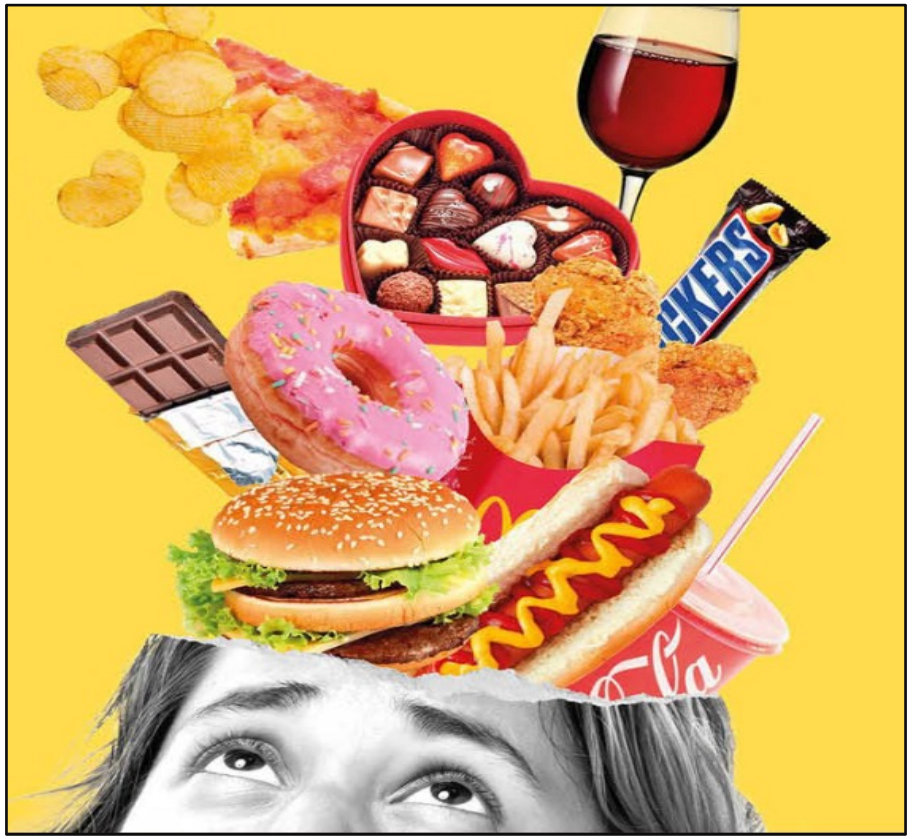


Mitos y verdades sobre la addición a los alimentos

Centro *de* Estudios *en* Nutrición
T. COLIN CAMPBELL

Lic. Prof. Fernando Javier Luna (UNLP)

Contenidos

- **El cerebro como órgano principal en la regulación del apetito.**
- **Cómo el entorno nos invita a comer más y peor**
- **Qué son alimentos ultrapalatables y cómo influyen en la ingesta de energía**
- **Podemos hablar de adicción a los alimentos?**
- **Que podemos hacer?**



6 millones



Ultima abuela común de humanos y chimpancés

2.5 millones



Humanos evolucionan en África. Australopitecus

500 mil



Neardentales aparecen en Europa y oriente

200 mil



Aparición Homo Sapiens

70 mil



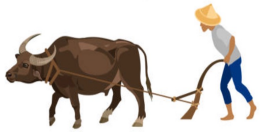
Revolución Cognitiva. Aparición del lenguaje ficticio

30 mil



Extinción de Neardentales. H. Sapiens única especie humana restante

12 mil



Revolución Agrícola. Domesticación plantas y animales

< 100 años

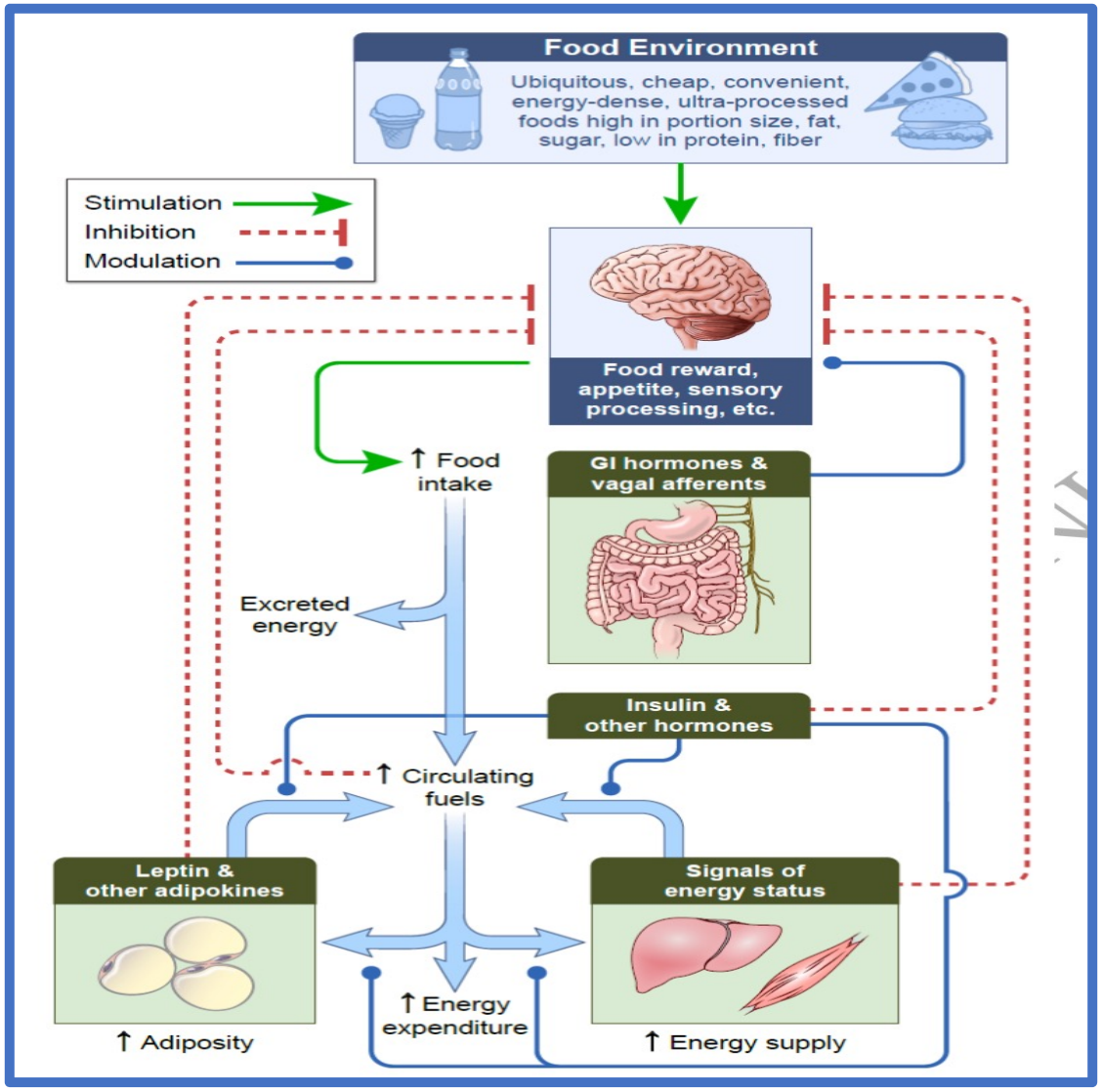


Sistema moderno de producción de alimentos



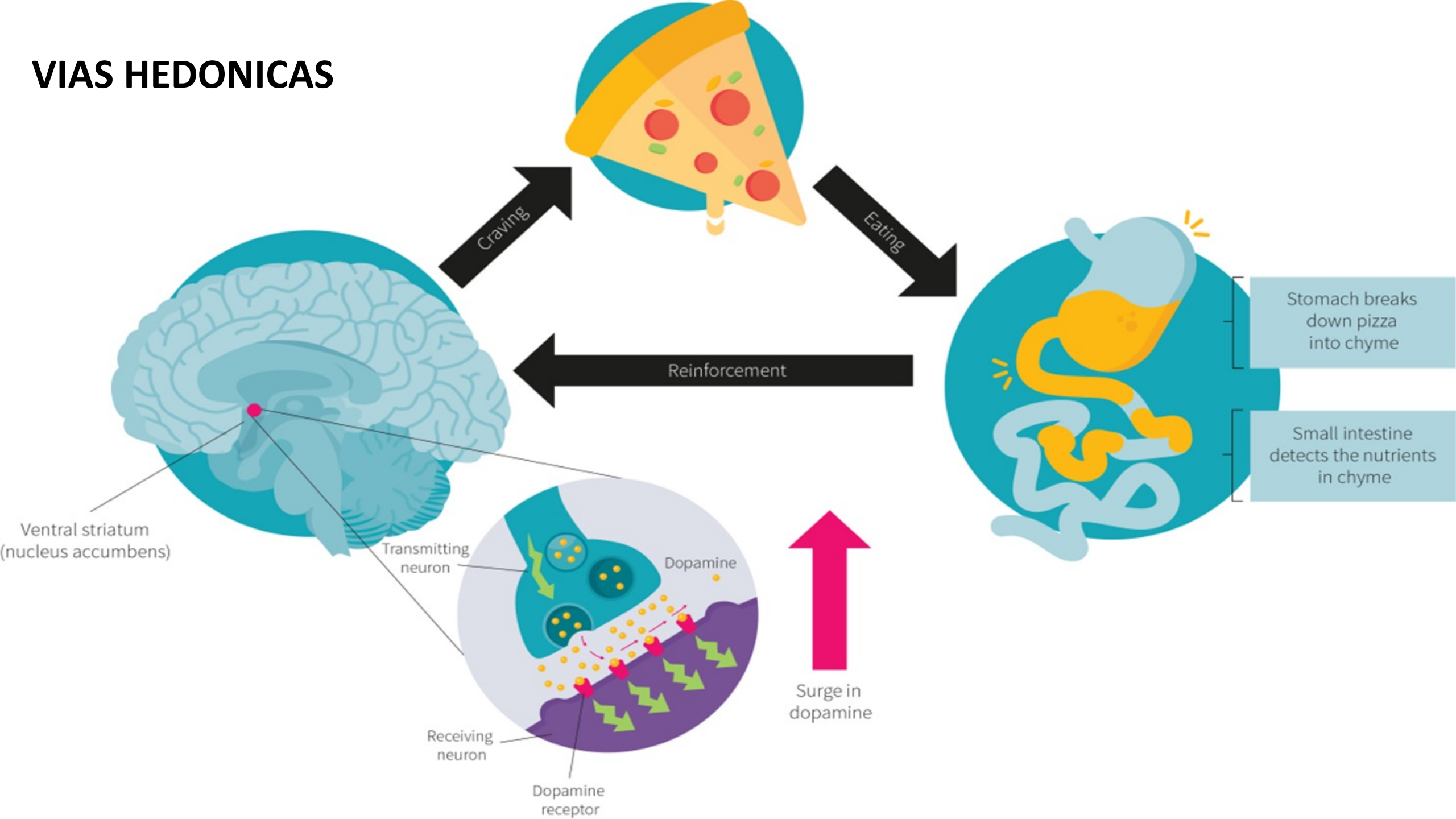
MISSMATCH EVOLUTIVO

- Fuimos cazadores-recolectores el 99,5% de nuestra historia
- Un 0,5% de ese tiempo pequeños agricultores
- Menos del 0,005% sistema moderno de producción de alimentos



Hall et al., 2022

VIAS HEDONICAS



WANTING

VIAS MESOLIMBICAS

DOPAMINA



VIAS HEDONICAS

LIKING

SISTEMA OPIODE

OPIOIDES

(ENDORFINAS, ENCEFALINAS, DINORINAS)




SUBWAY
BURGER KING
Donalds
McDonald's




PedidosYa





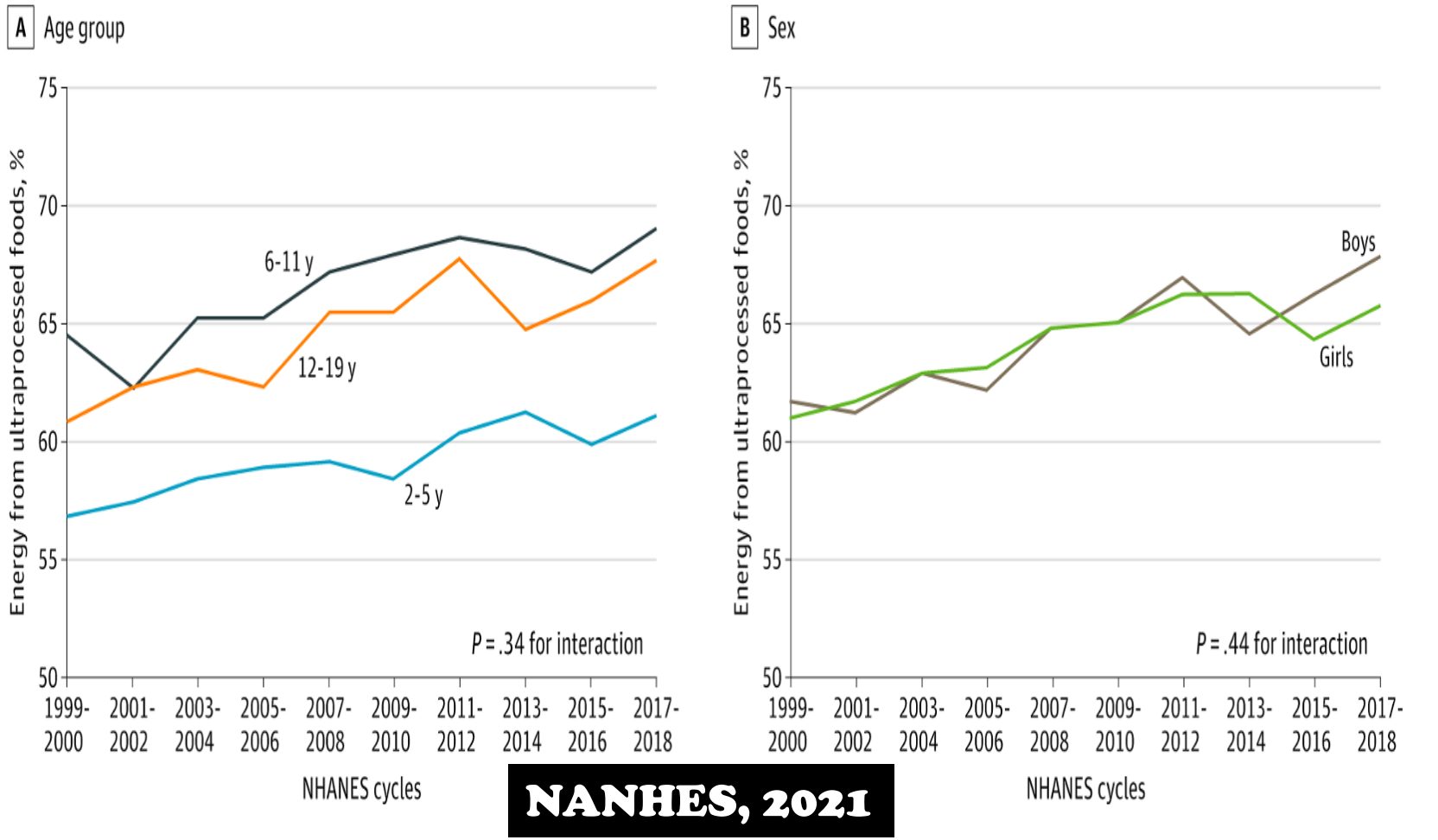
Ultra-processed foods and added sugars in the US diet: evidence from a nationally representative cross-sectional study

Eurídice Martínez Steele,[1,2] Larissa Galastri Baraldi,[1,2]
Maria Laura da Costa Louzada,[1,2] Jean-Claude Moubarac,[2]
Dariush Mozaffarian,[3] Carlos Augusto Monteiro[1,2]



Table 1 Distribution of the total energy intake and of the energy intake from added sugars according to food groups, and the mean content of added sugars of each food group

Food groups	Mean energy intake		Mean energy intake from added sugars		Mean content of added sugars
	Absolute (kcal/day)	Relative (% of total energy intake)	Absolute (kcal/day)	Relative (% of total energy intake from added sugars)	Percentage of energy from added sugars
Unprocessed or minimally processed foods	**585.5**	**29.6**	**0.0**	**0.0**	**0.0**
Meat (includes poultry)	165.3	7.9	0.0	0.0	0.0
Fruit*	97.5	5.2	0.0	0.0	0.0
Milk and plain yoghurt	96.4	5.1	0.0	0.0	0.0
Grains	53.3	2.8	0.0	0.0	0.0
Roots and tubers	32.2	1.6	0.0	0.0	0.0
Eggs	28.8	1.4	0.0	0.0	0.0
Pasta	28.4	1.4	0.0	0.0	0.0
Legumes	16.2	0.8	0.0	0.0	0.0
Fish and sea food	17.2	0.8	0.0	0.0	0.0
Vegetables	13.5	0.7	0.0	0.0	0.0
Other unprocessed or minimally processed foods†	36.7	1.8	0.0	0.0	0.0
Processed culinary ingredients	**64.3**	**2.9**	**24.4**	**8.7**	**38.8**
Table sugar‡	24.7	1.1	24.4	8.7	98.5
Plant oils	27.5	1.3	0.0	0.0	0.0
Animal fats§	11.2	0.5	0.0	0.0	0.0
Other processed culinary ingredients¶	0.9	0.04	0.0	0.0	0.0
Unprocessed or minimally processed foods+processed culinary ingredients	**649.8**	**32.6**	**24.4**	**8.7**	**3.7**
Processed foods	**209.7**	**9.4**	**2.5**	**1.6**	**2.4**
Cheese	80.1	3.7	0.0	0.0	0.0
Ham and other salted, smoked or canned meat or fish	26.4	1.2	0.3	0.2	1.4
Vegetables and other plant foods preserved in brine	13.4	0.7	1.6	0.9	13.7
Other processed foods**	89.8	3.8	0.6	0.5	1.2
Ultra-processed foods	**1209.8**	**57.9**	**265.2**	**89.7**	**21.1**
Breads	191.6	9.5	10.6	7.6	5.7
Cakes, cookies and pies	1	5.7	29.8	11.2	24.2
Salty snacks	3.2	4.6	1.2	0.7	1.4
Frozen and shelf-stable plate meals	80.6	4.02	1.1	0.7	1.6
Soft drinks, carbonated	81.8	3.7	75.2	17.1	69.9
Pizza (ready-to-eat/heat)	81.8	3.5	2.4	1.4	2.9
Fruit drinks‡‡	69.2	3.3	55.7	13.9	67.5
Breakfast cereals	50.9	2.8	12.4	6.4	23.3
Sauces, dressings and gravie	49.8	2.4	4.4	2.8	10.0
Reconstituted meat or fis ucts	51.5	2.4	0.7	0.6	2.0
Sweet snacks	50.9	2.4	19.4	7.1	38.9
Ice cream and i	48.7	2.3	18.3	5.9	36.9
Milk-based 3§	34.6	1.8	10.8	4.6	34.1
Desser	36.4	1.8	18.5	7.3	48.5
French es and other potato products	37.8	1.7	0.0	0.0	0.0
Sandwiches and hamburgers on bun (ready-to-eat/heat)	32.5	1.4	1.3	0.6	4.4
Instant and canned soups	14.3	0.8	0.1	0.1	0.7
Other ultra-processed foods†††	81.5	3.8	3.1	1.5	7.8
Total	**2069.5**	**100.0**	**292.2**	**100.0**	**13.8**


A Age group
Energy from ultraprocessed foods, %
75
70
65
60
55
50
6-11 y
12-19 y
2-5 y
P = .34 for interaction
1999-2000
2001-2002
2003-2004
2005-2006
2007-2008
2009-2010
2011-2012
2013-2014
2015-2016
2017-2018
NHANES cycles
B Sex
Energy from ultraprocessed foods, %
Boys
Girls
P = .44 for interaction
NHANES cycles

NANHES, 2021

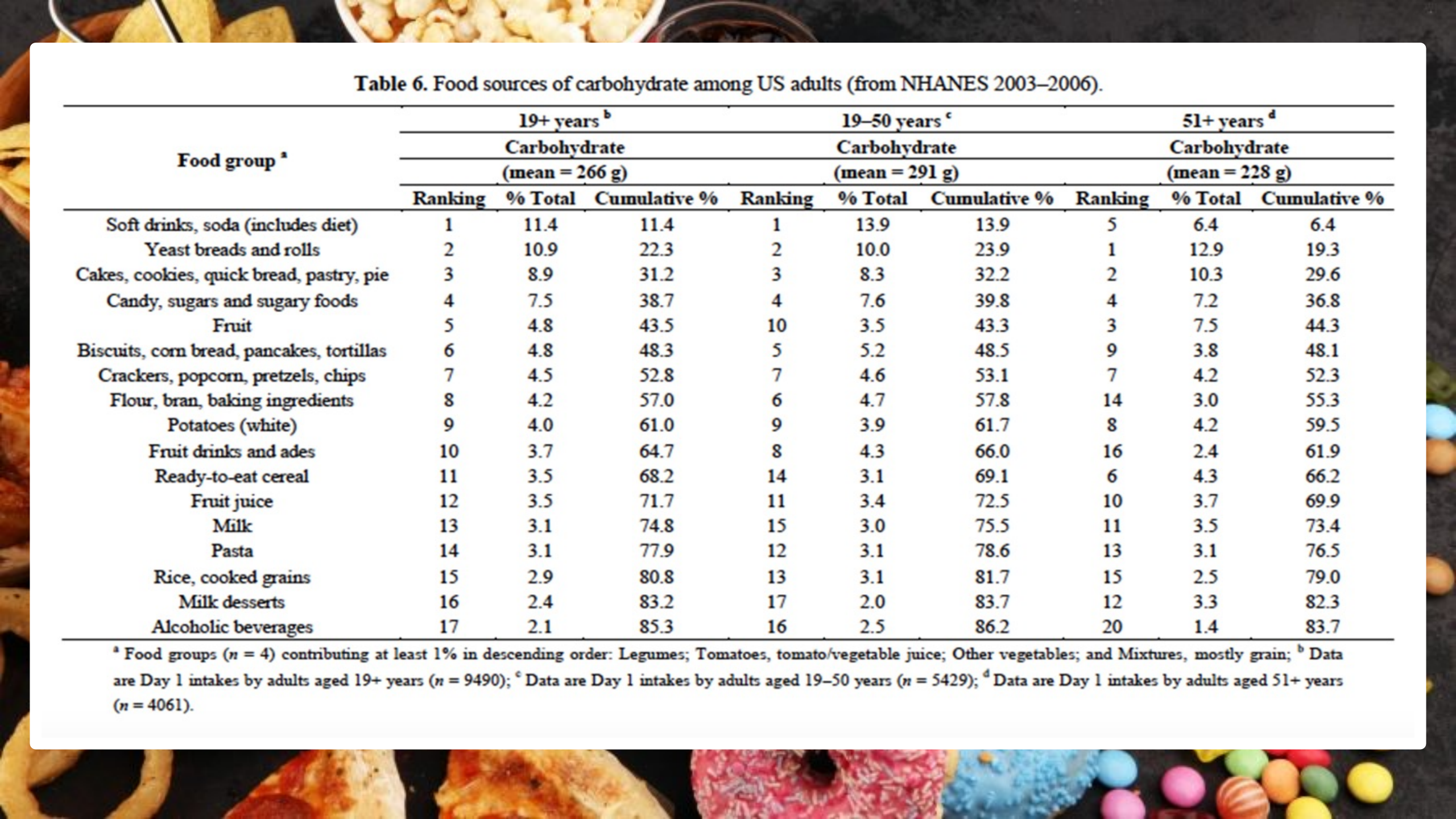


Table 6. Food sources of carbohydrate among US adults (from NHANES 2003–2006).

Food group [a]	19+ years [b]			19–50 years [c]			51+ years [d]		
	Carbohydrate (mean = 266 g)			Carbohydrate (mean = 291 g)			Carbohydrate (mean = 228 g)		
	Ranking	% Total	Cumulative %	Ranking	% Total	Cumulative %	Ranking	% Total	Cumulative %
Soft drinks, soda (includes diet)	1	11.4	11.4	1	13.9	13.9	5	6.4	6.4
Yeast breads and rolls	2	10.9	22.3	2	10.0	23.9	1	12.9	19.3
Cakes, cookies, quick bread, pastry, pie	3	8.9	31.2	3	8.3	32.2	2	10.3	29.6
Candy, sugars and sugary foods	4	7.5	38.7	4	7.6	39.8	4	7.2	36.8
Fruit	5	4.8	43.5	10	3.5	43.3	3	7.5	44.3
Biscuits, corn bread, pancakes, tortillas	6	4.8	48.3	5	5.2	48.5	9	3.8	48.1
Crackers, popcorn, pretzels, chips	7	4.5	52.8	7	4.6	53.1	7	4.2	52.3
Flour, bran, baking ingredients	8	4.2	57.0	6	4.7	57.8	14	3.0	55.3
Potatoes (white)	9	4.0	61.0	9	3.9	61.7	8	4.2	59.5
Fruit drinks and ades	10	3.7	64.7	8	4.3	66.0	16	2.4	61.9
Ready-to-eat cereal	11	3.5	68.2	14	3.1	69.1	6	4.3	66.2
Fruit juice	12	3.5	71.7	11	3.4	72.5	10	3.7	69.9
Milk	13	3.1	74.8	15	3.0	75.5	11	3.5	73.4
Pasta	14	3.1	77.9	12	3.1	78.6	13	3.1	76.5
Rice, cooked grains	15	2.9	80.8	13	3.1	81.7	15	2.5	79.0
Milk desserts	16	2.4	83.2	17	2.0	83.7	12	3.3	82.3
Alcoholic beverages	17	2.1	85.3	16	2.5	86.2	20	1.4	83.7

[a] Food groups (n = 4) contributing at least 1% in descending order: Legumes; Tomatoes, tomato/vegetable juice; Other vegetables; and Mixtures, mostly grain; [b] Data are Day 1 intakes by adults aged 19+ years (n = 9490); [c] Data are Day 1 intakes by adults aged 19–50 years (n = 5429); [d] Data are Day 1 intakes by adults aged 51+ years (n = 4061).



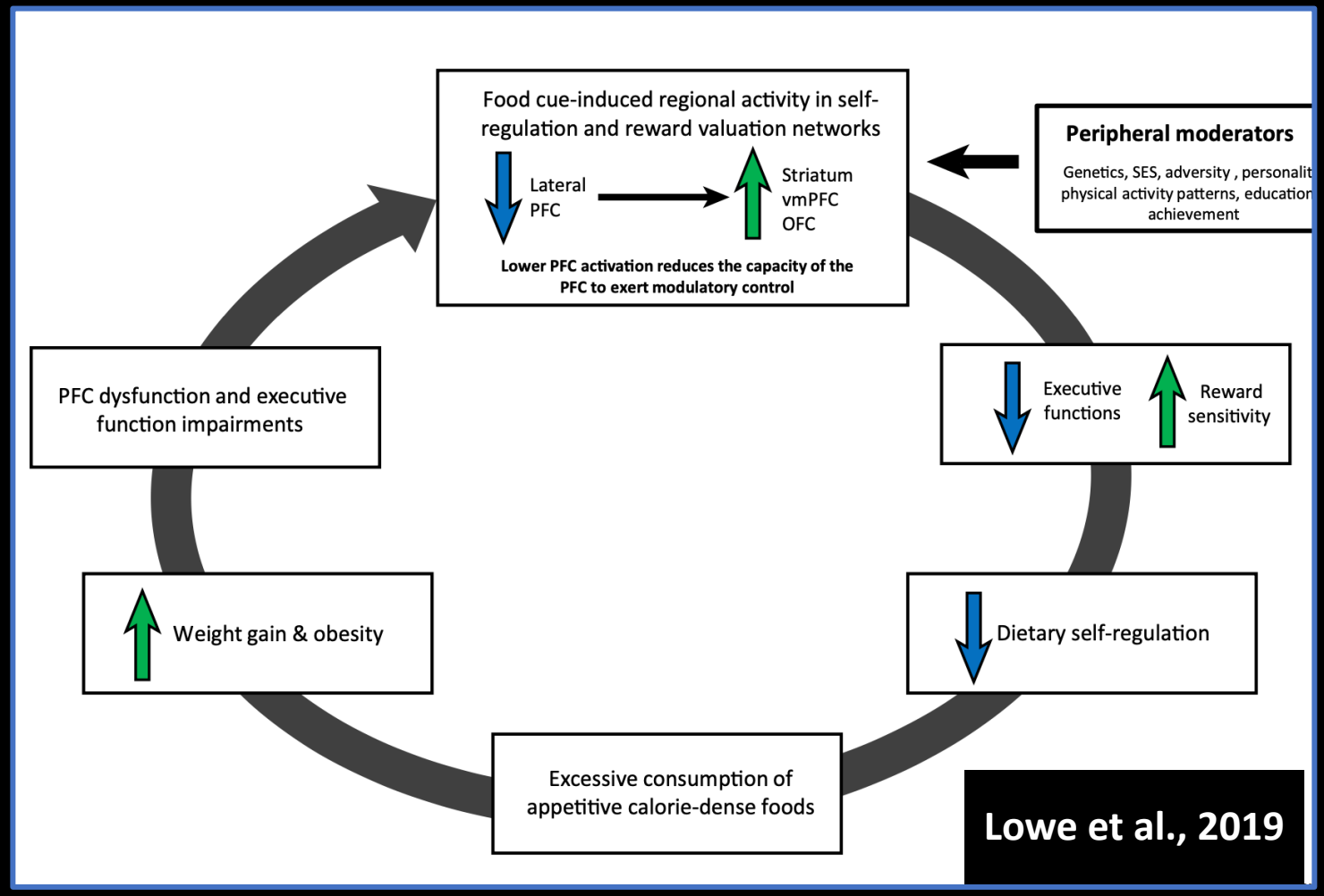
Ultrapalatables

- Los UP son alimentos que sufren desviaciones sustanciales de sus formas naturales con el fin de maximizar las propiedades gratificantes.
- A diferencia de los alimentos naturales que contienen un nutriente primario que induce la palatabilidad, los UP contienen combinaciones de nutrientes que normalmente no se encuentran en la naturaleza (p. ej., altas cantidades de azúcar y grasa en un mismo alimento) lo cual genera una fuerte activación en las regiones de recompensa cerebrales

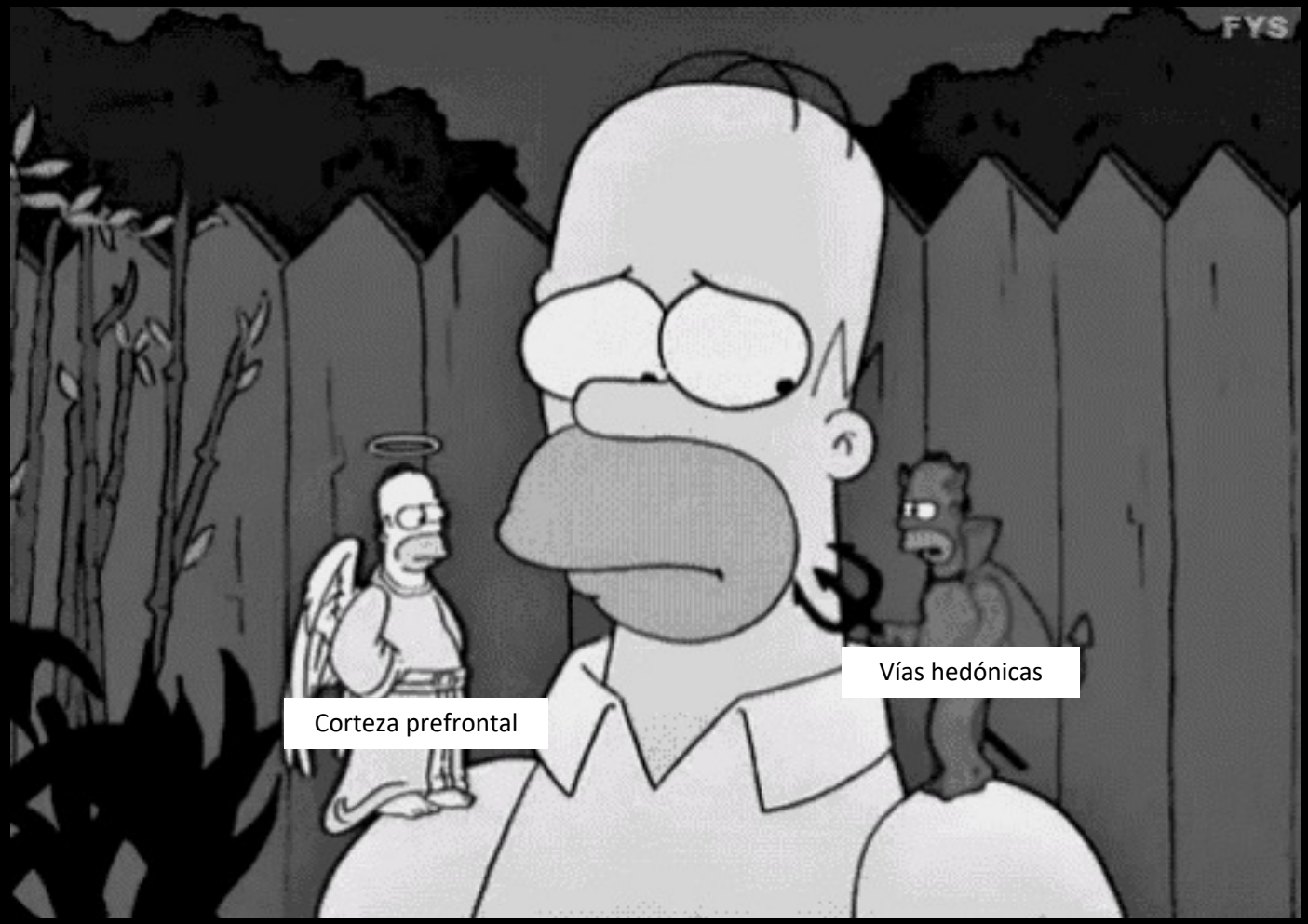
Ultrapalatables

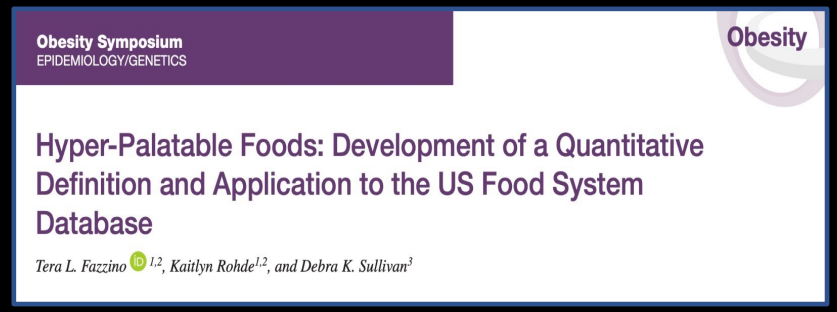
- Alto poder reforzamiento
- Sensibilización (< liking > wanting)
- Disminuyen actividad C. Prefrontal




Food cue-induced regional activity in self-regulation and reward valuation networks
Lateral PFC
Striatum vmPFC OFC
Lower PFC activation reduces the capacity of the PFC to exert modulatory control
Peripheral moderators
Genetics, SES, adversity , personalit
physical activity patterns, educatio
achievement
Executive functions
Reward sensitivity
Dietary self-regulation
Excessive consumption of appetitive calorie-dense foods
Weight gain & obesity
PFC dysfunction and executive function impairments
Lowe et al., 2019




FYS
Corteza prefrontal
Vías hedónicas



- HPF altos en grasa y sodio (>25 % kcal de grasa y ≥ 0,30 % de sodio por peso)
- HPF altos en Grasa y azúcar (>20 % kcal de grasa y >20 % kcal de azúcar)
- HPF altos en carbohidratos y sodio(>40% kcal de carbohidratos y ≥ 0,20% de sodio por peso).

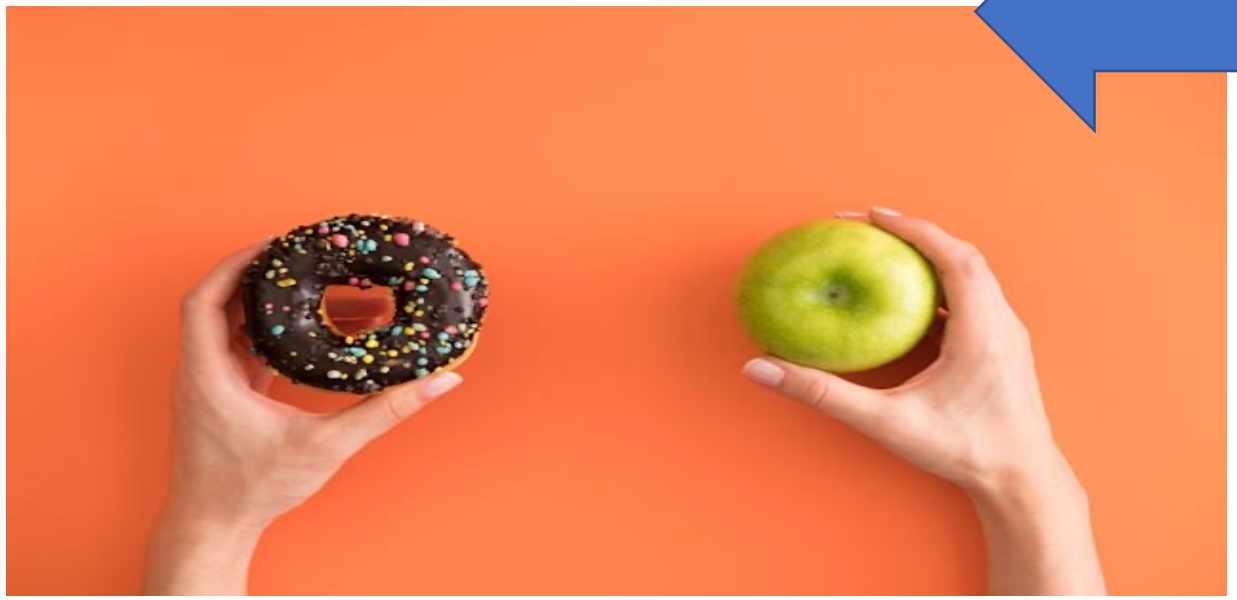


Fazzino et al en 2019

nature food

Brief Communication https://doi.org/10.1038/s43016-022-00688-4

Ad libitum meal energy intake is positively influenced by energy density, eating rate and hyper-palatable food across four dietary patterns

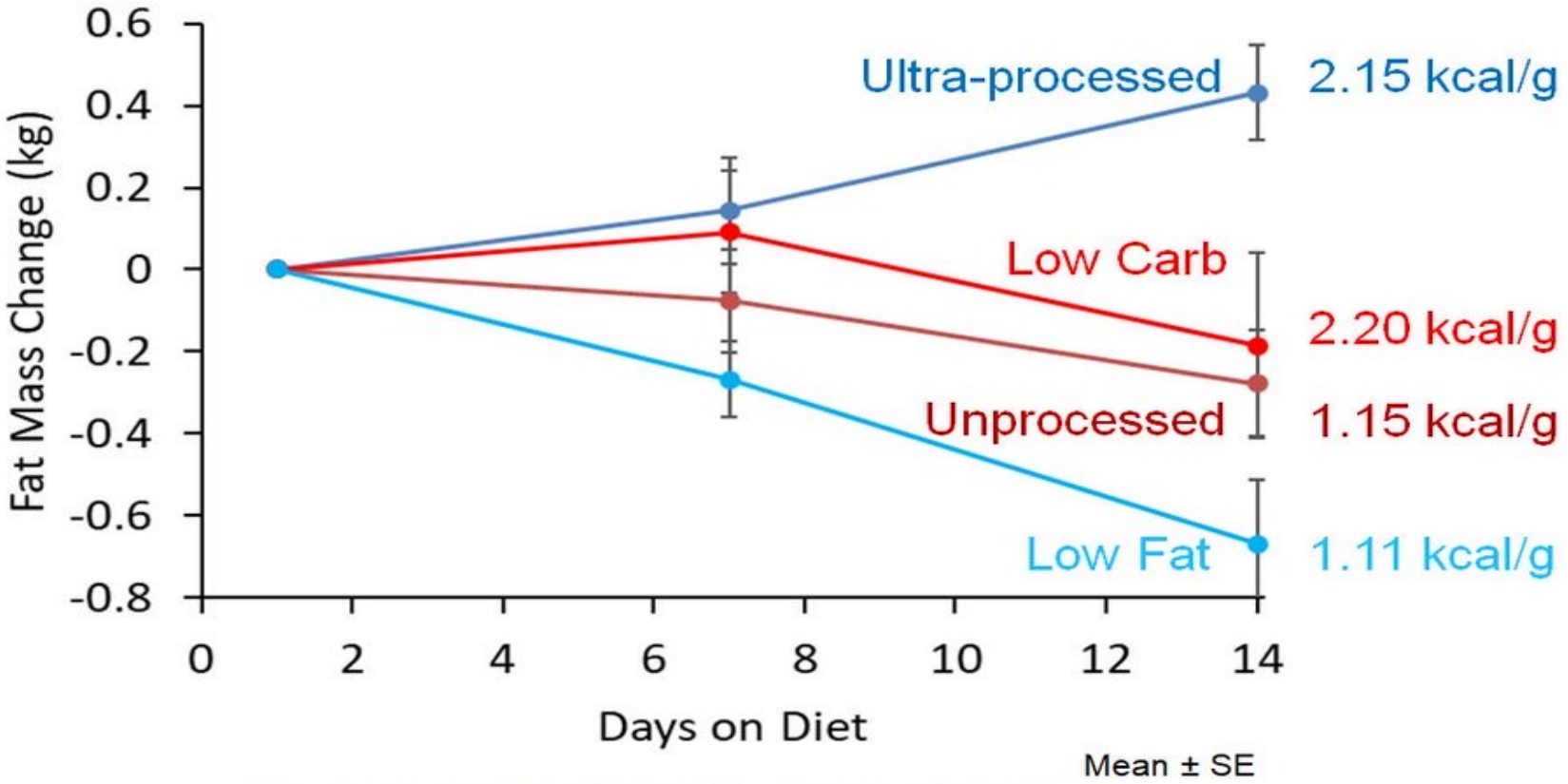




K. Hall

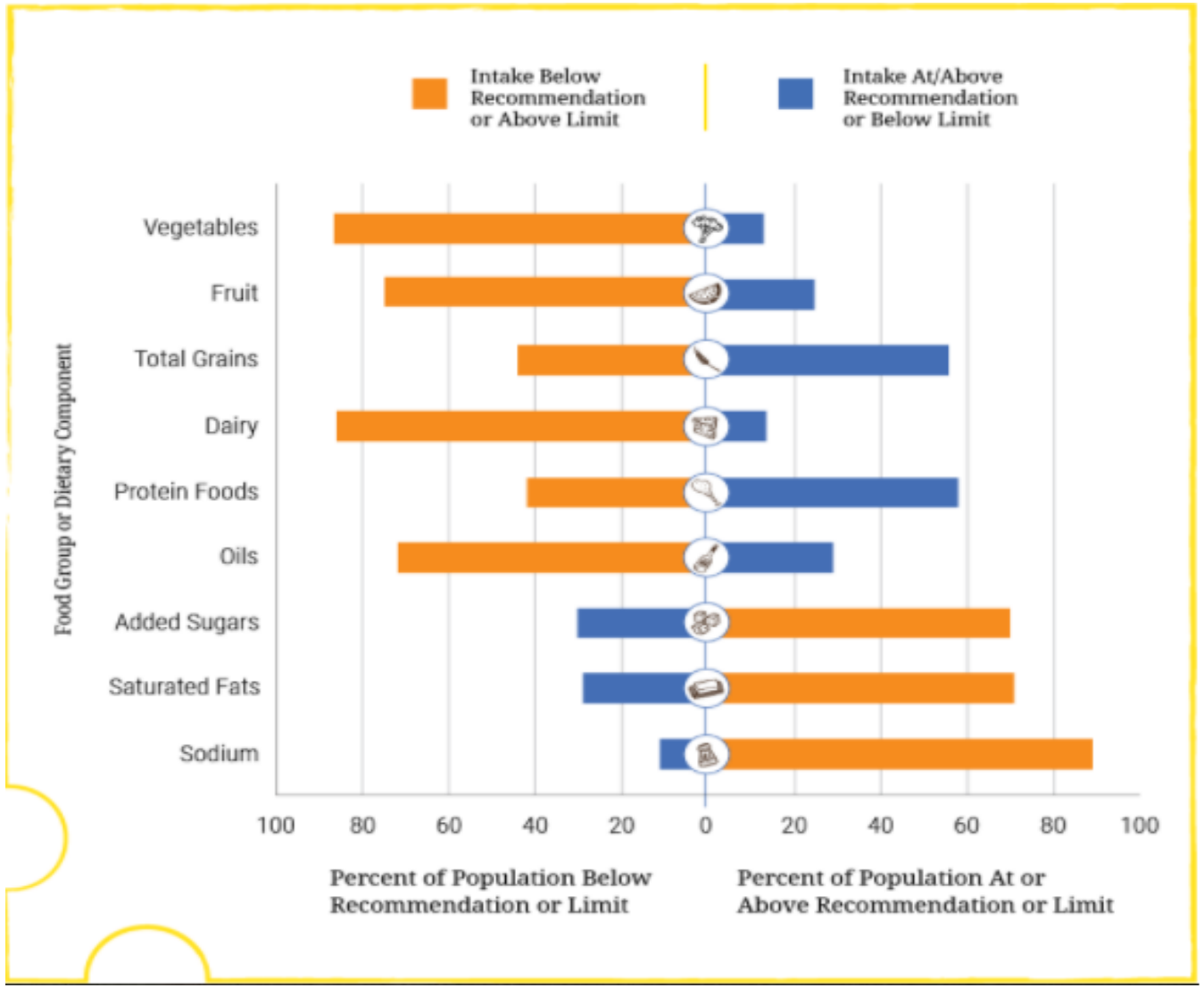
EL > % de HPF se asoció de manera significativa e independiente con la ingesta de energética en todos los patrones de alimentación .
(Fazzino et al, 2023)

Body Fat Changes During *Ad Libitum* Feeding



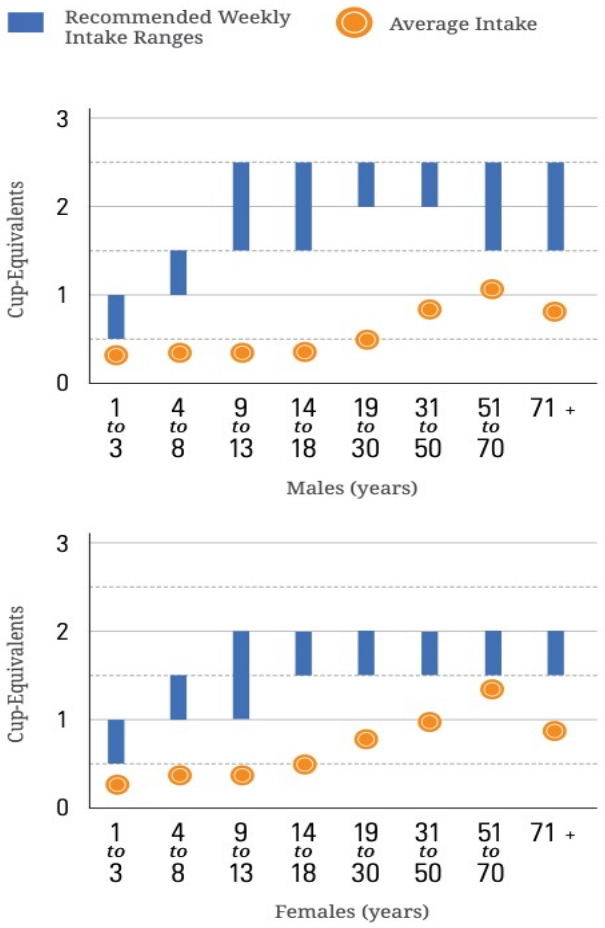
KD Hall et al. *Cell Metabolism* 30:1-11 (2019).

KD Hall et al. *Nature Medicine* 27:344-353 (2021).



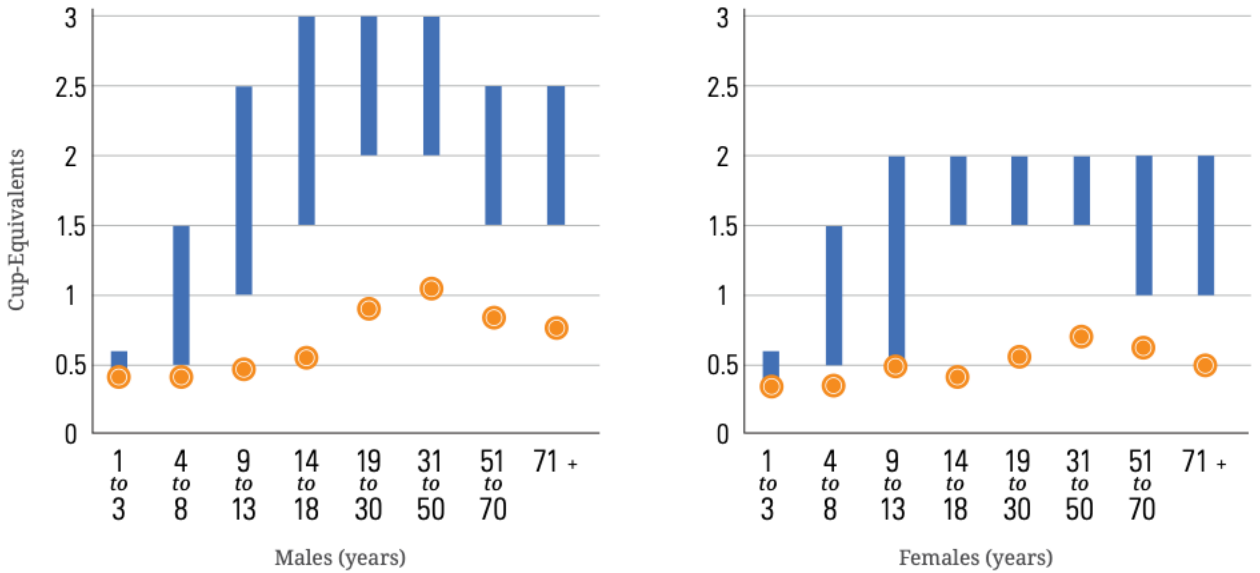
What We Eat in America, NHANES 2007-2010 for average intakes by age-sex group. Healthy U.S.-Style Food Patterns, which vary based on age, sex, and activity level, for recommended intakes and limits.

Dark Green Vegetables

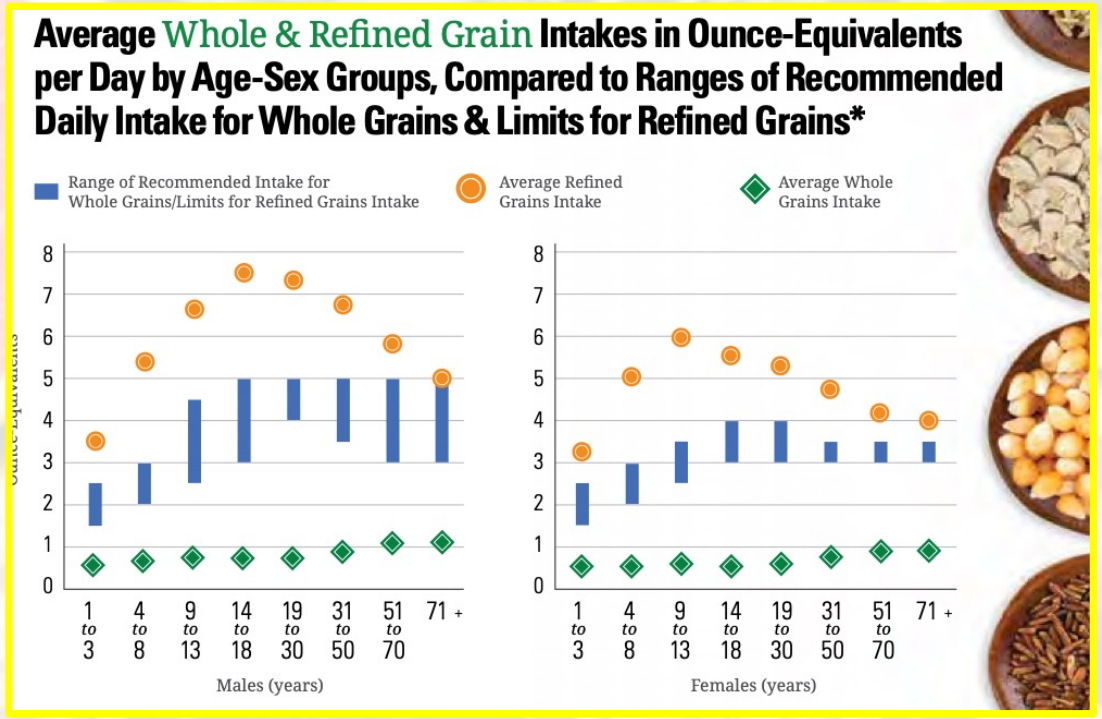


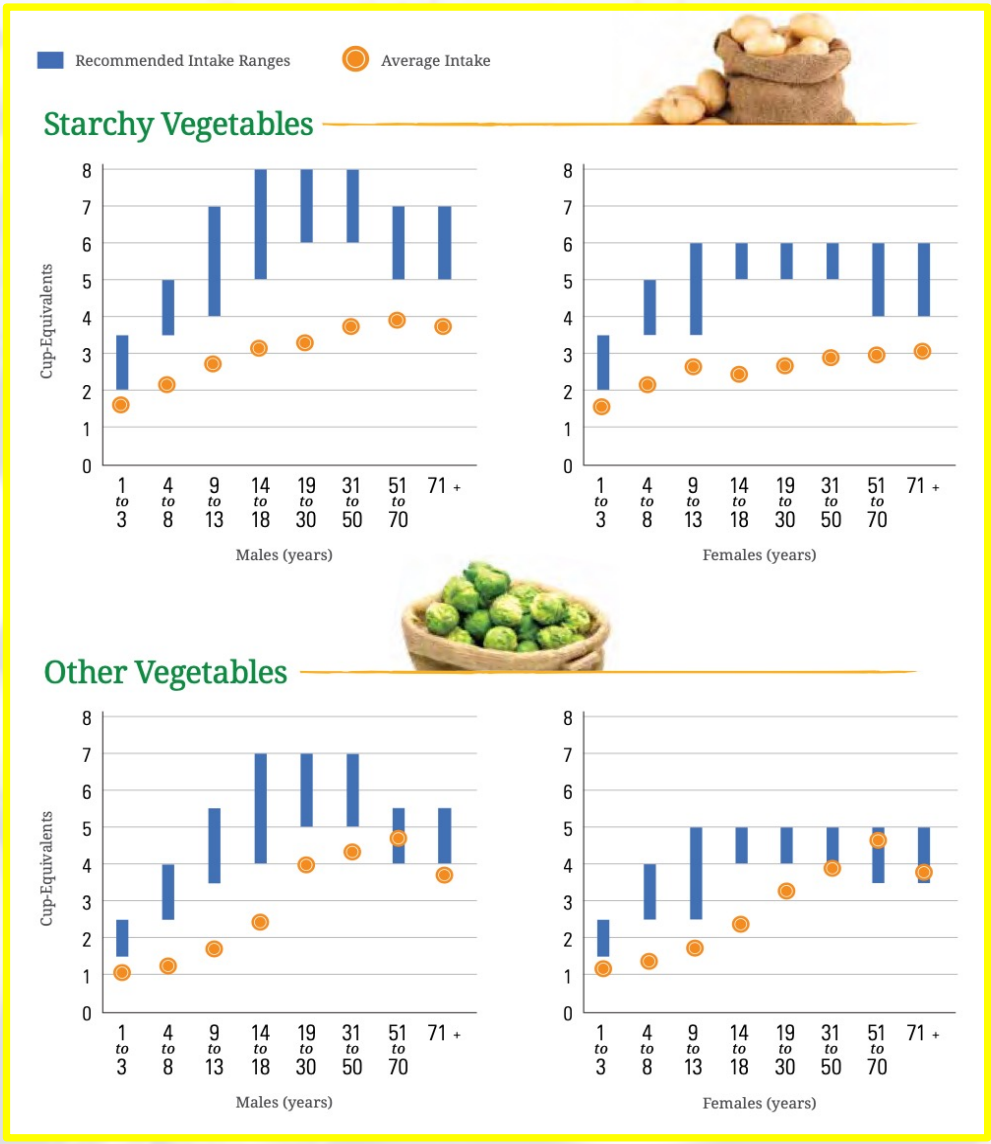
Legumes (Beans & Peas)





What We Eat in America, NHANES 2007-2010 for average intakes by age-sex group. Healthy U.S.-Style Food Patterns, which vary based on age, sex, and activity level, for recommended intakes and limits.

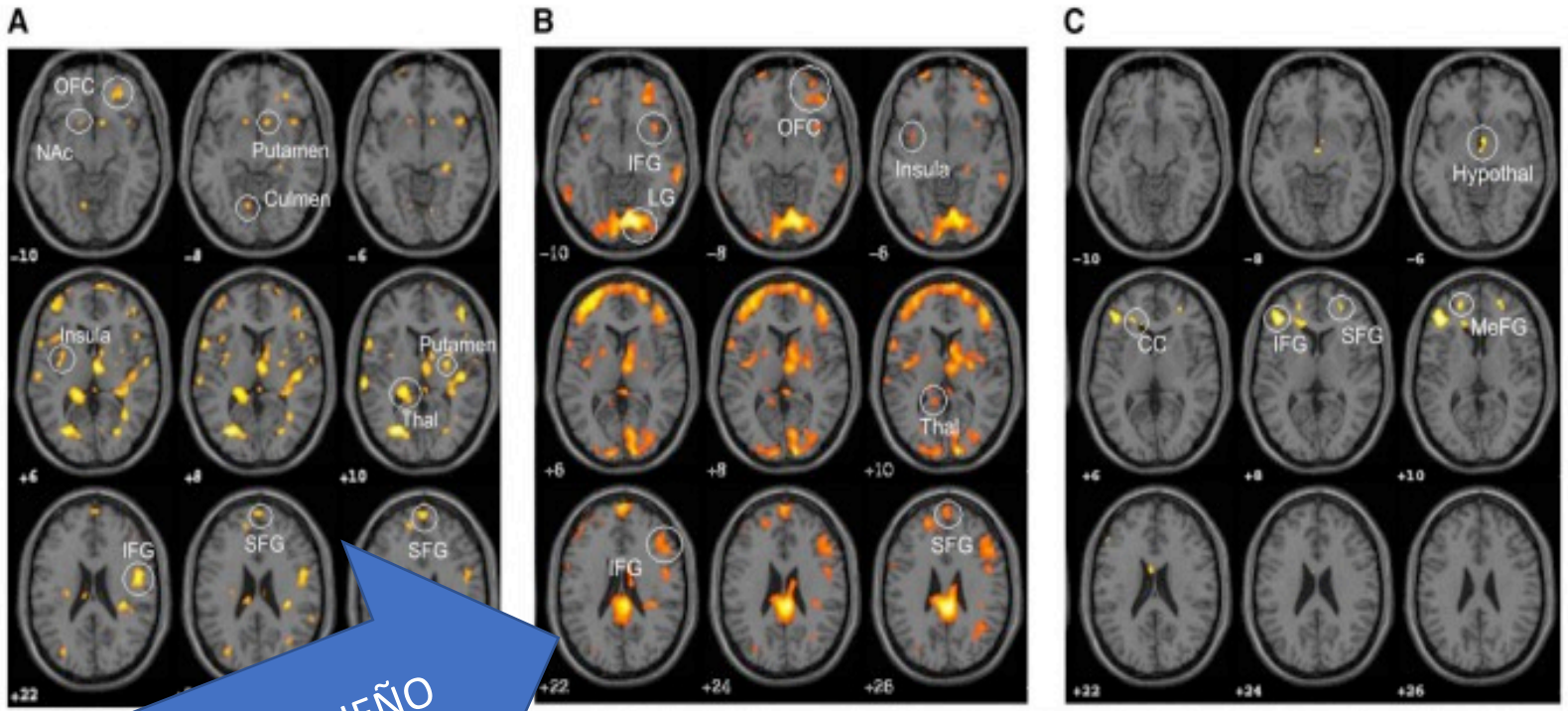




What We Eat in America, NHANES 2007-2010 for average intakes by age-sex group. Healthy U.S.-Style Food Patterns, which vary based on age, sex, and activity level, for recommended intakes and limits.

Sleep restriction leads to increased activation of brain regions sensitive to food stimuli[1–4]

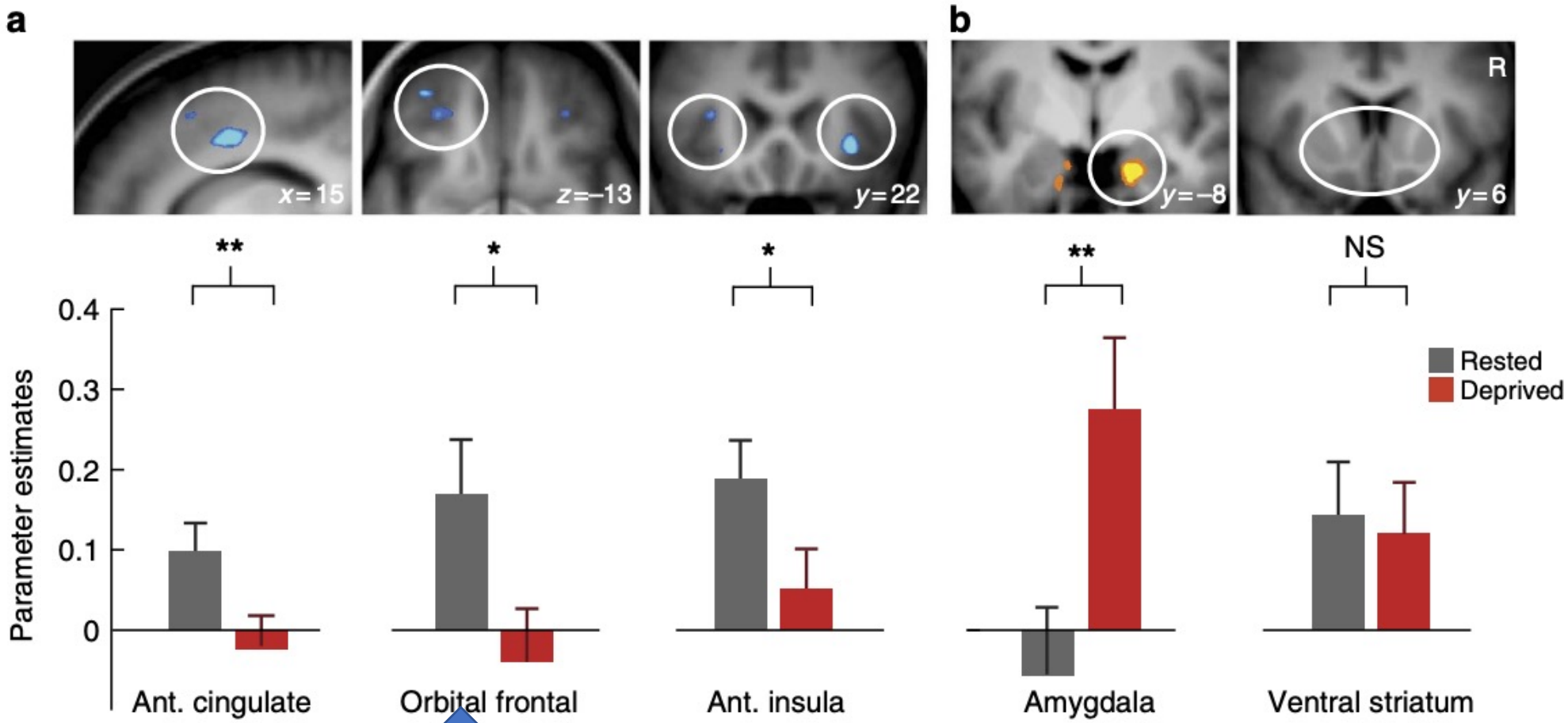
Marie-Pierre St-Onge, Andrew McReynolds, Zalak B Trivedi, Amy L Roberts, Melissa Sy, and Joy Hirsch



RESTRICCION DE SUEÑO

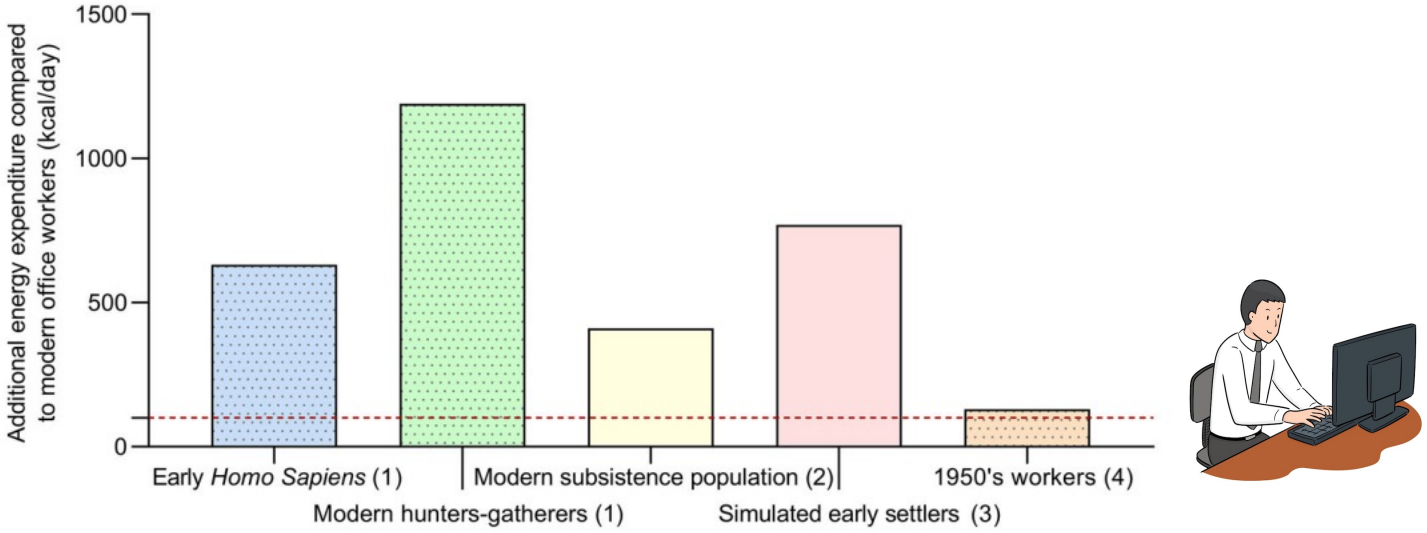
...d > nonfood stimuli during a period of restricted sleep > habitual sleep (A), restricted sleep (B), and ...uster-level $P < 0.01$, cluster ≥ 10). $n = 26$. Corresponding coordinates are provided in Tables 2–4 and in ...pplemen...ata" in the online issue. Contrasts for food > nonfood were performed for each subject and averaged. After ...t test for group ...alysis was performed by using the same statistical parameters to compare regional brain activity with food > ...ed sleep > habitual sleep. CC, corpus callosum; Hypothal, hypothalamus; IFG, inferior frontal gyrus; LG, lingual gyrus; MeFG, medial ..., NAc, nucleus accumbens; OFC, orbitofrontal cortex; SFG, superior frontal gyrus; SPM, Statistical Parametric Mapping; Thal, thalamus.

Greer et al., 2013



Toma de decisiones
Percepción riesgo-recompensa

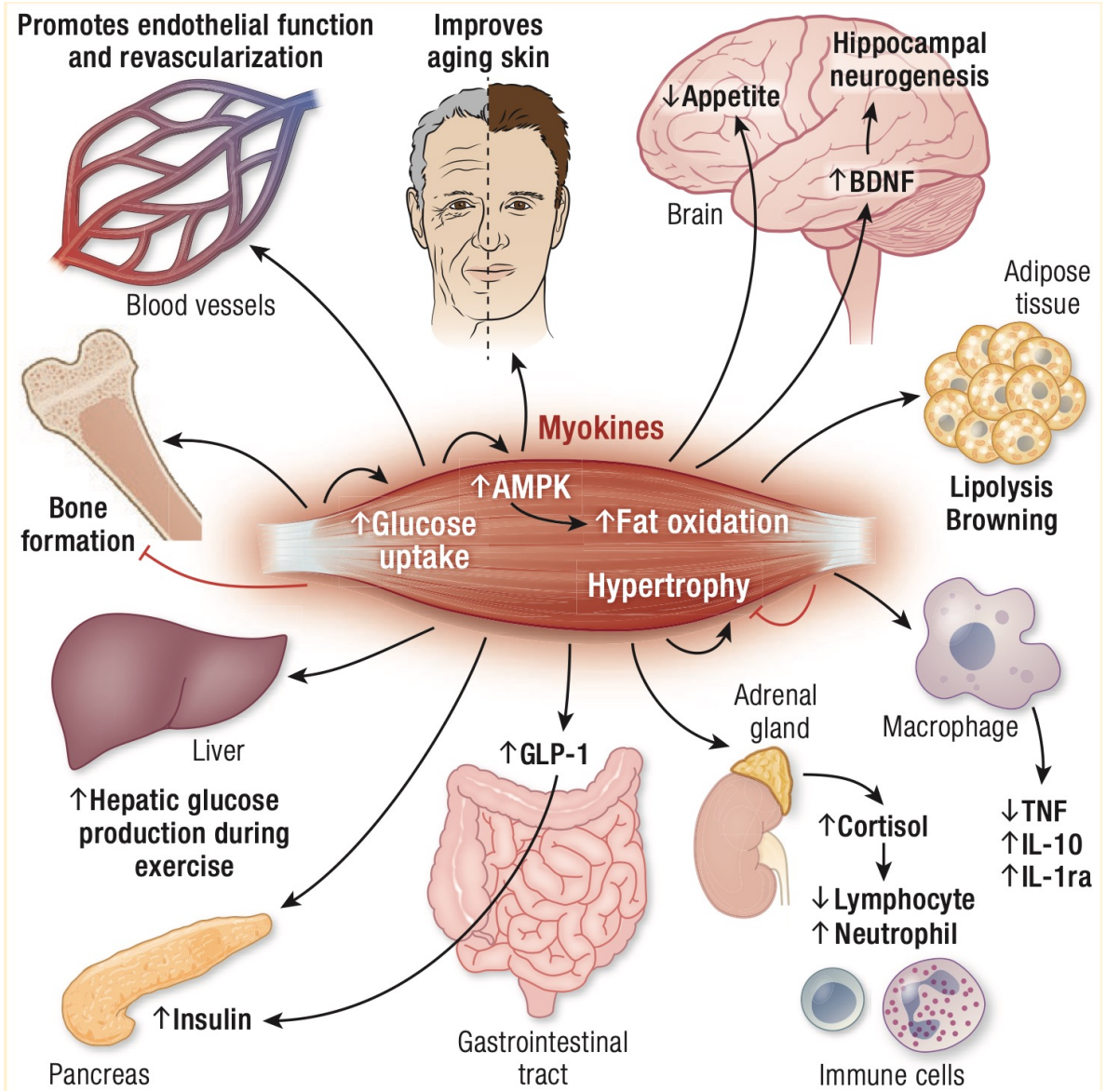
Estructuras parte de las vías de recompensa


Additional energy expenditure compared to modern office workers (kcal/day)
1500
1000
500
0
Early *Homo Sapiens* (1)
Modern subsistence population (2)
1950's workers (4)
Modern hunters-gatherers (1)
Simulated early settlers (3)

Efectos del ejercicio sobre la regulación del apetito

- Mayores niveles de Leptina
- Mayores niveles de GLP-1
- Reducción de niveles de inflamación
- Producción de otras moléculas de efecto anorexígeno?





Severinsen & Pedersen, 2020



great debates IN nutrition

The concept of “food addiction” helps inform the understanding of overeating and obesity: YES

Ashley N Gearhardt[1] *and Johannes Hebebrand*[2]

The concept of “food addiction” helps inform the understanding of overeating and obesity: NO

Johannes Hebebrand[1] *and Ashley N Gearhardt*[2]

Podemos hablar de adicción a los alimentos?

- Los alimentos HP son sustancias complejas que combinan ingredientes de alto poder de reforzamiento y aditivos para brindar niveles de recompensa anormalmente elevados
- Los alimentos HP entregan rápidamente estos ingredientes de refuerzo a través de la eliminación de ingredientes que retrasan la absorción
- Los HP activan la liberación elevada de dopamina desencadenando conductas tipo- adictivas
- Tienen un costo de salud pública que rivaliza con el del tabaco.

Gearhardt A. & Hebebrand J., 2021

Podemos hablar de adicción a los alimentos?

- Existen estudios que han documentado síntomas de abstinencia como irritabilidad, fatiga, sentimientos de tristeza y antojos.
- Estudios de imágenes cerebrales han señalado que las personas que consumen comida chatarra con frecuencia pueden desarrollar tolerancia (lo que las lleva a necesitar cantidades cada vez mayores para obtener el mismo placer)

Gearhardt A. & Hebebrand J., 2021

The concept of “food addiction” helps inform the understanding of overeating and obesity: Debate Consensus

Ashley N Gearhardt[1] *and Johannes Hebebrand*[2]

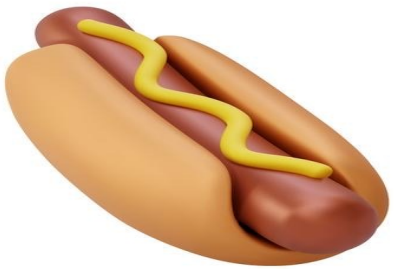
[1]Department of Psychology, University of Michigan, Ann Arbor, MI, USA; and [2]Department of Child and Adolescent Psychiatry, Psychosomatics, and Psychotherapy, University Hospital Essen, University of Duisburg-Essen, Essen, Germany

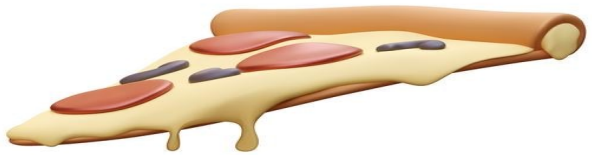
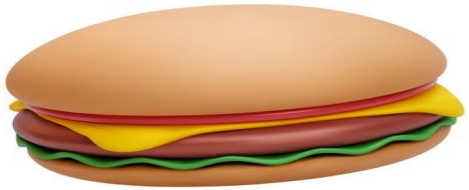
great debates in nutrition

ASN EST. 1928

Mas allá de todo NO anterior no existe consenso para hablar de adicción a los alimentos.

Al momento si podemos afirmar que existen conductas tipo-adictivas en sujetos vulnerables.



The concept of “food addiction” helps inform the understanding of overeating and obesity: Debate Consensus

Ashley N Gearhardt[1] *and Johannes Hebebrand*[2]

[1]Department of Psychology, University of Michigan, Ann Arbor, MI, USA; and [2]Department of Child and Adolescent Psychiatry, Psychosomatics, and Psychotherapy, University Hospital Essen, University of Duisburg-Essen, Essen, Germany

great debates IN nutrition

ASN EST. 1928

- Los atributos de los alimentos, las diferencias individuales y los patrones conductuales de consumo contribuyen a una alimentación tipo adictiva.
- Los mecanismos implicados en los trastornos adictivos y relacionados con sustancias (p. ej., circuitos de recompensa, control ejecutivo) desempeñan un papel importante en la sobrealimentación.
- Los comportamientos alimentarios de tipo adictivo no ocurren únicamente en personas con obesidad, sino que la prevalencia de estos comportamientos es mayor en personas con obesidad.

The concept of “food addiction” helps inform the understanding of overeating and obesity: Debate Consensus

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great debates IN nutrition

ASN EST. 1928

- Las prácticas de la industria alimentaria son un factor importante que contribuye al aumento de las tasas de obesidad y alimentación tipo adictiva.
- La industria alimentaria debe aspirar a mejorar la calidad dietética de los alimentos y dejar de dirigirse a las poblaciones vulnerables para la comercialización de alimentos poco saludables altamente procesados.
- Una perspectiva de salud pública centrada en el entorno será clave para reducir tanto la alimentación adictiva como la obesidad.



Ventajas de las PBD desde el punto de vista de la neurobiologia del apetito

- Alto contenido de fibra
- Alimentos minimamente procesados
- Alimentos sin aditivos ni mejoradores de texturas,etc.
- Baja densidad energética
- Alto impacto sobre saciedad
- Bajo poder de reforzamiento



Que mas podemos hacer vs un entorno obesogénico

- Llevar un registro de lo que comemos para identificar los alimentos ultrapalatables
- Disponer de de alimentos mínimamente procesados en el hogar
- Gestión del estrés
- Descanso adecuado
- Actividad física
- Llevar un registro de los factores desencadenantes que conducen a los antojos y los atracones.
- En los niños y niñas considerar el efecto persuasivo de la publicidad



Muchas gracias!!

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