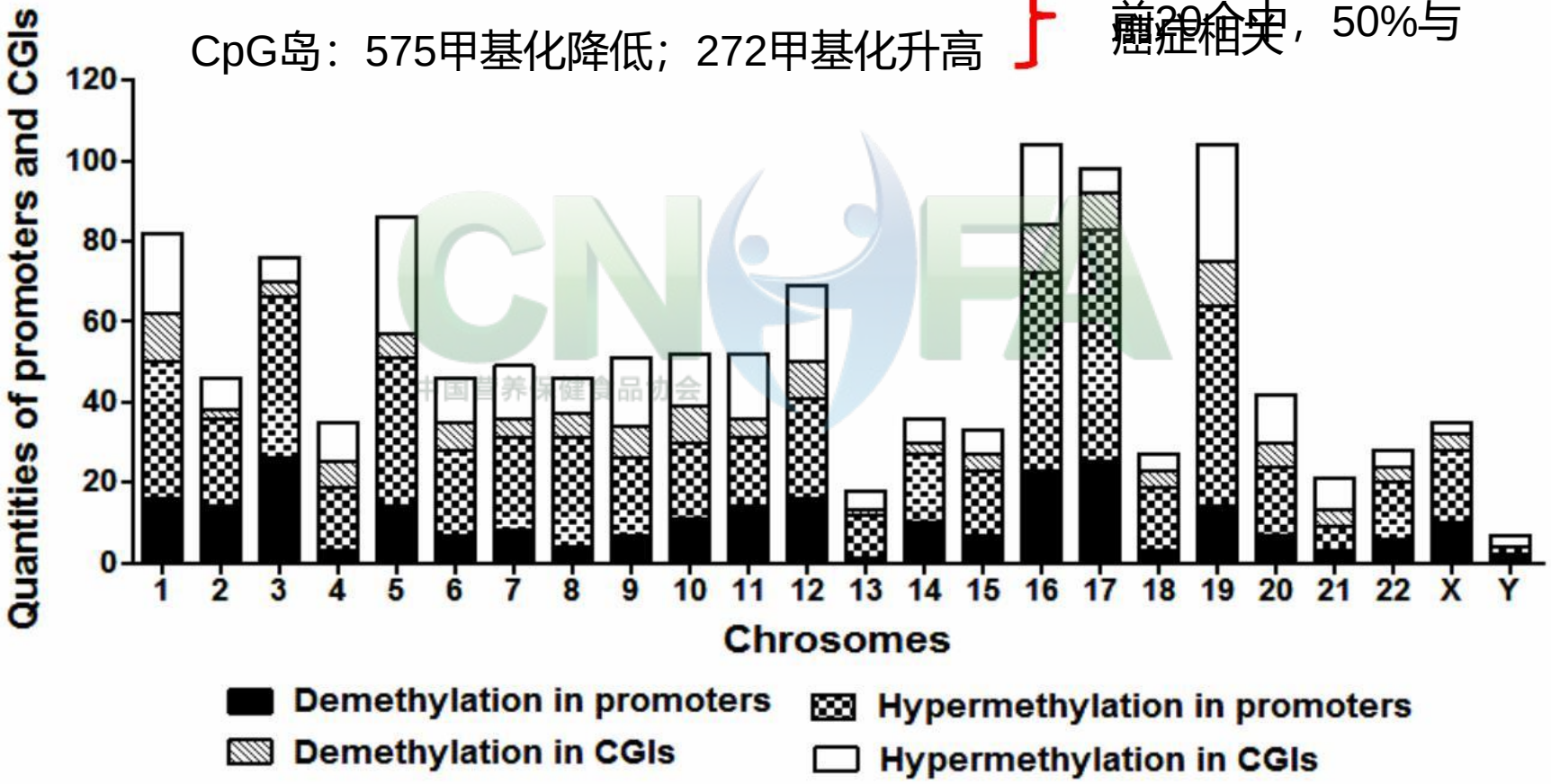
Pediatric Reports 2012; 4:e35

学龄前肥胖儿童基因DNA甲基化改变 -- 癌症发生潜在危险

启动子：251甲基化降低；145甲基化降低

CpG岛：575甲基化降低；272甲基化升高

前20个中，50%与癌症相关



Gene 2015; 566: 74-83.

肥胖儿童血浆阿尔兹海默症相关蛋白变化 -- 潜在危险

学龄前　　学龄期

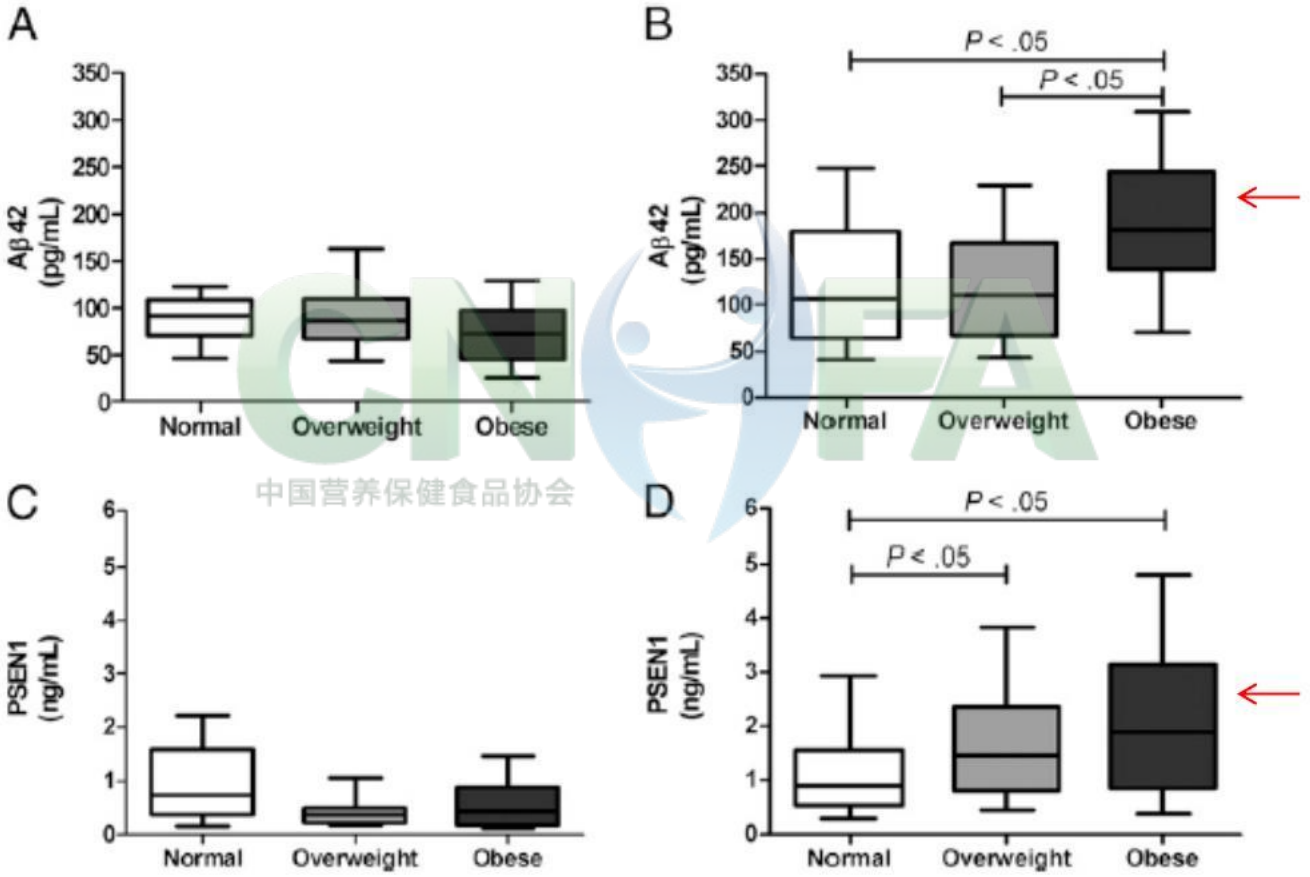


FIGURE 1

Box plots of serum concentrations of Aβ42 and PSEN1 in normal-weight (white bars), overweight (light gray bars), and obese (gray bars) preschoolers (Panels A and C, respectively) and adolescents (Panels B and D). *P* refers to the statistical significance at the 1-way analysis of variance.

PEDIATRICS .135(6), 2015

肥胖的诊断 人体测量指标

- 体脂肪量测定：生物电阻抗(BIA)、双能X线吸收(DEXA)、计算机断层扫描(NMRS)、体密度浮水试验等 -- 精确；复杂、费用高。
- 身高别体重：实际体重超过参照人群标准身高体重的10%为超重，超过20%为肥胖；其中超出标准体重介于20%～30%为轻度，介于30%～50%为中度，大于50%为重度。
- 体重指数（BMI）：体重(kg)/身高$(m)^2$
- 皮脂厚度、腰围(WC)、臀围(HC)和腰臀围比(WHR)：辅助诊断。

  -- WHO 界值点：WHR 男性为0.9，女性为0.85；WC 男性为94 厘米，女性为80厘米；

  -- 中国成年人以WC 男性85 厘米、女性80 厘米作为过渡期的界值点。

肥胖的诊断 BMI诊断标准

Table 1: Recommended cut-offs by the World Health Organization for screening for undernutrition and overnutrition[21,22]

	Age		
Variable	Birth to 2 yr	2 to 5 yr	5 to 19 yr
Measure	Weight-for-length	BMI-for-age	BMI-for-age
Wasted	< 3rd centile	< 3rd centile	< 3rd centile
Overweight	> 97th centile	> 97th centile	> 85th centile
Obese	99.9th centile	99.9th centile	97th centile

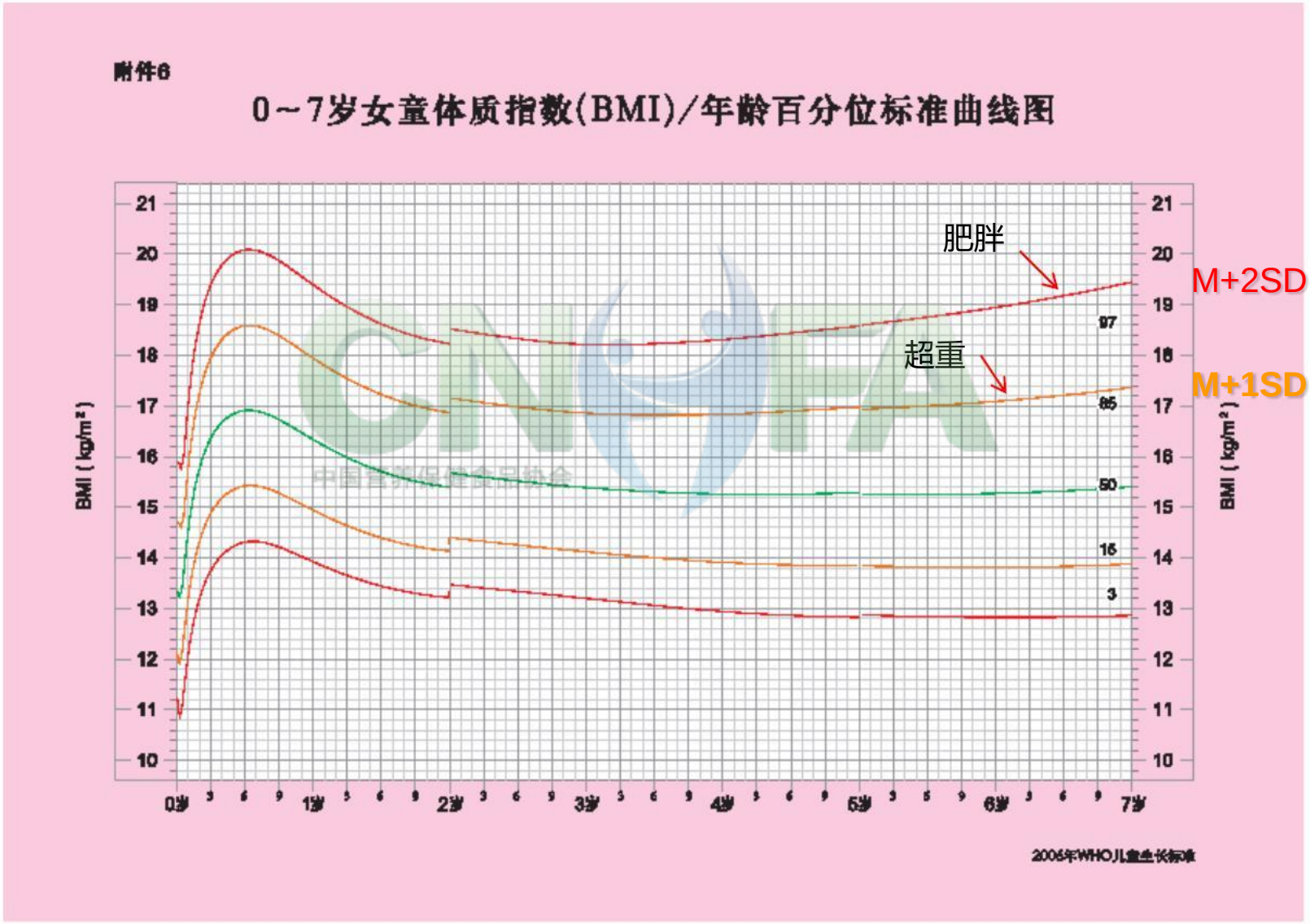
Note: BMI = body mass index.

成人超重和肥胖 – 西方BMI界值点25和30 kg/m^2；中国24和28 kg/m^2。

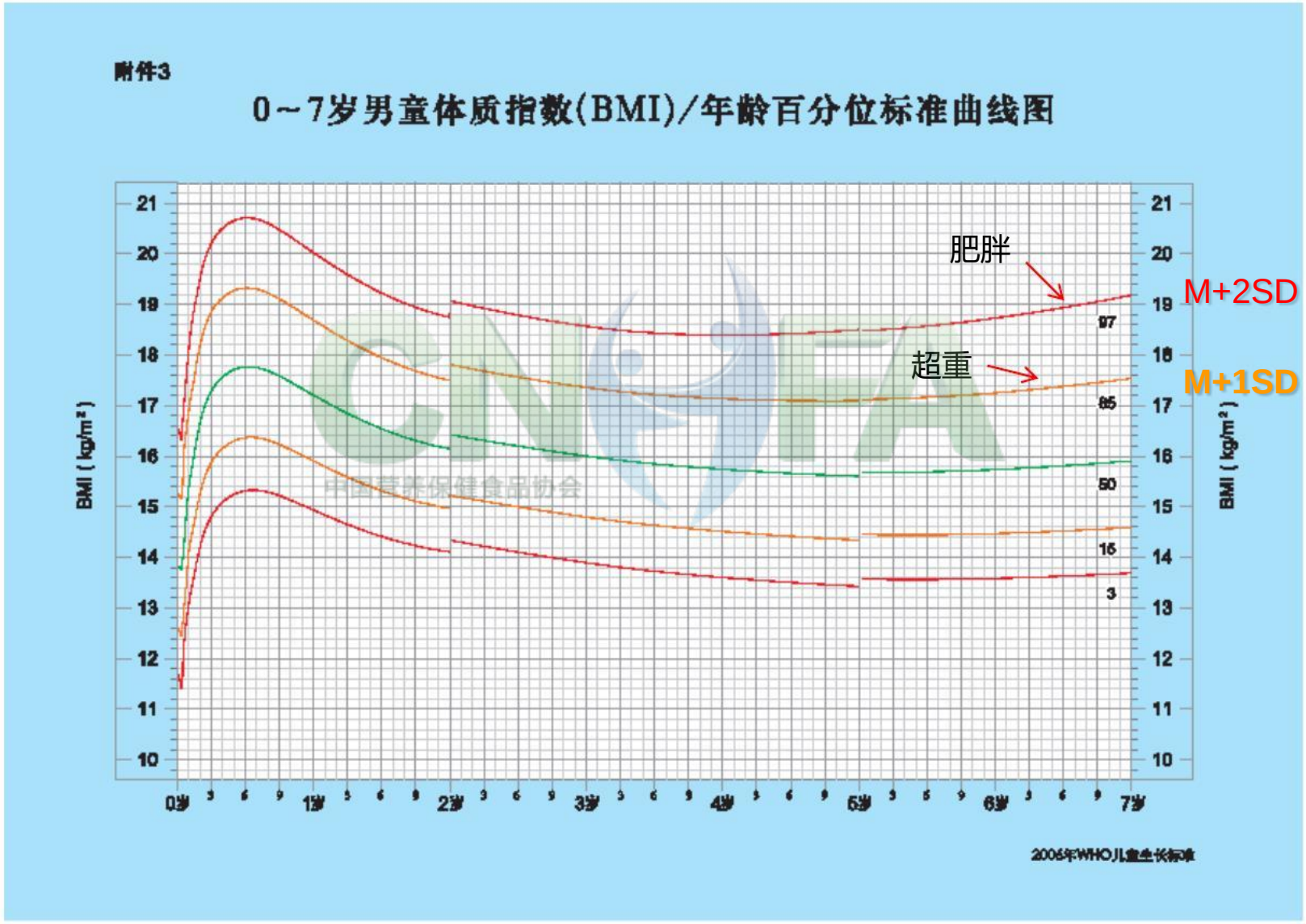
J Clin Endocrinol Metab, March 2017, 102(3):709–757

CMAJ, April 7, 2015, 187(6)

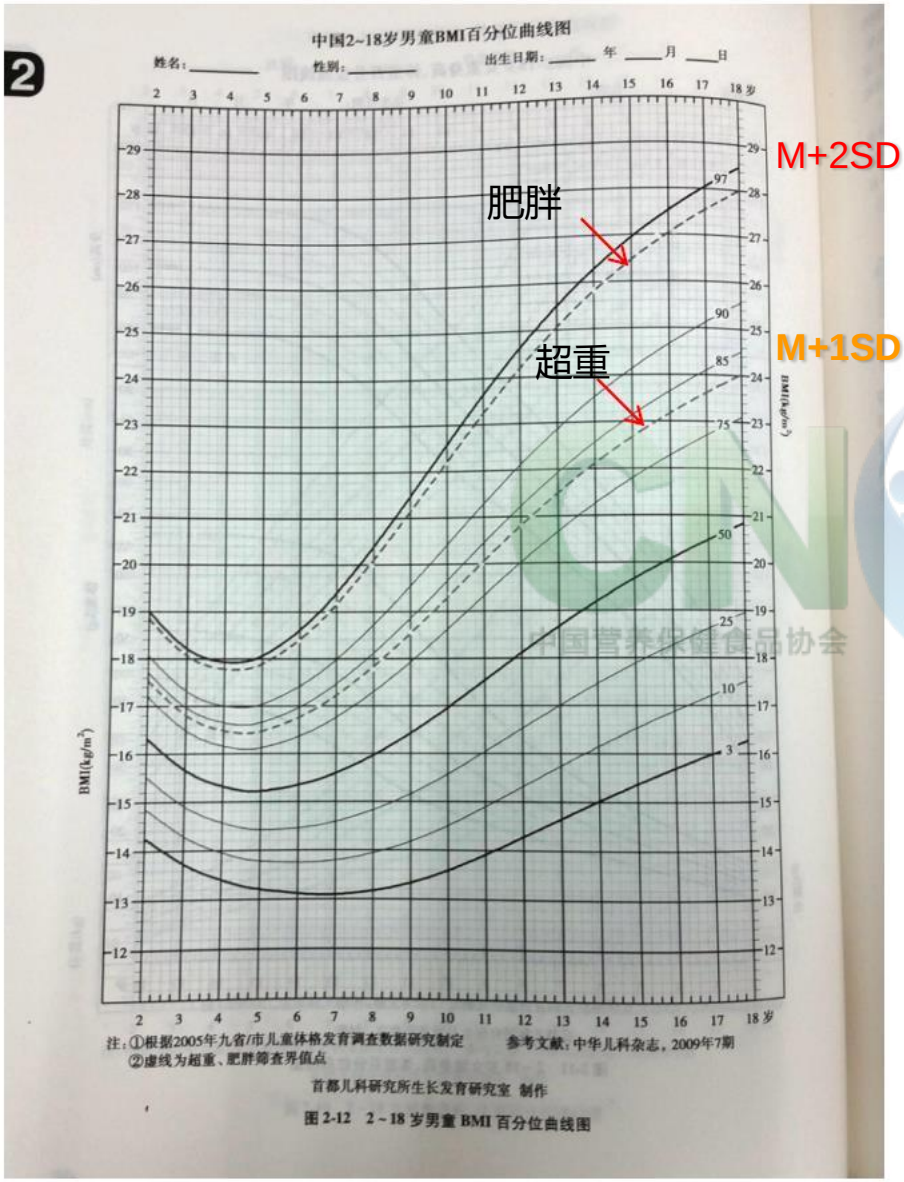
卫生部妇社司印发新生儿访视等儿童保健技术规范

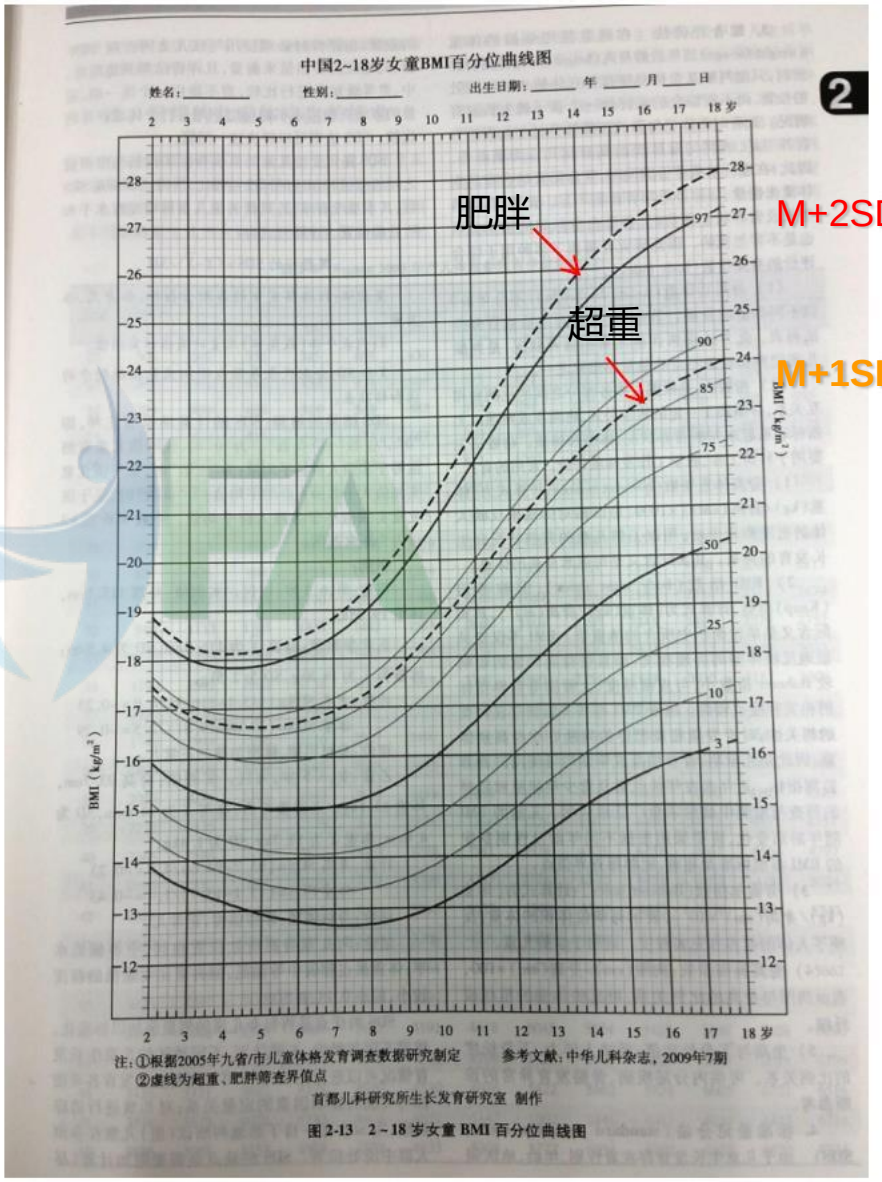


卫生部妇社司印发新生儿访视等儿童保健技术规范



中国2005年九省市儿童体格发育调查BMI标准





中华儿科杂志, ***2009; 47(7): 493***

中国2005年九省市儿童体格发育调查BMI标准

表3　2～18岁儿童肥胖、超重筛查BMI界值点（kg/m^2）

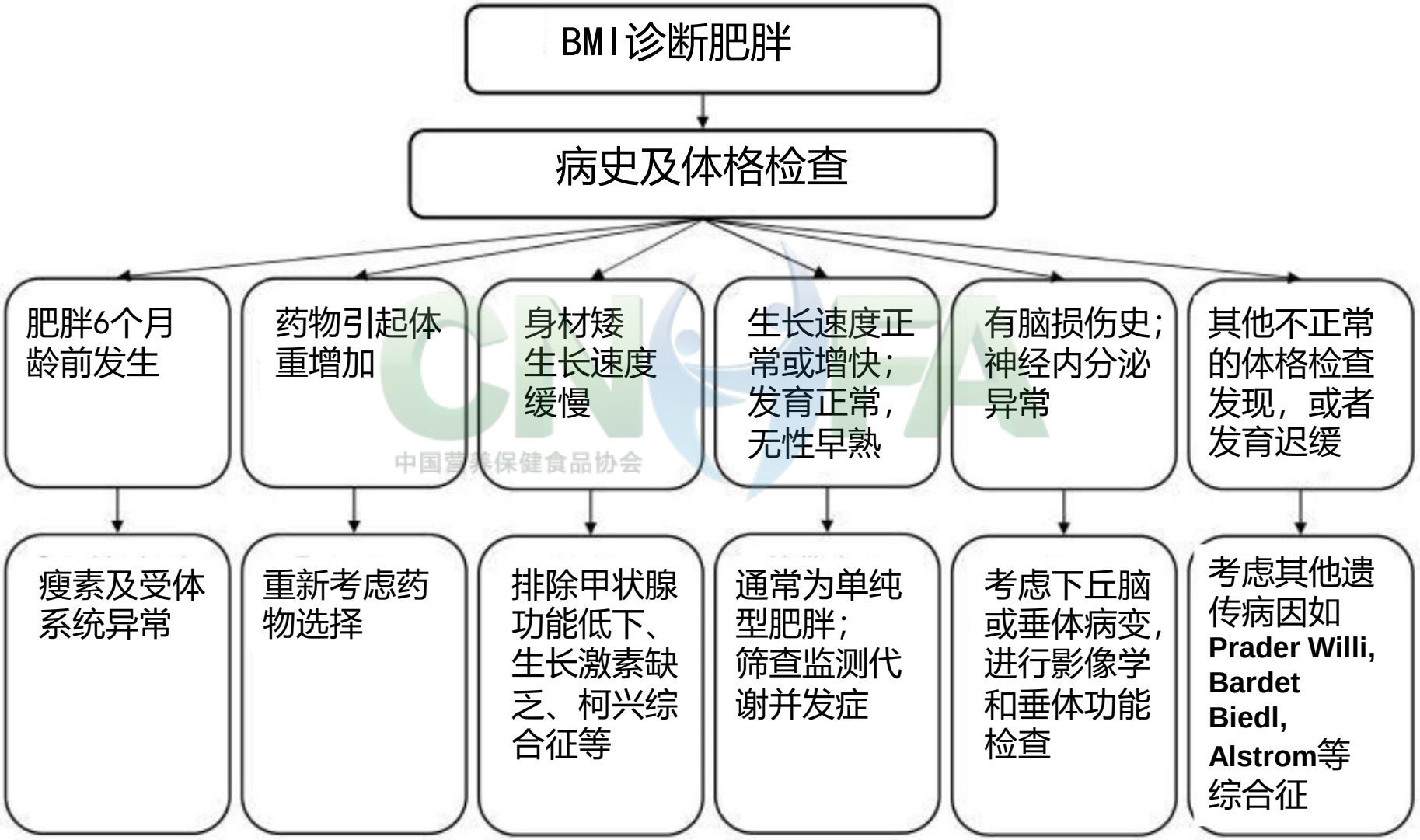
年龄（岁）	男		女	
	超重	肥胖	超重	肥胖
2.0	17.5	18.9	17.5	18.9
2.5	17.1	18.4	17.1	18.5
3.0	16.8	18.1	16.9	18.3
3.5	16.6	17.9	16.8	18.2
4.0	16.5	17.8	16.7	18.1
4.5	16.4	17.8	16.6	18.1
5.0	16.5	17.9	16.6	18.2
5.5	16.6	18.1	16.7	18.3
6.0	16.8	18.4	16.7	18.4
6.5	17.0	18.8	16.8	18.6
7.0	17.2	19.2	16.9	18.8
7.5	17.5	19.6	17.1	19.1
8.0	17.8	20.1	17.3	19.5
8.5	18.2	20.6	17.6	19.9
9.0	18.5	21.1	17.9	20.4
9.5	18.9	21.7	18.3	20.9
10.0	19.3	22.2	18.7	21.5
10.5	19.7	22.7	19.1	22.1
11.0	20.1	23.2	19.6	22.7
11.5	20.4	23.7	20.1	23.3
12.0	20.8	24.2	20.5	23.9
12.5	21.2	24.6	21.0	24.4
13.0	21.5	25.1	21.4	25.0
13.5	21.8	25.5	21.8	25.5
14.0	22.1	25.8	22.2	25.9
14.5	22.4	26.2	22.5	26.3
15.0	22.7	26.5	22.8	26.7
15.5	22.9	26.8	23.1	27.0
16.0	23.2	27.0	23.3	27.2
16.5	23.4	27.3	23.5	27.4
17.0	23.6	27.5	23.7	27.6
17.5	23.8	27.8	23.8	27.8
18.0	24.0	28.0	24.0	28.0

中华儿科杂志, ***2009; 47(7): 493***

肥胖的诊断 病因

- 详细询问病史：包括患儿及家庭饮食情况、心理行为、体力活动情况、家族遗传代谢病及代谢综合征等；
- 全面体格检查：身高/体重、脂肪分布、特殊体征；
- 实验室检查：空腹血脂、血糖，胰岛素及糖耐量，肝肾功能，肾上腺、甲状腺等相关内分泌检查，头颅核磁(下丘脑)。
- 鉴别病理型肥胖：身材较矮、骨龄落后，往往伴有智力缺陷，性腺等内分泌功能低下，黑棘皮体征等。

肥胖鉴别诊断


BMI诊断肥胖
病史及体格检查
肥胖6个月龄前发生
药物引起体重增加
身材矮生长速度缓慢
生长速度正常或增快；发育正常，无性早熟
有脑损伤史；神经内分泌异常
其他不正常的体格检查发现，或者发育迟缓
瘦素及受体系统异常
重新考虑药物选择
排除甲状腺功能低下、生长激素缺乏、柯兴综合征等
通常为单纯型肥胖；筛查监测代谢并发症
考虑下丘脑或垂体病变，进行影像学和垂体功能检查
考虑其他遗传病因如Prader Willi, Bardet Biedl, Alstrom等综合征

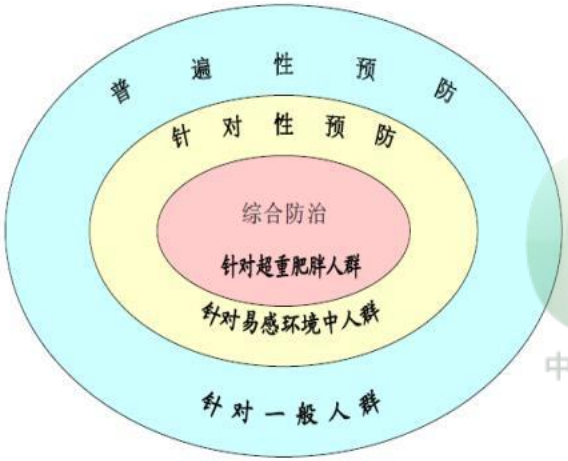
儿童肥胖防治 原则

- 饮食调理：平衡膳食，减少高脂肪、高糖食物的摄入；
- 运动治疗：中等强度、有养运动，时间1小时/ 天；
- 心理行为矫正：自我监督与评价、刺激控制、正确行为强化。目的是纠正日常生活（包括饮食）的不良习惯；
- 家庭参与：改变不良的家庭习惯（饮食、运动），为孩子创造一个良好的家庭环境。鼓励孩子树立减肥的信心和毅力；
- 社区、学校参与：营养健康知识宣教，体育课等；
- 药物治疗；
- 手术治疗。

不影响生长发育（体格和心理）为原则

中国学龄儿童少年超重和肥胖预防与控制指南（试用）

--中华人民共和国卫生部疾病预防控制局 .2007 年 3 月



受检对象

测量身高、体重，计算BMI

体重正常

超重\肥胖

临床医生诊断、鉴别

处于非肥胖易感环境

处于肥胖易感环境

超重或单纯肥胖

继发肥胖

无并发症

有并发症

- 创造支持环境
- 健康教育
- 监测

- 正确认识身体变化
- 合理膳食
- 积极参加体力活动
- 改变不健康生活方式

- 饮食调整
- 运动
- 行为矫正
- 心理治疗

临床治疗

普遍预防

针对性预防

超重肥胖的综合治疗

儿童肥胖治疗 – 体重控制及目标

年龄	BMI	体重控制目标
2～5岁	85～94百分位	体重维持或者控制体重增长速度
	>95百分位	体重维持直到BMI <85百分位；如果有并发症，需要减体重，不超过1磅/月
6～11 岁	85～94百分位	体重维持或者控制体重增长速度
	95～99百分位	体重维持直到BMI <85百分位；或者缓慢减体重，但不超过1磅/月
	>99百分位	需减体重，但不超过2磅/周
12～18岁	85～94百分位	体重维持直到BMI <85百分位；或者缓慢减体重
	95～99百分位	减体重直到BMI <85百分位，但不超过2磅/周
	>99百分位	需减体重，但不超过2磅/周

肥胖的药物治疗

- 治疗肥胖的药物主要包括四类：能量消耗促进剂、食欲抑制剂、营养吸收抑制剂以及胰岛素调节剂。
- 能量消耗促进剂：苯丙胺**(amphetamine)**、二硝基酚**(dinitrophenol)**、芬氟拉明**(fenfuramine)**、麻黄素**(ephedra)**，因副作用大而被禁用。
- 西布曲明**(sibutramine)**：非选择性抑制食欲中枢神经细胞对**5-**羟色胺、去甲肾上腺素以及多巴胺的重新摄取，用于**16**岁以上的青少年，常见的副作用包括轻微血压升高、心动过速、头疼、焦虑、抑郁等。**2010**年因发现增加心血管病风险在欧美和我国被禁用。
- 奥利司他**(orlistat)**：抑制胰脂肪酶活性来减少肠道对脂肪消化和吸收，用于**12**岁以上的青少年，副作用主要是脂溶性维生素的缺乏。
- 二甲双胍：降血糖药，可改善糖耐量和胰岛素异常，延缓发展为**2**型糖尿病，还降低体脂肪含量和血脂水平。

制定儿童肥胖干预措施的依据

——遵从发育规律

不同年龄段的健康、保健指标

保健指标	<1岁	1-2岁	3-4岁
脂肪组织（超重、肥胖，BMI）	关键期	关键期	关键期
骨发育（骨骼系统健康）	不重要	重要	关键期
运动发育（大动作、精细动作控制）	关键期	关键期	关键期
心理社会健康发育	不重要	关键期	关键期
认知功能发育	重要	重要	关键期
心血管、代谢系统	不重要	不重要	重要
其它健康风险（外伤等）			

Note: Health indicators were ranked based on whether they were critical for decision-making, important but not critical, or of low importance for decision-making. The focus when searching and summarizing the evidence was on indicators that were important or critical. Rankings were based on the GRADE framework (Guyatt et al. 2011).

Appl. Physiol. Nutr. Metab. 37: 345–356 (2012)

父母干预方式对儿童饮食习惯、体力活动以及体重的影响效果

四种干预方式：面对面咨询，群体宣教，宣传材料信息邮寄到家，电话咨询。

-- 面对面咨询和电话咨询能有效改善儿童饮食习惯，对体力活动仅有轻微作用；而宣传材料信息邮寄到家无作用。

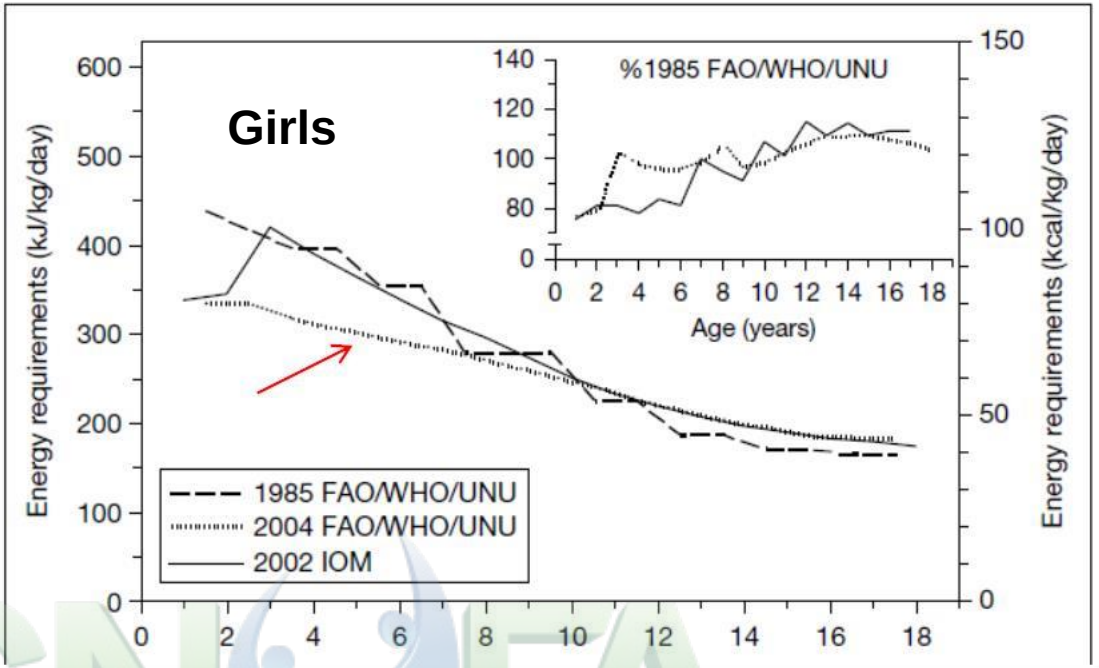
-- 对于体重控制，群体宣教比个体咨询更有效果。

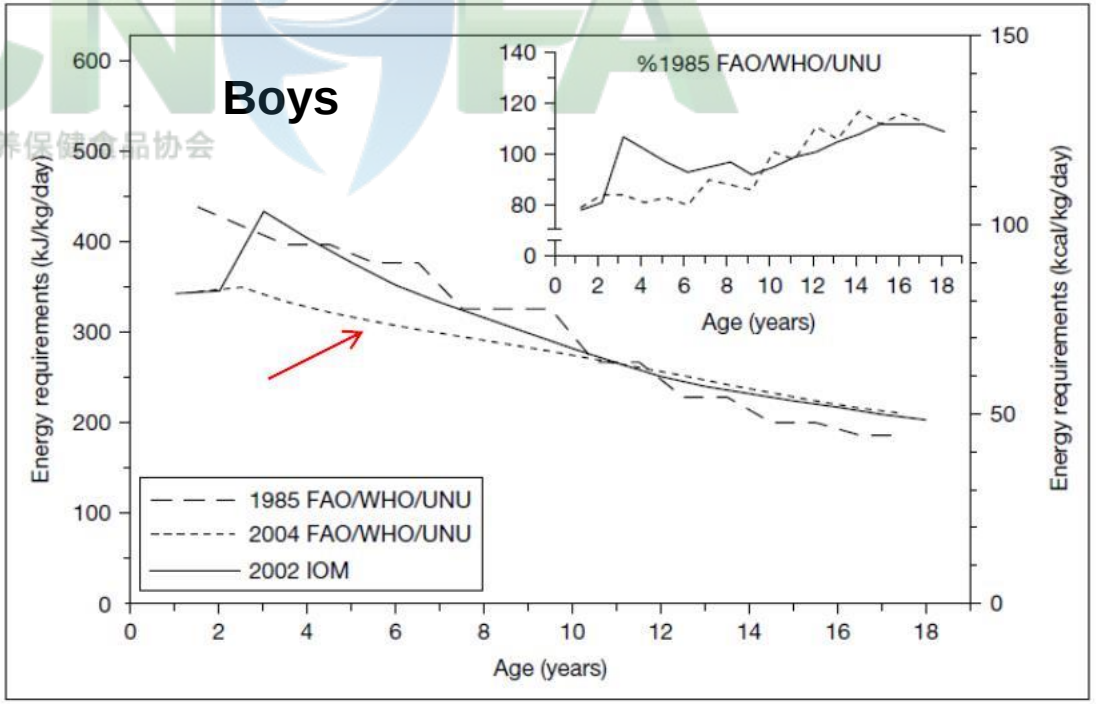
-- 对年龄小的儿童干预效果优于年龄大的儿童。

-- 对于低收入社会阶层，群体宣教更有效果。

Preventive Medicine 77 (2015) 52–67

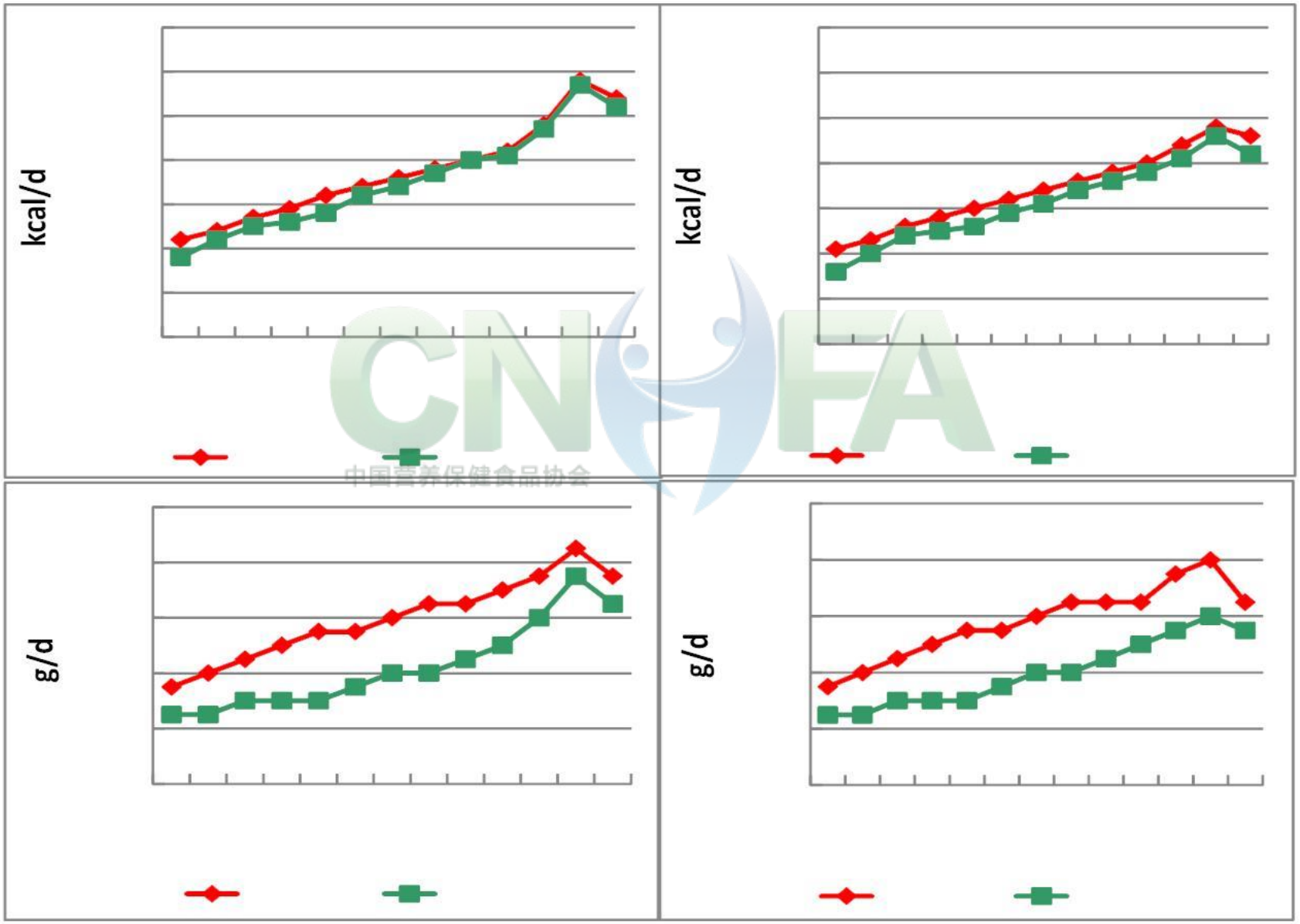
能量推荐摄入量的变迁





Nestlé Nutr Workshop Ser Pediatr Program, 2006(58):19–37

中国居民膳食营养素参考摄入量



中国居民膳食指南（2016）

中国妇幼人群膳食指南（2016）：

- 中国备孕妇女膳食指南（2016）
- 中国孕期妇女膳食指南（2016）
- 中国哺乳期妇女膳食指南（2016）
- 中国6月龄内婴儿母乳喂养指南（2016）
- 中国7～24月龄婴幼儿喂养指南（2016）
- 中国学龄前儿童膳食指南（2016）

“全球维持健康体力活动建议” WHO

儿童少年**(5-18 岁)**

-- 每天**60 min**中**-**高强度的体力活动，种类多样、与年龄发育水平相适应。

成年人 **(18-65 岁)**

-- 30 min中等强度锻炼，**5 d/w**；

-- 20 min高强度锻炼**/d**，**3 d/ w**；

-- 中等和高强度锻炼合理结合；

同时

-- 8-10 种肌肉强度锻炼 **(**至少**8-12** 次重复**)** ，**2d/w**。

老年人**(65**岁以上**)**

-- 同成年人，运动种类和强度应适应老人特点。

最大心率 **= 220 –** 年龄（岁）
中等强度 -- 最大心率*** 50-70%**
高强度 -- 最大心率*** 70-85%**

中-高强度体力活动类型

代谢当量 **(metabolic equivalents, METs)**：表示体力活动强度，工作/活动代谢率与静息代谢率的比值。1个MET相当于静坐状态下的能量消耗= 1 kcal/kg/h 。

中等强度体力活动 – 能量消耗为3-6 METs；高强度体力活动 – 能量消耗为>6 METs。

中等强度体力活动（3-6 METs） 感觉到累，心率增快（最大心率50-70%）	高强度体力活动（> 6 METs） 感觉到很累，呼吸急促，心率增快（最大心率80%以上）
运动方式举例	运动方式举例
快步走	跑步
跳舞	爬山
花园的工作	快速骑自行车
家务劳动	健身
传统的狩猎活动	快速游泳
参与儿童的游戏和体育活动	竞技游戏和体育活动
遛狗	重体力的建筑装修
一般的建筑装修工作	搬运地板砖等建材、挖地基等
油漆粉饰墙面，吊顶等	
搬运中等重量物体	搬运重型物体

体力活动对肥胖的预防干预效果 – 智利研究

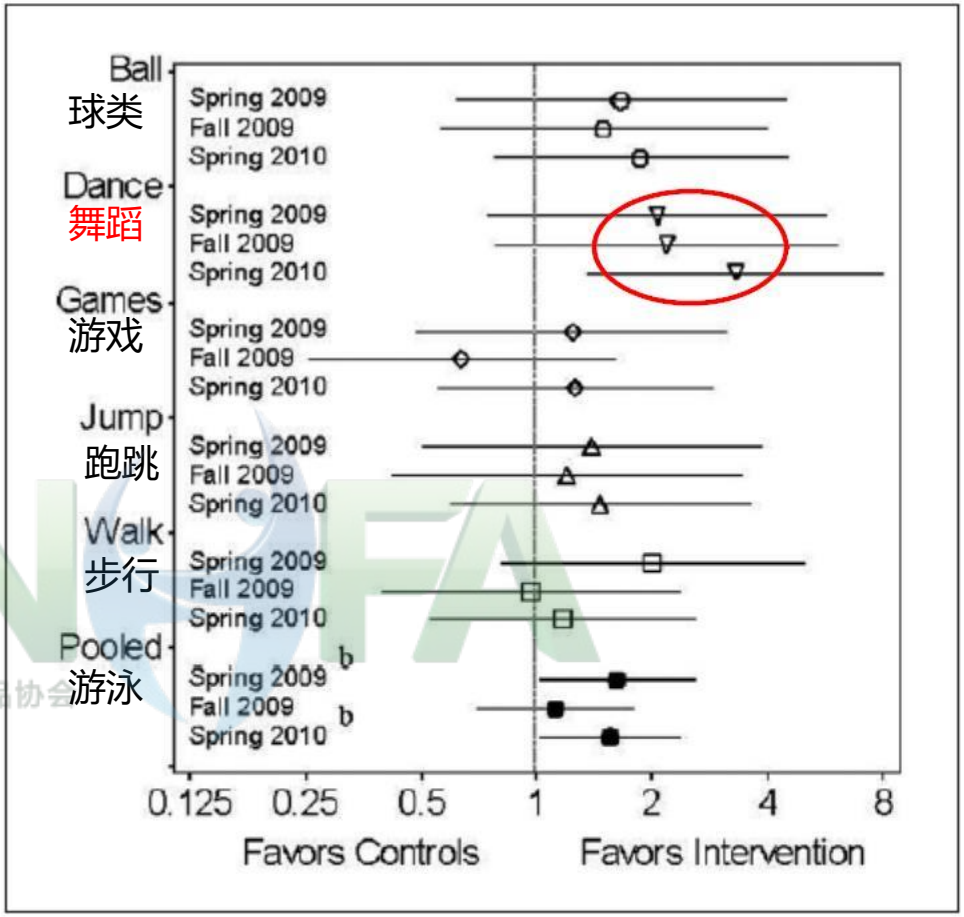
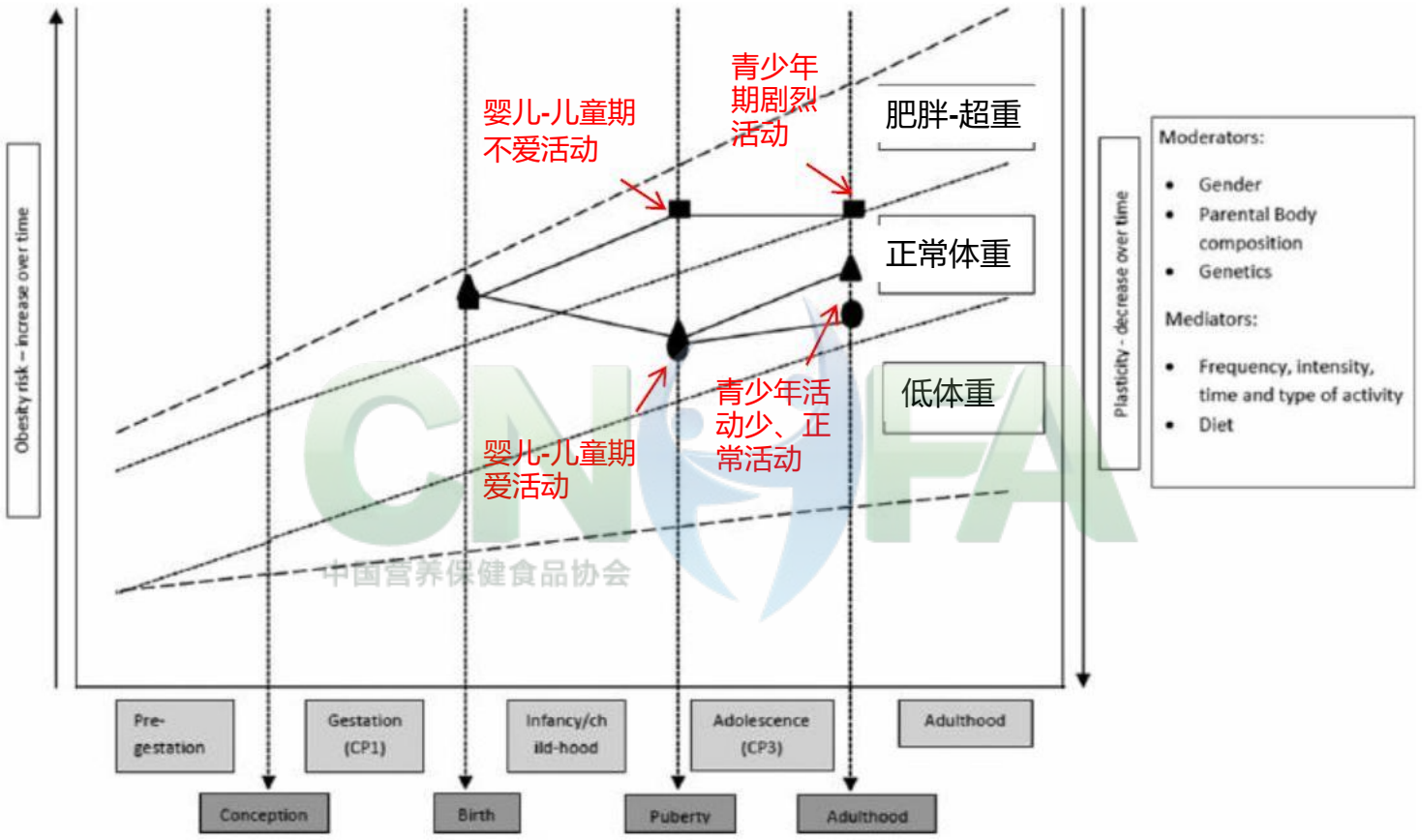


FIGURE 2 Specific Activities and Pooled Activity Relative Changes[a] (95% Confidence Intervals; Log 2 Scale), According to Assessment Time, in the Control Compared with the CHILE Intervention Group

NOTE: CHILE = Child Health Initiative for Lifelong Eating and Exercise.

Health Promotion Practice
Month XXXX Vol. XX , No. (X) 1–9

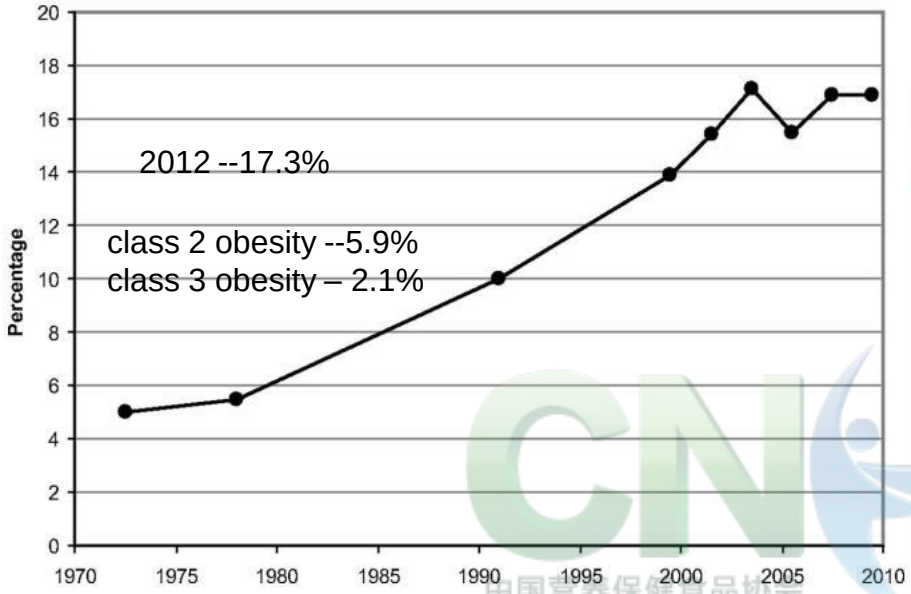
体力活动预防肥胖的关键窗口期

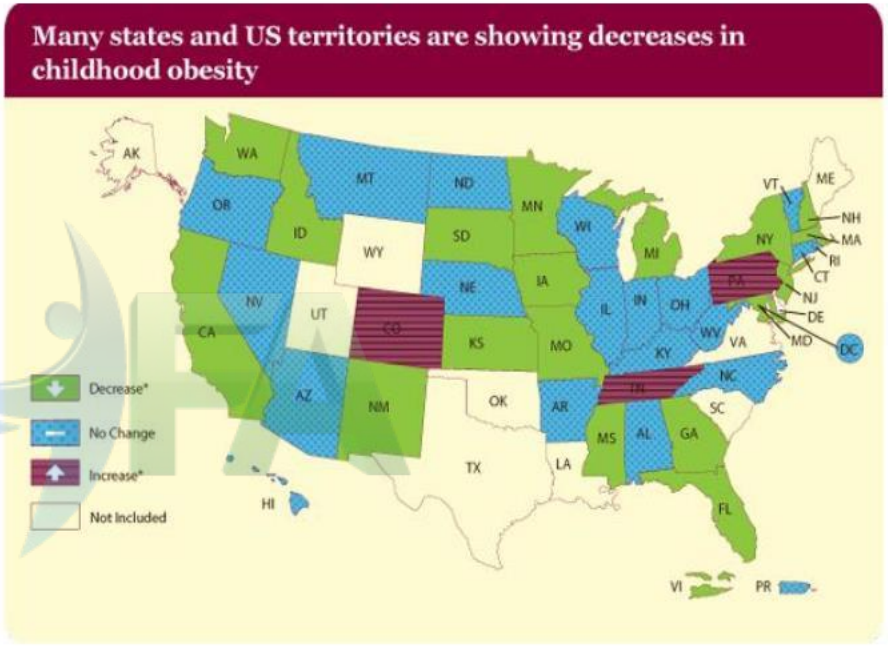


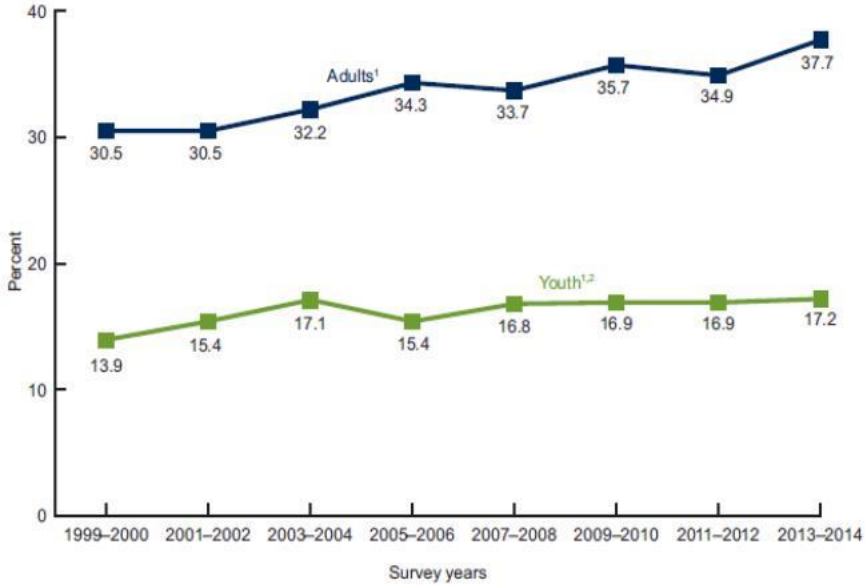
The hypothesized body composition outcomes as a function of age of physical activity commencement, and discontinuation during different critical periods. The effect of physical activity on body composition is weighted by plasticity at each critical period. In this figure, all children were large-birth weight babies. The children represented by the circle and triangle were active during infancy and childhood. The child represented by the square was not an active infant or child. During adolescence, the child represented by the square becomes more active, and the child represented by the circle maintains age appropriate activity levels. However, the child represented by the triangle reduces activity levels. CP1, CP2, and CP3 refer to critical periods 1, 2 and 3, respectively.

37. obesity reviews (2015) 16, 857–870

美国儿童肥胖防治的效果







Pediatric Nutrition Surveillance System, 2008-2011
JAMA Pediatrics 2014;168(4).
Lakshman R et al. Circulation. 2012;126:1770-1779
NCHS Data Brief. 2015 Nov;(219):1-8.

美国肥胖预防措施


Fruits
Grains
Dairy
Vegetables
Protein
MyPlate.gov


Whole grains fill your tummy
Milk builds strong bones and teeth
Fill half your plate with fruits and veggies
Fruits
Grains
Dairy
Vegetables
Protein
Beans, eggs, seeds and nuts are protein, too!
How does your plate look?

学龄前儿童健康促进、肥胖预防措施

CDC. MMWR. 2009 July; 58(RR-7): 1-26

纽约儿童早期保健中心肥胖防治措施

- 1-3岁：体力活动60 min/d
- >3岁：体力活动60 min/d，包括30 min有指导的结构化的体力活动（体育锻炼）

看电视

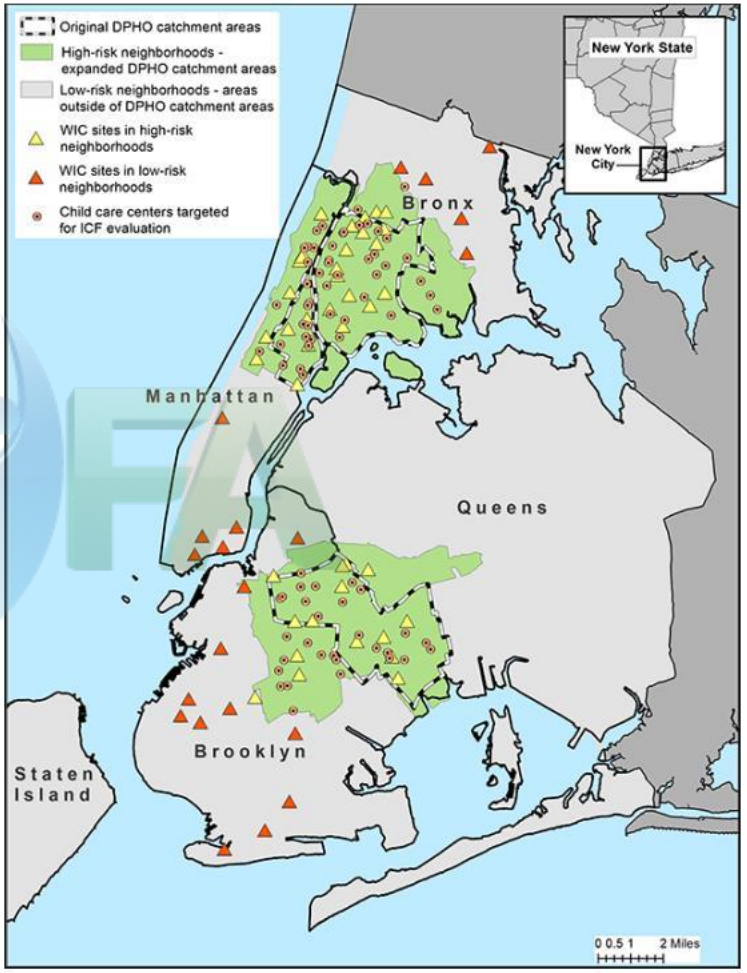
- <2岁：限制
- >2岁：不超过1小时
- 教育类的节目或者能够激发孩子活动的节目

营养/饮品

- 避免加糖饮料摄入
  - 只允许100%纯果汁摄入
  - < 180 mL/d
  - > 8月龄饮用，用杯子喂，避免奶瓶喂

奶类

- <2岁：避免饮用1%或者脱脂奶；奶替代品（如豆奶不应加糖和其它风味品
  - <1岁避免喂养普通牛奶
- 保证白开水随时供应，方便孩子饮用

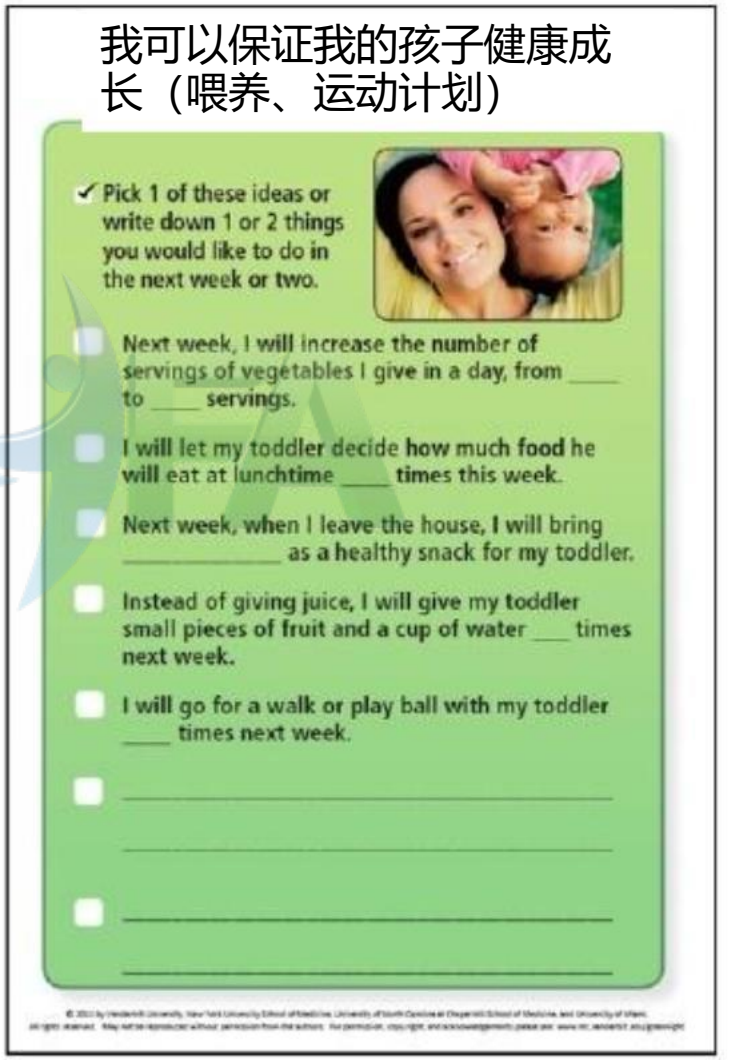


The greatest decline occurred in Manhattan high risk neighborhoods where childhood obesity prevalence decreased from 18.6% during 2004–2006 to 15.3% during 2008–2010 (P <.001).

38-Prev Chronic Dis 2014;11:130435.

红绿灯研究：低文化水平家庭儿童早期肥胖预防

"Greenlight study": a controlled trial of low-literacy, early childhood obesity prevention.



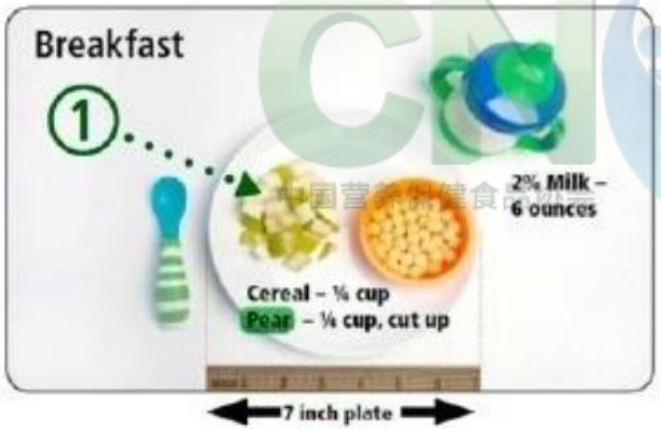
Pediatrics. 2014 Jun;133(6):e1724-37.

红绿灯研究：低文化水平家庭儿童早期肥胖预防

"Greenlight study": a controlled trial of low-literacy, early childhood obesity prevention.

保证孩子健康的饮食与零食，
保证每天**5**份水果与蔬菜

怎样才能为孩子提供每天**5**份水果与蔬菜？（**1**岁孩子举例）



红绿灯研究：低文化水平家庭儿童早期肥胖预防

"Greenlight study": a controlled trial of low-literacy, early childhood obesity prevention.

让整个家庭动起来！

让每个家庭成员都活动起来，包括孩子

You can do a lot to make sure your whole family is healthy.

孩子每天1小时的活动

every day.
Adults need at least 30 minutes, most days.

户内和户外活动

and outdoors.
Television time is not active time!

Greenlight
First steps to growing healthy

Supplement 6-24 months – English

让孩子活动起来的有趣方式

Sitting time play

- While he is sitting up, roll a soft ball to him and clap when he tries to get it or roll it back. He may clap too!
- Do sit-ups while facing him. Say "Hi" to him every time you look in his eyes. He will love the game.

Music time play

- Put on your favorite music and dance.
- It's great exercise for you, and your infant will start to move to the music too!
- When she is ready, let her pull to a stand while holding your hand and bounce to the music.

Tummy time play

- Put your infant on her tummy. Put a toy like a soft ball, rattle or baby mirror in front of her to look at.
- Get down on the floor and play with her (try peek-a-boo).
- While she is on her tummy, you can also do exercises on the floor. Try push-ups!

红绿灯研究：低文化水平家庭儿童早期肥胖预防

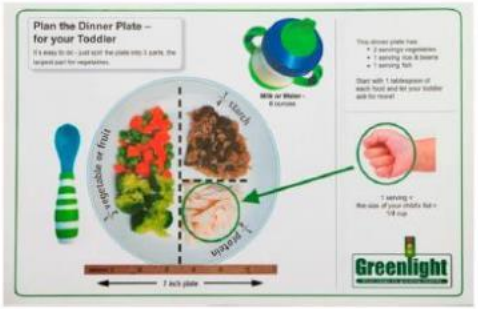
"Greenlight study": a controlled trial of low-literacy, early childhood obesity prevention.

A

B

C

D

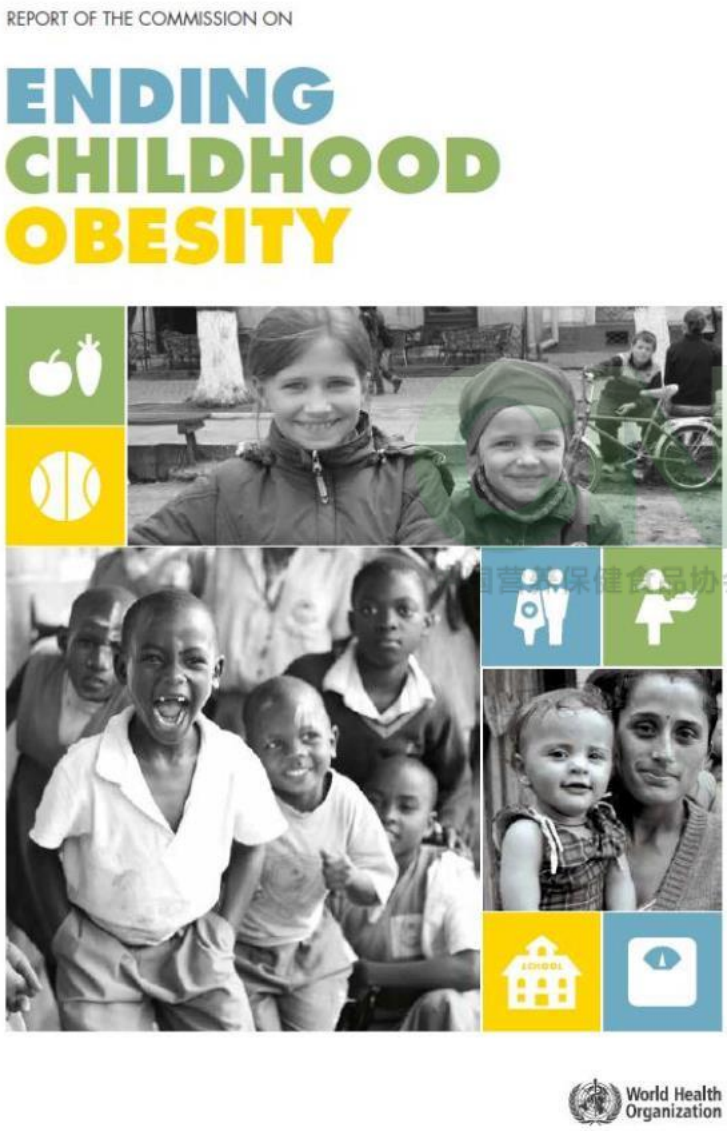


Greenlight

EARLY CHILDHOOD
Obesity Prevention Counseling Schedule

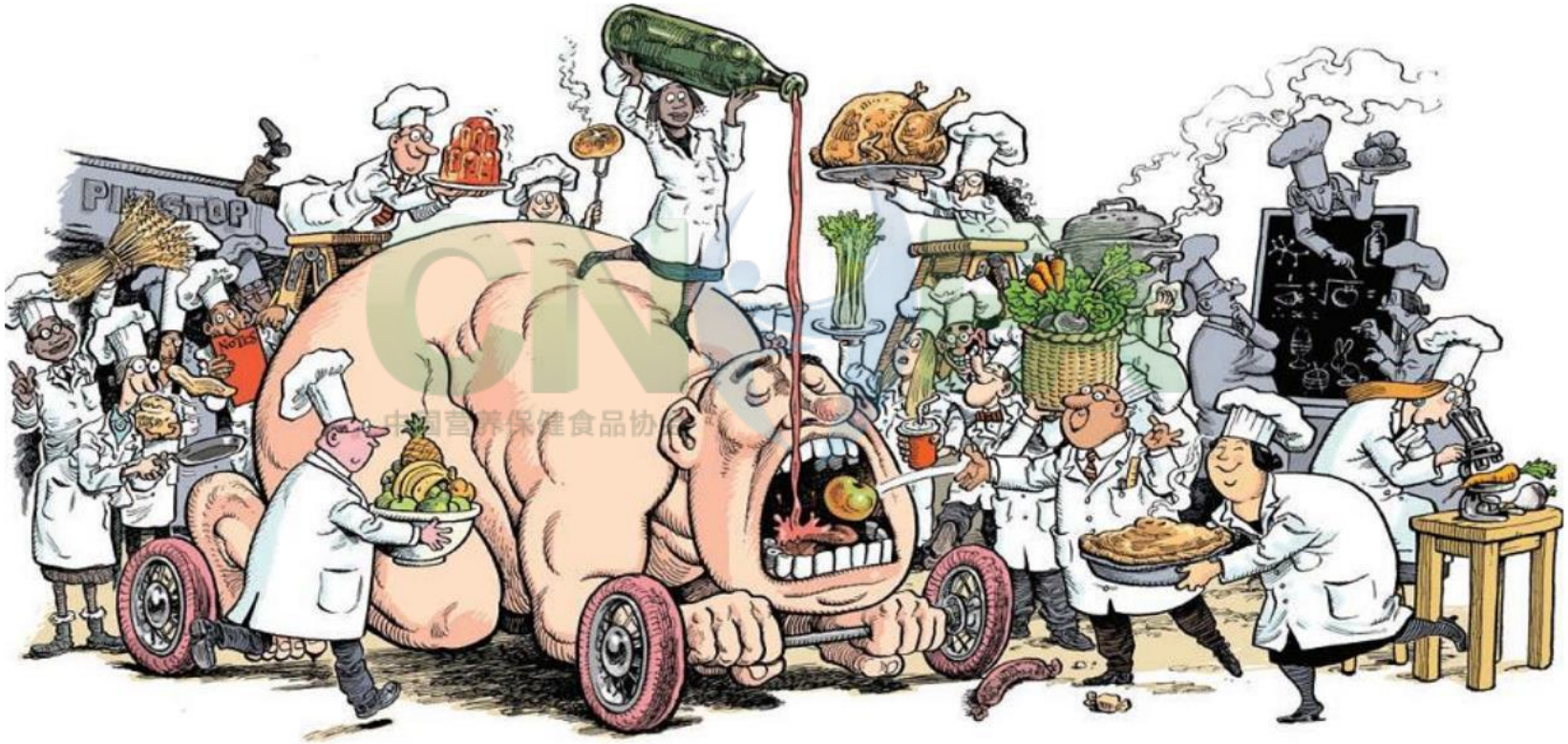
AGE	CORE TOPICS	SUPPLEMENTAL TOPICS
2 mo.	• Recognizing satiety cues • Breastfeeding promotion • Child physical activity promotion (tummy time/TV)	• Breastfeeding tips • Formula feeding tips • Family physical activity • Family nutrition
4 mo.	• Recognizing satiety cues • Giving liquids: – Liquid choices – Portion size • Introducing solid foods: – Wait to start solids – Portion size	• Breastfeeding tips • Child physical activity promotion (tummy time/TV) • Family physical activity • Family nutrition
6 mo.	• Giving liquids: – Liquid choices – Portion size • Giving solid foods: – Food choices – Portion size • Child physical activity promotion (age-appropriate activities/TV)	• Breastfeeding tips • Nutrition label reading: 100% juice vs. juice drinks • Family physical activity • Family nutrition
9 mo.	• Giving liquids: – Liquid choices – Portion size • Switching to the sippy cup • Giving solid foods: – Food choices – Portion size	• Child physical activity promotion (tummy time/TV) • Child growth • Family physical activity • Family nutrition
12 mo.	• Giving liquids: – Liquid choices – Portion size • Giving solid foods: – Food choices – Portion size • Child physical activity promotion (age-appropriate activities/TV)	• Nutrition label reading • Switching to the sippy cup • Family physical activity • Family nutrition
15–18 mo.	• Giving liquids: – Liquid choices – Portion size • Giving solid foods: – Food choices – Portion size • Child physical activity promotion (age-appropriate activities/TV)	• Nutrition label reading • Child growth • Family physical activity • Family nutrition

终止儿童肥胖委员会报告的最终草案



国家人食医学中心 北京儿童医院

谢谢！



INTERDISCIPLINARY RESEARCH

Big science at the table