Diseño y evaluación del Programa MOVI: Un ejemplo de intervención en horario extraescolar frente a la obesidad infantil

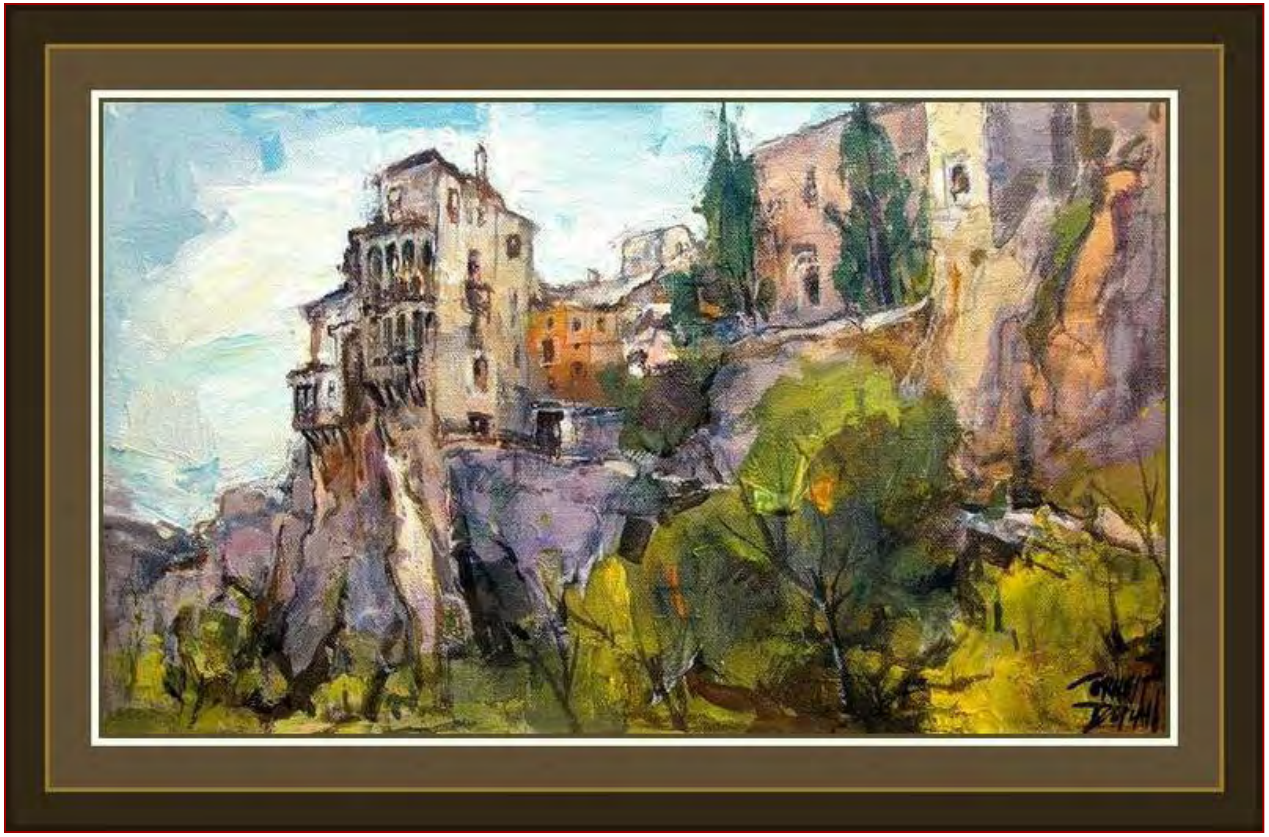
Curso de Verano UCM

LOS NUEVOS RETOS DEL CONSUMIDOR: PREVENCIÓN DE LA OBESIDAD INFANTIL

El Escorial, 9 de julio de 2013

Vicente Martínez Vizcaíno
Centro de Estudios Sociosanitarios
UCLM

El Estudio de Cuenca

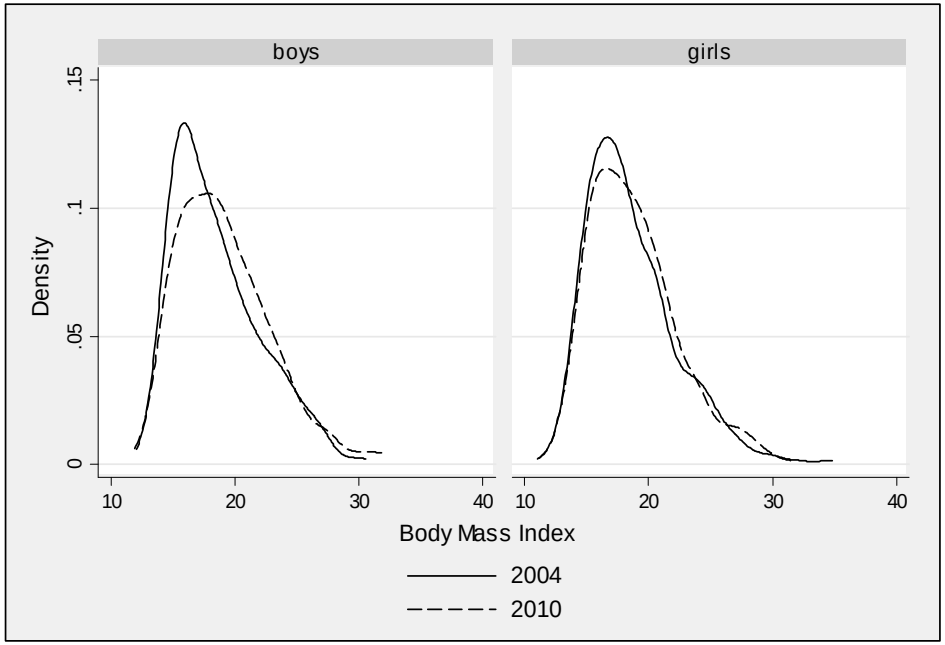


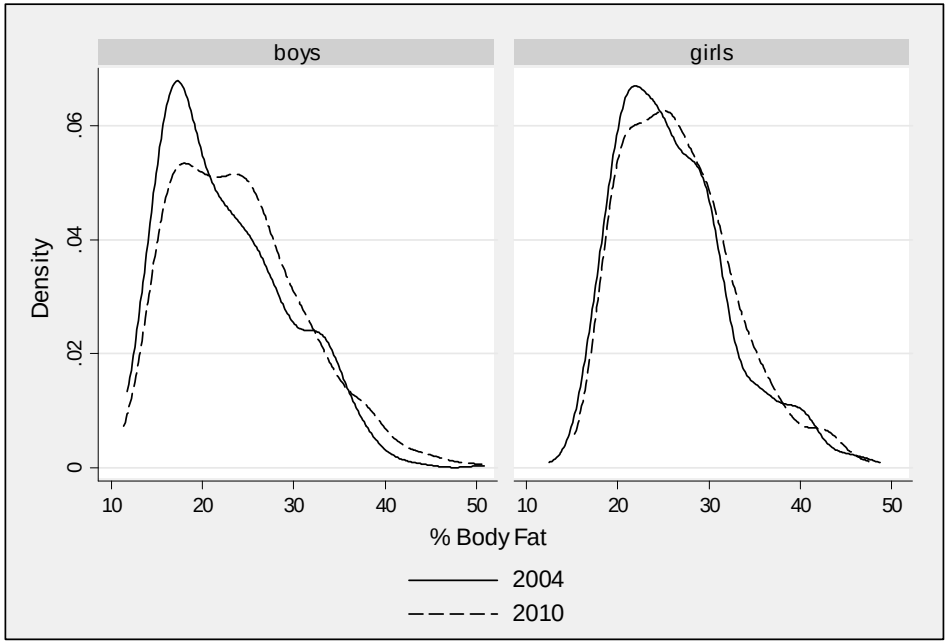
Cuenca-Casas colgadas- óleo de Ernest Descals

La obesidad infantil: características del problema en nuestro medio

La obesidad infantil en España: prevalencia y tendencia 2004-10

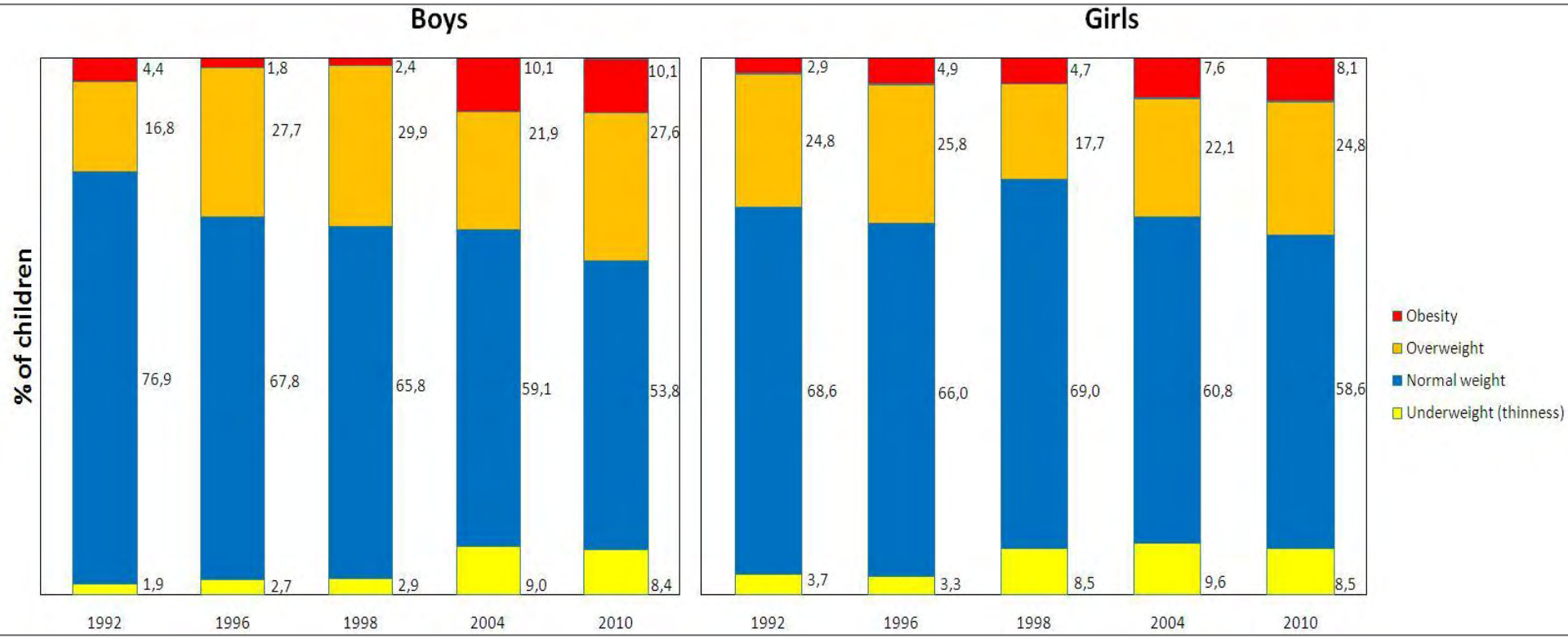
¿Ha tocado techo el problema de la obesidad infantil en España?





Tendencia en la distribución del IMC y del % de grasa corporal 2004-2010

La carga dual de los problemas de peso en escolares en España: Estudio de Cuenca



Evidencias científicas en la prevención de sobrepeso en la población infantil

Estudios de revisión de intervenciones para prevenir la obesidad infantil

Escasez de estudios bien diseñados.

Heterogeneidad de:

a. Diseño
b. Ámbito de aplicación
c. Tipo de intervención
d. Medidas de efecto

Conclusiones:

- No hay evidencia suficiente que avale intervenciones basadas exclusivamente en la promoción de cambios dietéticos
- Evidencia inconsistente o ambigua de la efectividad de intervenciones basadas en dieta + actividad física
- Parecen más efectivas las intervenciones que aumentan el tiempo de actividad física y reducen el tiempo de sedentarismo.

-F. Hillier, Bundesgesundheitsbl 2011 · 54:259–264

-Luttikhuis et al. Cochrane Database Syst Rev 2009; 1: CD001872.

-González-Suaréz C, Am J Prev Med 2009;37(5)
-Lissau L, Acta Paediatr Suppl 2007;96:12-8

¿Cuál es la intervención prioritaria cuya efectividad deberíamos probar?

¿Estaría justificada una intervención para todos que **redujera la ingesta**?

A nuestro juicio **NO**, porque podría perjudicar a algunos con problemas de bajo peso

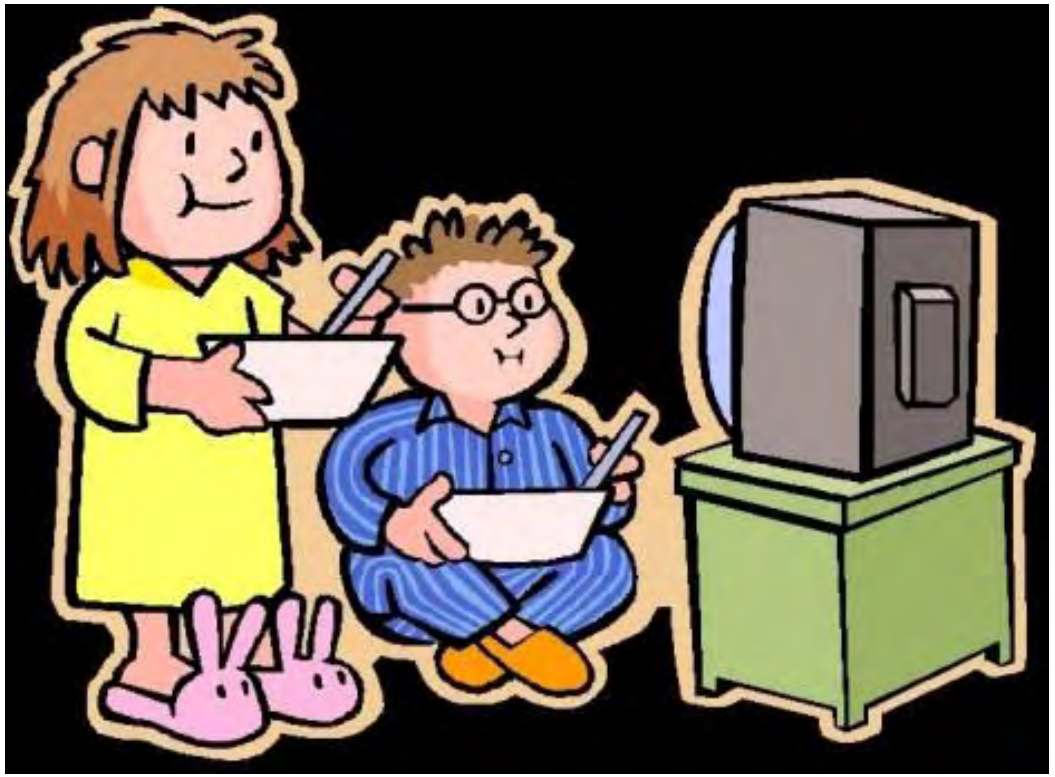
¿Por qué debería estar **dirigida a niños**?

- Prevalencia creciente de obesidad infantil
- Dificultad de control de la obesidad en adultos
- Persistencia de hábitos que se adquieren en la infancia durante la edad adulta

¿Cuál es la intervención prioritaria cuya efectividad deberíamos probar?

¿Estaría justificada una intervención basada en la **reducción de horas de TV**?

Probablemente **SÍ,** pero habría que dar alternativas para esas horas



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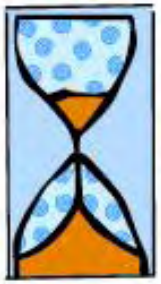
?

¿Qué tipo de intervención es la más adecuada en escolares españoles?


Libre de riesgo para los de bajo peso
Hablamos de juego, no de obesidad
Puede mejorar otros aspectos relacionados con la salud
Supone una alternativa a los juegos de pantalla
Sin excluidos
Actividad física recreativa no competitiva

¡A tener en cuenta!



Seguimiento a largo plazo

€

Coste - efectividad

¿Cómo implicar a las familias?

¿Qué es lo que funciona?

Cómo funciona (mediadores)

Efectividad en ambientes ajenos a la investigación

Calidad/ rigor al llevarla a cabo

Conductas compensatorias

MOVI-2

Impacto de una intervención de actividad física de larga duración sobre el sobrepeso y la obesidad en escolares. Estudio de Cuenca

IP: Martínez Vizcaíno, V

Financiación:

- Instituto de Salud Carlos III:

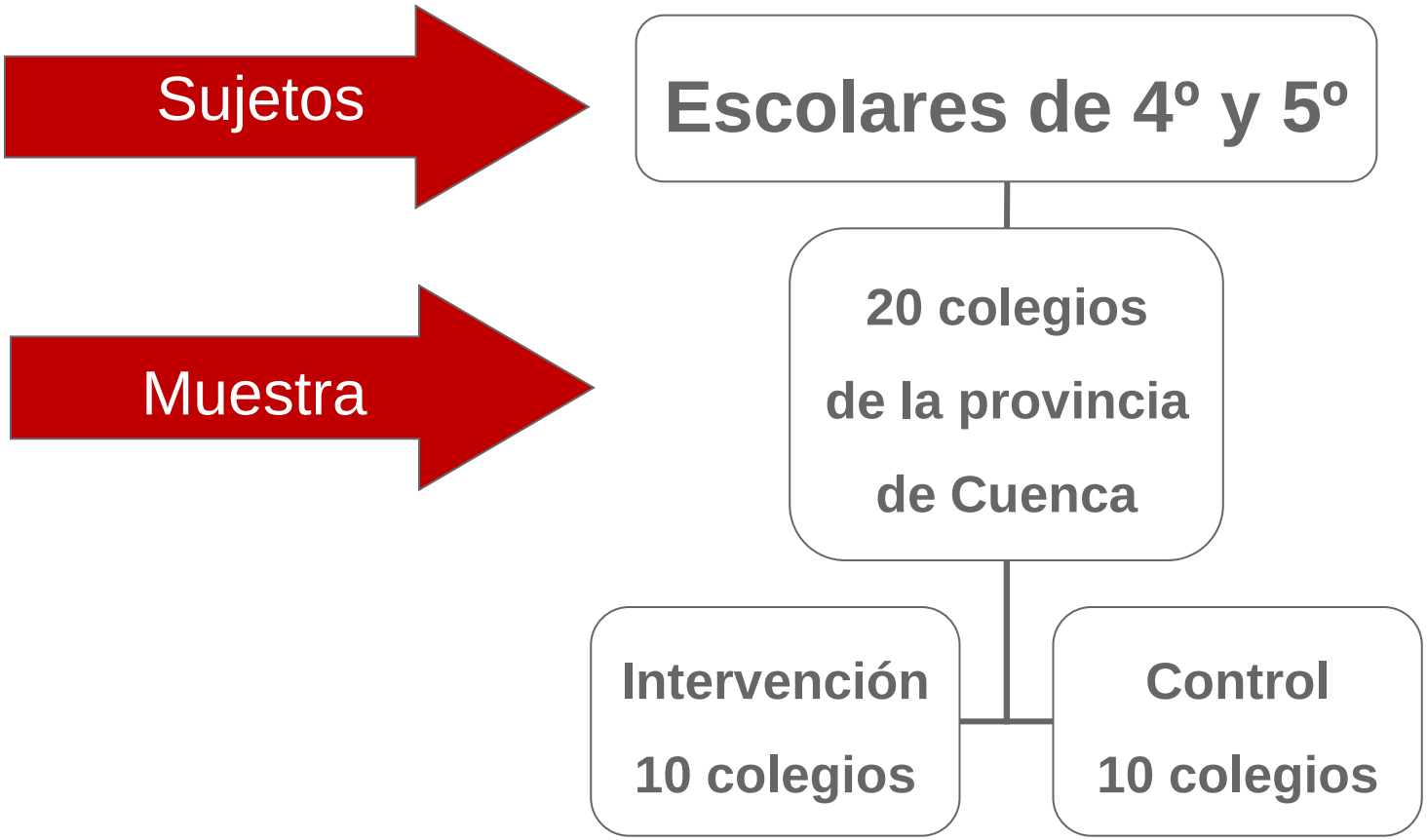
- Junta de Comunidades de C-LM

Objetivos

- Principal: Probar la efectividad de MOVI-2 para **prevenir el sobrepeso y reducir el riesgo cardiovascular** en escolares de educación primaria en la provincia de Cuenca.
- Secundarios:
  - Aumentar la actividad física y la forma física
  - Mejorar la calidad de vida y del sueño
  - Mejorar el rendimiento académico
  - Mejorar el disfrute con la actividad física y la autoeficacia

DISEÑO

Estudio experimental randomizado por clusters



Cuestionarios

- Patrón de consumo de alimentos (YANA-C)
- Calidad de vida (KIDSCREEN)
- Hábitos de sueño:
    - *Children's Sleep Habits Questionnaire*
    - *Sleep Self Report-Child*
- Rendimiento académico

Forma física

- Autopercibida (International Fitness Scale)
- Medidas objetivas:
  - Capacidad aeróbica:
    - 20 m shuttle run test
    - VO_2 max (en una submuestra)
  - Fuerza muscular:
    - Dinamometría
    - Test de salto horizontal
  - Velocidad-agilidad: test de ida y vuelta 4 x 10
  - Flexibilidad: sit and reach test

Actividad física

- Netherlands Physical Activity Questionnaire (NPAQ)
- Disfrute con la actividad física (PACES)
-Autoconcepto físico (C-PSQ)
-En una submuestra de 200 participantes:
    - Acelerometría: MTI/CSA 7164, Actigraph
    - Una semana
    - Día y noche (calidad de sueño)

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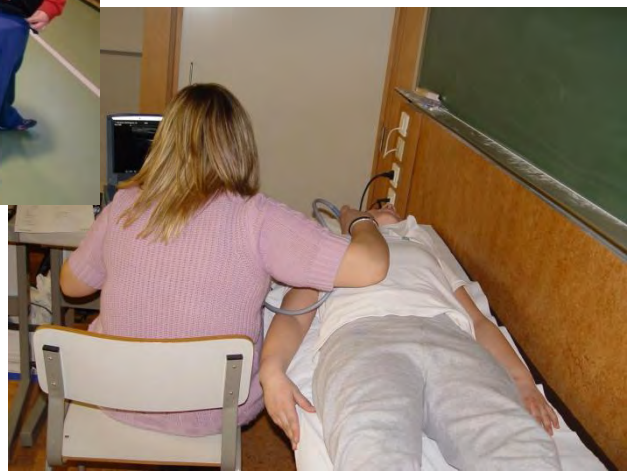
Densitometría

Ecografía carótida



Fitness cardiorrespiratorio

Gasto calórico

La intervención

Rev Esp Cardiol (Engl Ed). 2012 May;65(5):427-33. doi: 10.1016/j.recesp.2011.12.008. Epub 2012 Mar 10.

Protocol of a randomized cluster trial to assess the effectiveness of the MOVI-2 program on overweight prevention in schoolchildren.

[Article in English, Spanish]

Martínez-Vizcaíno V, Sánchez-López M, Salcedo-Aguilar F, Notario-Pacheco B, Solera-Martínez M, Moya-Martínez P, Franquelo-Morales P, López-Martínez S, Rodríguez-Artalejo F; MOVI-2 group.

MOVI2 vs MOVI

1. Mayor intensidad y duración: dos sesiones de 90' en días lectivos, y una ***sesión de 150' en fin de semana***

MOVI vs MOVI2

2. Más trabajo de fuerza que MOVI-1 para mejorar riesgo cardiometabólico

MOVI vs MOVI2

3. Sencilla, aplicable en múltiples entornos y… no es UNA CAJA NEGRA

MOVI vs MOVI2

4. Más estandarizable

Sesión 2

Objetivos	Actividades	Organización	Tiempo	Descripción gráfica
	**6. El transportador:** Los dos grupos enfrentados, se trata de desplazar de un lado a otro del campo 6 pelotas sobre el paracaídas. Los niños deben ir todos agarrados al paracaídas. REGLA: Si se cae alguna pelota, o algún componente se suelta del paracaídas en el trayecto, hay que empezar de nuevo.	2 GRUPOS	8'	
	**7. Palomitas de maíz:** Todos alrededor del paracaídas agarrados a él. El profesor va introduciendo pelotas que los niños deben mover agitando el paracaidas de arriba hacia abajo sin que caigan al suelo, ¿cuántas son capaces de mantener?	GRAN GRUPO	8'	
	**8. Desplazarse libremente con las plataformas y una cuerda:** Dejar que los jugadores inventen formas de transportar, empujar, traccionar, etc.	GRAN GRUPO	7'	
	**9. Ejercicios de flexibilidad guiados por el profesor.**	PAREJAS	10'	**FDF-I**
	**VUELTA A LA CALMA** **10. Risotada seria:** Todos los jugadores formarán un gran círculo permaneciendo en silencio y con cara seria. El que inicia el juego mirará a su compañero de la derecha lo más serio posible diciéndole: ¡Ja!, éste mirará a otro compañero diciendo ¡Ja, ja!, luego: ¡Ja, ja, ja!, etc. y así sucesivamente hasta que alguno no pueda resistir la risa. Entonces se comenzará de nuevo. VARIANTE: El que se ría, quedará eliminado.	GRAN GRUPO	10'	

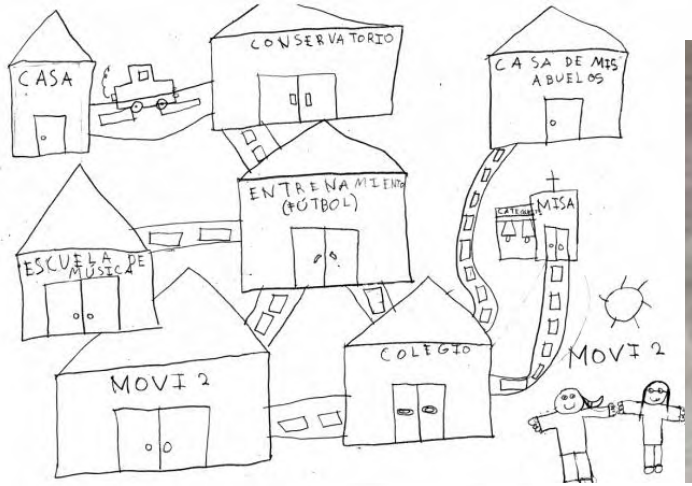
Seguridad para todos los juegos con paracaidas:

-Debe haber un control completo del grupo antes de iniciar cualquier actividad.
-Siempre desplegar el paracaídas en el suelo. Sentar a los participantes alrededor cuando se da la explicación.
-Empezar con la orden: Preparados, ¡ya! Para evitar que unos empiecen antes que otros.
-Al levantarse del suelo la espalda debe estar recta.

MOVI vs MOVI2

5. CUALI-MOVI

- Evaluación cualitativa
- Percepción de barreras y facilitadores para la actividad física



BMC Public Health. 2012 Sep 14;12:785. doi: 10.1186/1471-2458-12-785.

Barriers, facilitators and preferences for the physical activity of school children. Rationale and methods of a mixed study.

Martínez-Andrés M, García-López U, Gutiérrez-Zornoza M, Rodríguez-Martín B, Pardo-Guijarro MJ, Sánchez-López M, Cortés-Ramírez E, Martínez-Vizcaíno V.

Centro de Estudios Sociosanitarios, Universidad de Castilla-La Mancha, Cuenca, España.

MOVI vs MOVI2

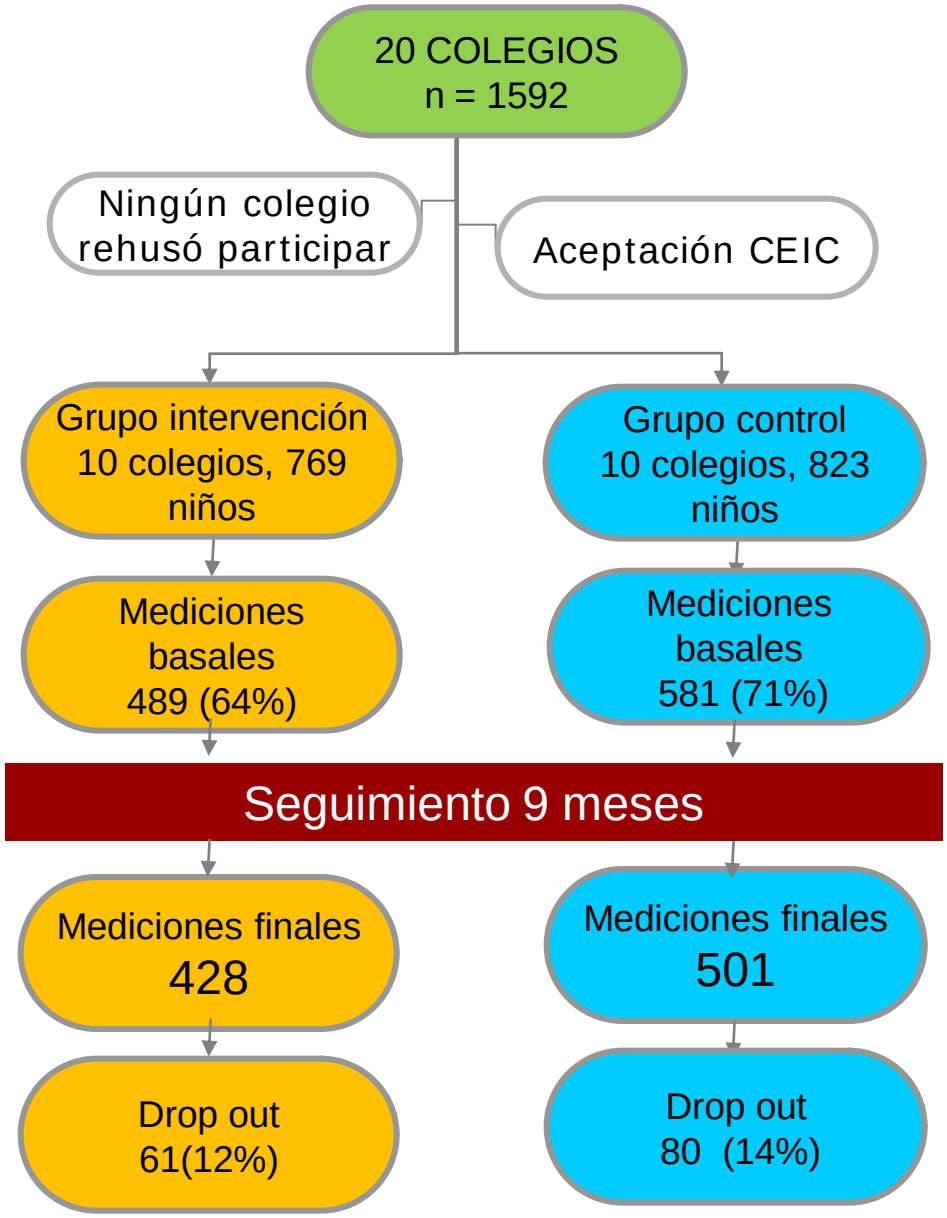
6. Enfoque ecológico multinivel incluyendo mejoras en el plan de adherencia e intervención en el entorno

Regalos/refuerzo por cumplimiento

Imán nevera

Calendario guía para la familia

Resultados MOVI2


20 COLEGIOS
n = 1592
Ningún colegio rehusó participar
Aceptación CEIC
Grupo intervención
10 colegios, 769 niños
Grupo control
10 colegios, 823 niños
Mediciones basales
489 (64%)
Mediciones basales
581 (71%)
Seguimiento 9 meses
Mediciones finales
428
Mediciones finales
501
Drop out
61(12%)
Drop out
80 (14%)

Objetivo principal:
Disminuye la adiposidad en chicos y chicas
(y aumenta la masa libre de grasa)

Table 2. Changes in adiposity and cardiovascular risk factors from baseline to the end of follow-up among intervention versus control schoolchildren, by sex.

	Girls (n=469)					Boys (n=443)				
	Baseline[a]	End of follow-up[a]	Crude change	Adjusted difference of intervention vs control[b] (95% CI)	p	Baseline[a]	End of follow-up[a]	Crude change	Adjusted difference of intervention vs control[b] (95% CI)	p
ADIPOSITY										
Overweight or obesity, %										
Control	30.0	31.7	1.7	0.8[c] (0.3; 1.7)	0.53	36.5	38.5	2.0	0.7[c] (0.4; 1.2)	0.16
Intervention	33.2	32.8	-0.4			40.3	38.2	-2.1		
Underweight, %										
Control	7.9	7.1	-0.8	1.1[c] (0.3; 4.7)	0.88	9.5	8.3	-1.2	0.5[c] (0.1; 2.1)	0.38
Intervention	8.7	7.4	-1.3			6.3	7.3	1		
BMI, kg/m²										
Control	18.7(3.6)	19.1 (3.7)	0.4	-0.2 (-0.4; 0.1)	0.09	19.0 (3.6)	19.3 (3.7)	0.3	0.01 (-0.1; 0.1)	0.89
Intervention	18.7 (3.5)	19.0 (3.5)	0.3			19.3 (3.6)	19.4 (3.6)	0.1		
TST, mm										
Control	14.5 (5.4)	17.7 (7.5)	3.2	-1.1 (-2.1; -0.7)	0.02	13.4 (5.7)	16.4 (8.3)	3.0	-0.6 (-1.9; 0.8)	0.43
Intervention	15.7 (5.2)	18.2 (7.6)	2.5			14.8 (5.6)	17.3 (8.2)	2.5		
Body fat %										
Control	26.3 (6.0)	26.3 (6.0)	0.0	-0.9 (-1.3; -0.4)	<0.001	23.8 (8.3)	23.6 (7.0)	-0.2	-0.5 (-1.2; 0.1)	0.13
Intervention	26.6 (5.8)	25.9 (5.8)	-0.7			24.2 (6.9)	23.5 (6.7)	-0.7		
Fat free mass (kg)										
Control	26.7 (4.8)	28.5 (5.2)	1.7	0.3 (0.1; 0.6)	0.04	28.0 (4.7)	29.6 (5.2)	1.5	0.5 (0.2; 0.9)	0.003
Intervention	26.5 (4.6)	28.6 (4.9)	2.1			28.1 (4.6)	29.8 (4.5)	1.7		
Waist circumference, cm										
Control	66.2 (8.8)	68.5 (9.1)	2.3	-2.7 (-4.5; -0.9)	0.01	68.1 (9.3)	69.9 (9.9)	1.8	-1.4 (-2.6; -0.1)	0.03
Intervention	67.1 (8.9)	67.4 (8.4)	0.3			68.1 (9.7)	68.7 (9.2)	0.6		

Factores de riesgo cardiovascular:

- Lípidos: Mejora del LDL en niñas
- Insulina: Disminuye
- PA: no se modifica
- Proteína C: no se modifica

Table 2. Cont.

	Girls (n=469)					Boys (n=443)				
	Baseline[a]	End of follow-up[a]	Crude change	Adjusted difference of intervention vs control[b] (95% CI)	p	Baseline[a]	End of follow-up[a]	Crude change	Adjusted difference of intervention vs control[b] (95% CI)	p
CARDIOVASCULAR RISK FACTORS										
LDL-C, mg/dl										
Control	94.1 (23.1)	90.7 (22.2)	-3.5	-3.8 (-6.9; -0.7)	0.015	92.9 (20.7)	90.9 (20.9)	-2.0	-2.7 (-6.9; 1.5)	0.21
Intervention	100.7 (24.2)	94.3 (23.1)	-6.4			101.1 (24.5)	97.1 (22.3)	-3.9		
TGL / HDL-C										
Control	1.3 (0.9)	1.3 (0.9)	-0.1	0.01 (-0.2; 0.2)	0.92	1.1 (0.8)	1.0 (0.7)	-0.1	0.4 (0.1; 0.8)	0.02
Intervention	1.3 (1.0)	1.3 (1.0)	0.1			1.1 (0.8)	1.2 (1.2)	0.1		
Insulin (µU/mL)										
Control	8.1 (4.1)	9.7 (7.3)	1.6	-2.3 (-3.7; -0.8)	0.002	7.1 (5.5)	7.9 (6.9)	0.8	-0.04 (-2.3; 2.2)	0.97
Intervention	9.0 (5.4)	8.9 (5.0)	-0.1			7.6 (3.9)	8.0 (7.2)	0.4		
CRP, mg/L										
Control	1.4 (2.4)	1.6 (2.5)	0.2	0.1 (-0.5; 0.7)	0.83	1.4 (2.1)	1.7 (2.5)	0.3	-0.3 (-1.3; 0.8)	0.62
Intervention	1.5 (2.1)	1.7 (2.2)	0.2			1.4 (2.1)	1.6 (2.3)	0.2		
MAP, mm Hg										
Control	75.1 (6.3)	76.5 (6.9)	1.4	-0.2 (-2.5; 2.2)	0.89	75.8 (7.4)	76.8 (7.3)	1.04	0.7 (-1.8; 3.1)	0.60
Intervention	74.0 (7.6)	76.3 (6.9)	2.3			74.7 (6.9)	77.2 (6.0)	2.45		

BMI: Body mass index; TST: Triceps skinfold thickness; LDL-C: LDL-cholesterol; TGL/HDL-C: Triglycerides / HDL-cholesterol; CRP: C-reactive protein; MAP: Mean arterial pressure

[a]Figures at baseline and end of follow-up correspond to crude data. [b] Differences adjusted for baseline value, age, tanner change and cluster (random effect) using generalized mixed linear models. [C] Odds ratiof overweight or obesity, and of underweight, among intervention versus control children.

Table 3. Changes in physical fitness, physical activity enjoyment and physical self-concept from baseline to the end of follow-up among intervention versus control schoolchildren, by sex.

	Girls (n=469)					Boys (n=443)				
	Baseline[a]	End of follow-up[a]	Crude change	Adjusted difference of intervention vs control[b] (95% CI)	p	Baseline[a]	End of follow-up[a]	Crude change	Adjusted difference of intervention vs control[b] (95% CI)	p
Cardiorespiratory fitness [c]										
Control	3.0 (1.3)	3.6 (1.5)	0.6	0.7 (0.1; 1.2)	0.012	4.3 (1.8)	5.2 (1.9)	0.9	-0.3 (-1.0; 0.3)	0.33
Intervention	2.8 (1.2)	4.0 (1.5)	1.2			3.9 (1.7)	4.8 (1.8)	0.9		
Standing broad jump test (cm)										
Control	109.8 (17.5)	114.7 (19.0)	4.9	5.2 (-0.2; 10.6)	0.06	121.0 (20.9)	129.9 (19.5)	5.9	-0.1 (-6.2; 6.0)	0.98
Intervention	110.0 (20.1)	115.2 (21.3)	5.2			119.8 (19.2)	125.7 (20.6)	5.9		
Handgrip test (Kg)										
Control	13.9 (3.3)	15.1 (3.7)	1.2	0.2 (-0.5; 1.0)	0.59	15.7 (3.4)	16.4 (3.7)	0.7	0.1 (-0.9; 1.2)	0.78
Intervention	13.7 (3.0)	14.9 (3.1)	1.2			15.2 (3.4)	16.1 (3.7)	0.9		
Speed/Agility [d]										
Control	14.4 (1.4)	13.2 (1.2)	-1.2	0.0 (-0.4; 0.5)	0.97	13.5 (1.1)	12.4 (1.1)	-1.1	0.2 (-0.3; 0.8)	0.42
Intervention	14.6 (1.3)	13.4 (1.1)	-1.2			13.8 (1.3)	12.7 (1.2)	-1.1		
Flexibility [e]										
Control	25.7 (5.6)	25.3 (5.7)	-0.4	-2.0 (-3.4; -0.6)	0.005	23.0 (5.7)	21.5 (6.1)	-1.5	0.5 (-0.7; 1.7)	0.44
Intervention	23.8 (5.7)	24.1 (6.2)	0.3			23.3 (5.3)	22.3 (5.6)	-1.0		
Physical Activity enjoyment										
Control	13.2 (1.9)	13.2 (1.8)	0.0	0.1 (-0.2; 0.5)	0.47	13.7 (1.9)	13.7 (2.2)	0.0	0.1 (-0.4; 0.6)	0.62
Intervention	13.1 (2.0)	13.5 (1.9)	0.4			13.2 (2.0)	13.7 (1.8)	0.5		
Physical self-concept										
Control	11.1 (2.7)	10.6 (2.7)	-0.5	0.3 (-0.1; 0.8)	0.14	12.3 (2.5)	12.0 (2.8)	-0.3	0.6 (-0.1; 1.3)	0.10
Intervention	10.7 (2.9)	10.9 (2.7)	0.2			11.7 (2.4)	11.8(2.7)	0.1		

[a]Figures at baseline and end of follow-up correspond to crude data. [b]Differences adjusted for baseline value, age, tanner change and cluster (random effect) using generalized mixed linear models; [c] 20 m Shuttle run test (stage); [d] Shuttle run test (14x5 m) (s); [e] Sit and reach test (cm).

Table 4. Process indicators of the MOVI-2 physical activity program.

Attendance/dropout

66.7% schoolchildren attended more than 70% of the program sessions
49 (10.4%) children withdrew from the program because of the following reasons:

- Problem behaviors (aggression to peers or monitor)
- Changes of residence
- Incompatibility with other activities
- As punishment by parents for poor academic performance of children.

Satisfaction/compliance

312 (66.5%) children completed questionnaires to evaluate satisfaction with the program activities:

- 96.1% reported that always or almost always they liked the games played in MOVI-2
- 95.5% reported that rarely or never was it necessary to remind them that they should go to MOVI-2 session
- 94.8% reported that always or almost always they felt happy with the monitor
- 92.2% reported that always or almost always they felt loved by the group

286 (61%) parents : completed questionnaires to evaluate satisfaction with the program activities

- 99.7% reported that always or almost always the monitor arrived in time.
- 100% indicated that always or almost always the monitor kept control of the group.
- 99.7% reported that the monitor favored a good climate in classroom.
- 98.2% reported that always or almost always their children were interested in attending MOVI-2
- 97.2% indicated that always or almost always they were happy with the monitor.
- 90.9% reported that the program was one of the most important activities where their children were engaged.
- 99.2% responded that they were satisfied or very satisfied with the program.

Conclusiones

Our results show that an extracurricular PA program (MOVI-2) conducted for one academic year led to improvements in several adiposity indicators and cardiovascular risk factors in schoolgirls; among boys, the results were in the same direction but of lower magnitude. These effects seem to derive from an increase in PA, whose intensity was not sufficient to augment physical fitness in schoolchildren. No important adverse events were registered, the cost of the program was comparable to that of other common extracurricular activities of children in Spain, and satisfaction of the children and parents with the program was high.

In conclusion, this work has shown that a 1-year extracurricular intervention with non-competitive PA addressing all fourth- and fifth-grade schoolchildren, regardless of body weight, is effective and safe in reducing adiposity. Future research should assess whether similar interventions are effective in children of lower and higher age; moreover, renewed efforts should devoted to devise interventions with the potential to reduce cardiovascular risk factors in children.

Productos MOVI2

Transferencia/Innovación MOVI

Catálogo de juegos con evaluación de tiempo e intensidad de la actividad física de cada y de cada sesión

Intensidad de la actividad	Tipos de juego			
Moderada	**Juegos de Fuerza**			
3-6 METS 4-7 kcal/min	JUEGO	Vo2/Kg	FC	METS
	Iceman	19.05	150.93	5.4
	Pañuelo de canguro	19.43	153.04	5.5
	Pelea de gallos	17.53	152.73	5
Vigorosa	**Juegos de Resistencia**			
> 6 METS >7 kcal/min	JUEGO	Vo2/Kg	FC	METS
	Transportadores	31.30	184.33	8.9
	Balón cazador	26.65	150.55	7.6
	Equipo forzudo	27.41	149.37	7.8

Transferencia/Innovación MOVI

Calculadora de riesgo de síndrome metabólico

CALCULADORA DE RIESGO METABÓLICO EN LA INFANCIA

Proporciona los siguientes datos y al final oprime el botón **Calcular**, a continuación revisa el resultado del riesgo metabólico.

Cómo calcular el Riesgo Metabólico en la infancia

El síndrome metabólico es un cluster de trastornos cardiometabólicos considerado como un predictor de enfermedad cardiovascular, de diabetes tipo 2 y de mortalidad general.

Seleccione la edad[a] Elegir una opción

Seleccione el sexo Elegir una opción

Perímetro de cintura (en centímetros)

Triglicéridos (mg/dL)

Colesterol-HDL (mg/dL)

Insulina (mclu/ml)

PAD[b] (mmHg)

PAS[c] (mmHg)

Calcular

Para introducir decimales emplear el punto en vez de la coma.

[a] Para edades entre 6 y 10 años en la ecuación que estima el punto para el riesgo metabólico se emplearon los parámetros de la muestra con 10 años.

[b] PAS: Presión arterial sistólica.

[c] PAD: Presión artirial diastólica.

Transferencia/Innovación MOVI

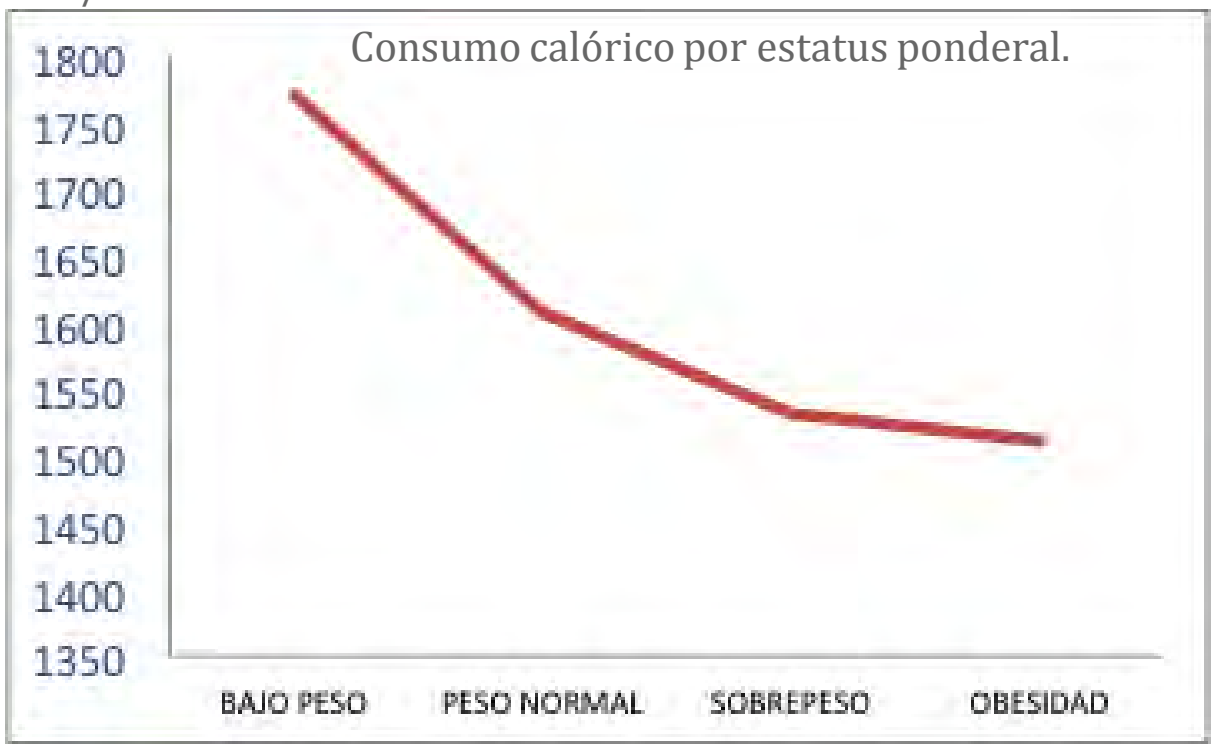
Calibración de acelerómetro en juegos de calle

EL FUTURO YA ESTÁ AQUÍ

Muy bien, ¿ y ?
¿No es posible seguir?
¿Por dónde podemos seguir para aportar conocimiento?

ANALICEMOS LAS ÚLTIMAS APORTACIONES DE CONOCIMIENTO ACERCA DE LA OBESIDAD

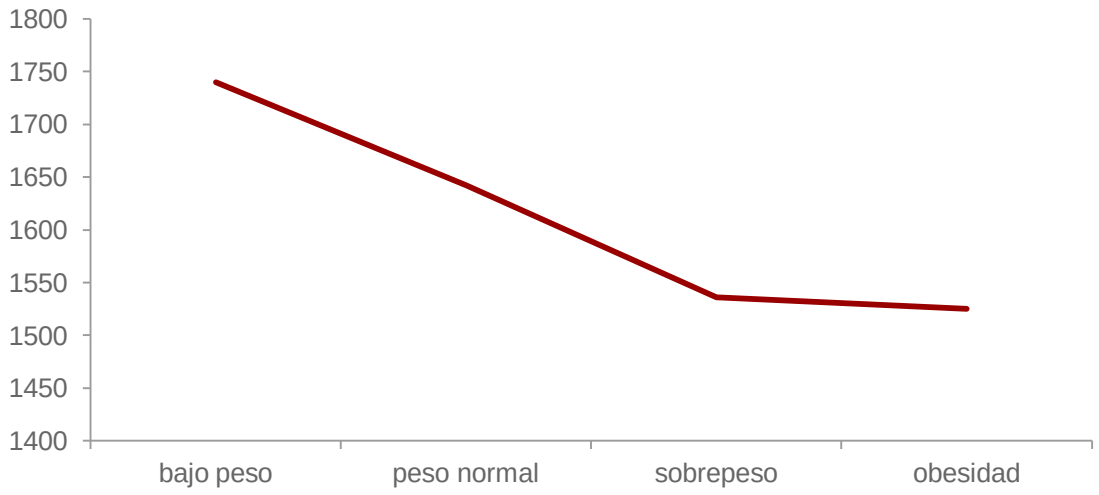
1. LOS MÁS GORDITOS NO COMEN MÁS



Estudio de Cuenca (2010). *Niños de 5º curso de Educación Primaria n = 401*

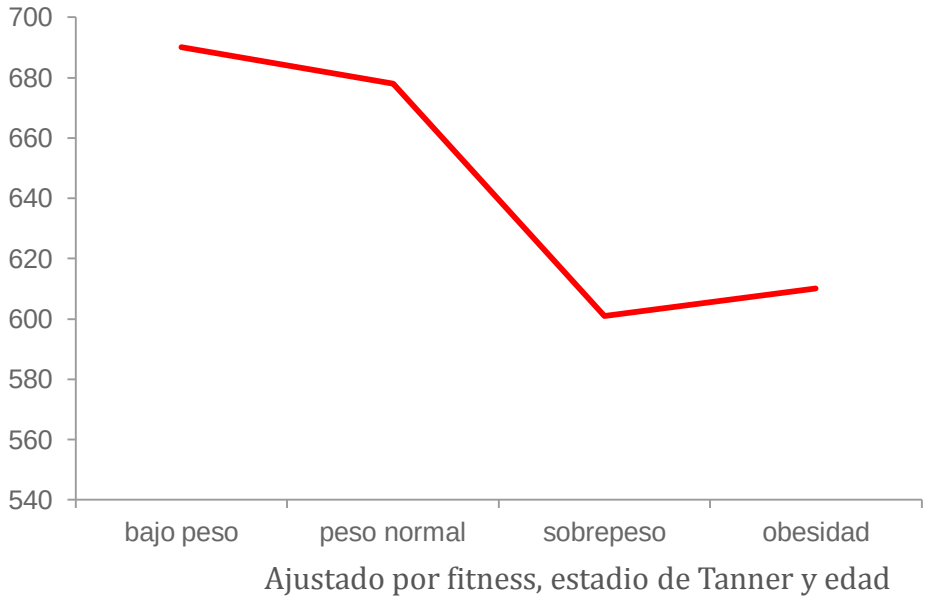
Pero a lo mejor se mueven menos….

Consumo calórico por estatus ponderal, ajustado por fitness cardiorrespiratorio, estadio de Tanner y edad



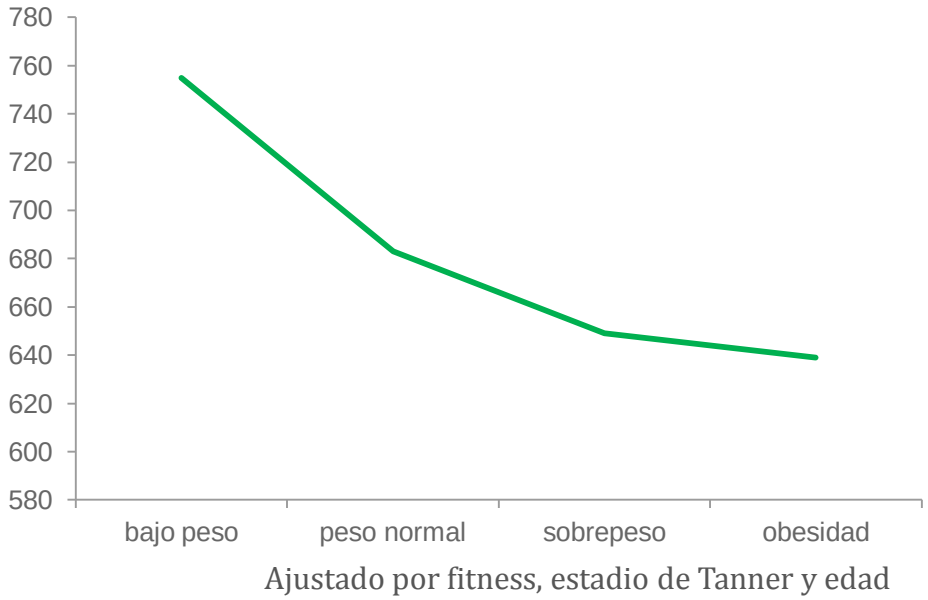
Estudio de Cuenca (2010). *Niños de 5º curso de Educación Primaria n = 401*

Ingesta de grasa por estatus ponderal



Estudio de Cuenca (2010). *Niños de 5º curso de Educación Primaria n = 401*

Ingesta de hidratos de carbono por estatus ponderal



Estudio de Cuenca (2010). *Niños de 5º curso de Educación Primaria n = 401*

Table 6. Energy and macronutrients intake for quartiles of FM/H, controlling for CRF and age.

	FM/H				
		EI	%EIC	%EIP	%EIF
Boys	Q1 (n=36)	1840.0(95.2)	39.4 (1.7)	17.0 (0.9)	43.6 (1.5)
	Q2 (n=37)	1710.4(86.1)	41.5 (1.6)	18.0 (0.8)	40.5 (1.4)
	Q3 (n=37)	1561.2(84.7)	42.2 (1.5)	19.5 (0.8)	38.3 (1.4)
	Q4 (n=36)	1481.5(96.2)	44.8 (1.7)	18.9 (0.9)	36.3 (1.5)
	p	0.093	0.271	0.268	**0.026**
Girls	Q1 (n=43)	1782.7 (83.1)	44.4 (1.6)	16.3 (0.8)	39.4 (1.5)
	Q2 (n=44)	1563.9(73.4)	43.6 (1.4)	17.0 (0.7)	39.3 (1.3)
	Q3 (n=44)	1508.8(73.9)	39.5 (1.4)	18.9 (0.7)	41.5 (1.3)
	Q4 (n=43)	1474.5(80.5)	45.4 (1.5)	18.1 (0.7)	36.5 (1.4)
	p	0.063	**0.020**	0.067	0.072
Overall	Q1 (n=80)	1800.5 (61.8)	42.3 (1.2)	16.6 (0.6)	41.1 (1.0)
	Q2 (n=80)	1627.2 (56.1)	42.9 (1.1)	17.4 (0.5)	39.7 (0.9)
	Q3 (n=80)	1531.5 (56.0)	40.6 (1.1)	19.3 (0.5)	40.1 (0.9)
	Q4 (n=80)	1491.0 (61.2)	44.7 (1.2)	18.6 (0.6)	36.7 (1.0)
	p	**0.005**	0.053	**0.005**	**0.028**

A tener en cuenta

International Journal of Obesity (2011) 35, 29–32

0307-0565/11
www.nature.com/ijo

DEBATE

Diet vs exercise for the prevention of pediatric obesity: the role of exercise

B Gutin[1,2,3]

Implications for the prevention of pediatric obesity

The emerging evidence suggests that continuing to expend large amounts of our resources on interventions that emphasize dietary changes is unwise and wasteful. It is likely that we can improve the effectiveness of our preventive efforts by focusing on body composition rather than body weight, and by devoting more attention to PA, especially vigorous PA, rather than restriction of energy intake.[19]

In general, vigorous PA involves activities such as dancing, running, strength training and sports. In youths, such high-intensity activities generally involve both anaerobic and aerobic energy systems, but little information is available on the relative impact of these energy systems. To involve youths of varying fatness levels in the activities, it will be necessary to provide structured activities within regular physical education classes, as well as less-structured activities during non-school hours, weekends and vacations. Although providing the facilities and teachers needed so that every youth can be involved in these activities will be expensive for our societies, the resulting improvements in public health are likely to make it worthwhile. Moreover, funds will be saved by reducing what may be counter-productive efforts to prevent growing youths from eating as much as their biological needs incline them to eat.

A tener en cuenta

International Journal of Obesity (2011) 35, 72–83

0307-0565/11
www.nature.com/ijo

PEDIATRIC REVIEW

Epigenetic changes in early life and future risk of obesity

KA Lillycrop[1] and GC Burdge[2]

The rapid increase in incidence of obesity over the past two decades cannot be explained solely by genetic and adult lifestyle factors. There is now considerable evidence that the fetal and early postnatal environments also strongly influence the risk of developing obesity in later life. Initially, human studies showed that low birth weight was associated with an increased risk of obesity but increasingly there is evidence that overnutrition in the early life can also increase susceptibility to future obesity. These findings have now been replicated in animal models, which have shown that both maternal under- and overnutrition can induce persistent changes in gene expression and metabolism. The mechanism by which the maternal nutritional environment induces such changes is beginning to be understood and involves the altered epigenetic regulation of specific genes. In this review, we discuss the recent evidence that shows that early-life environment can induce altered epigenetic regulation leading to the induction of an altered phenotype. The demonstration of a role for altered epigenetic regulation of genes in the developmental induction of obesity opens the possibility that interventions, either through nutrition or specific drugs, may modify long-term obesity risk and combat this rapid rise in obesity.
International Journal of Obesity (2011) **35**, 72–83; doi:10.1038/ijo.2010.122; published online 15 June 2010

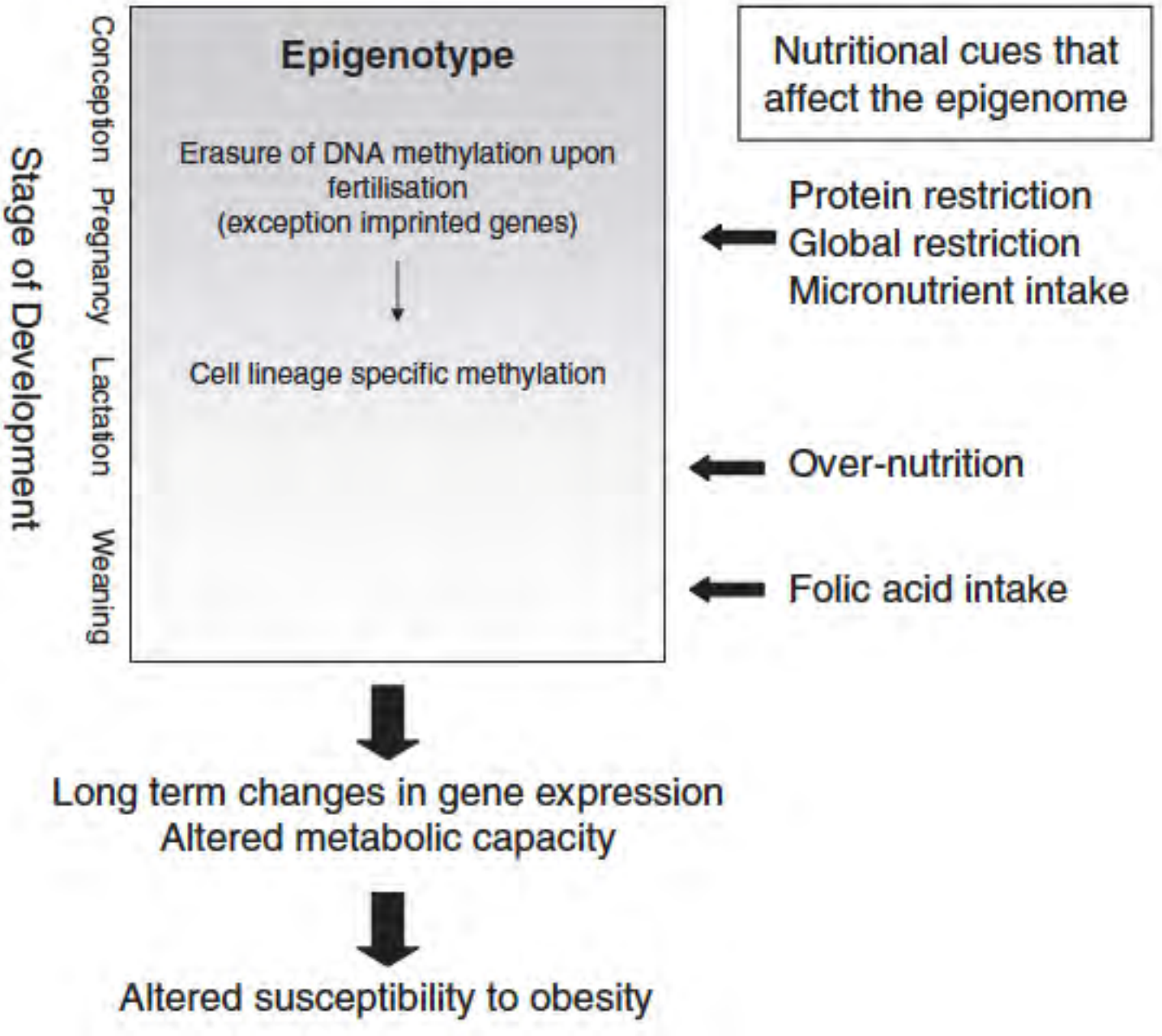
A tener en cuenta

Obesity (Silver Spring). 2008 December ; 16(Suppl 3): S51–S54. doi:10.1038/oby.2008.518.

Epigenetic Influences on Food Intake and Physical Activity Level: Review of Animal Studies

Barry E. Levin[1,2]

of obesity. While many factors promote the development of offspring obesity, even when there is an obesity-resistant genotype, early-onset exercise appears to be the one factor which has a long-lasting and selective effect on reducing the propensity of DIO offspring to become obese. There is now good evidence that such interventions can have long-lasting effects on the development, structure, and function of the neural pathways involved in the regulation of energy expenditure. Since it is unlikely that our genetic makeup has changed in the last few decades, such studies suggest that we should focus on such early life factors as a possible explanation for the recent increase in childhood and adult obesity in humans. The hope is that identification of such factors will lead to therapeutic interventions which will stem the obesity epidemic now sweeping the developed world.


Stage of Development
Conception
Pregnancy
Lactation
Weaning
Epigenotype
Erasure of DNA methylation upon fertilisation (exception imprinted genes)
Cell lineage specific methylation
Nutritional cues that affect the epigenome
Protein restriction
Global restriction
Micronutrient intake
Over-nutrition
Folic acid intake
Long term changes in gene expression
Altered metabolic capacity
Altered susceptibility to obesity

OPEN ACCESS Freely available online PLoS MEDICINE

Physical Activity Attenuates the Influence of *FTO* Variants on Obesity Risk: A Meta-Analysis of 218,166 Adults and 19,268 Children

What Do these Findings Mean? This study demonstrates that people who carry the susceptibility gene for obesity can benefit from physical activity. This should inform health care professionals and the wider public that the view of genetically determined obesity not being amenable to exercise is incorrect and should be challenged. Dissemination, implementation, and ensuring uptake of effective physical activity programs remains a challenge and deserves further consideration. That the researchers

Etapas clave en el desarrollo de la obesidad

- Embarazo
- Infancia temprana
- Rebote adiposo
- Pubertad

Interventions for preventing obesity in children (Review)

Waters E, de Silva-Sanigorski A, Hall BJ, Brown T, Campbell KJ, Gao Y, Armstrong R, Prosser L, Summerbell CD

Analysis 1.1. Comparison 1 Childhood obesity interventions versus control by age groups 0-5, 6-12 and 13-18 years, Outcome 1 Standardised mean change in Body Mass Index (BMI/zBMI) from baseline to postintervention.

Review: Interventions for preventing obesity in children

Comparison: 1 Childhood obesity interventions versus control by age groups 0-5, 6-12 and 13-18 years

Outcome: 1 Standardised mean change in Body Mass Index (BMI/zBMI) from baseline to postintervention

Study or subgroup	Experimental N	Mean(SD)	Control N	Mean(SD)	Std. Mean Difference IV,Random,95% CI	Weight	Std. Mean Difference IV,Random,95% CI
1 0-5 years							
Mo-Suwan 1998 (1)	65	-0.67 (0.85)	57	-0.39 (0.99)		1.5 %	-0.30 [-0.66, 0.05]
Mo-Suwan 1998 (2)	82	-0.33 (1.23)	88	-0.44 (1.06)		1.8 %	0.10 [-0.21, 0.40]
Harvey-Berino 2003 (3)	17	-0.27 (0.52)	20	0.31 (0.7)		0.6 %	-0.91 [-1.59, -0.23]
Dennison 2004	43	-0.24 (1.64)	34	0.12 (1.75)		1.1 %	-0.21 [-0.66, 0.24]
Fitzgibbon 2005	179	0.05 (0.67)	183	0.14 (0.68)		2.3 %	-0.13 [-0.34, 0.07]
Reilly 2006	231	0.07 (0.45)	250	0.02 (0.46)		2.5 %	0.11 [-0.07, 0.29]
Fitzgibbon 2006	196	0.11 (1.54)	187	0.13 (1.5)		2.3 %	-0.01 [-0.21, 0.19]
Keller 2009	49	-0.15 (0.23)	134	0.11 (0.23)		1.5 %	-1.13 [-1.47, -0.78]
Subtotal (95% CI)	**862**		**953**			**13.7 %**	**-0.26 [-0.53, 0.00]**

Am J Prev Med. 2009 Jul;37(1 Suppl):S40-9.

Physical activity, energy intake, sedentary behavior, and adiposity in youth.

Fulton JE, Dai S, Steffen LM, Grunbaum JA, Shah SM, Labarthe DR.

Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention, 4770 Buford Highway NE, Atlanta, GA 30341-3724, USA. jkf2@cdc.gov

Abstract

BACKGROUND: It is unclear to what extent factors affecting energy balance contribute to the development of body fatness in youth. The objective of the current study was to describe the relationship of physical activity, energy intake, and sedentary behavior to BMI, fat free-mass index (FFMI), and fat mass index (FMI) in children aged 10-18 years.

METHODS: In the subsample studied, participants were 245 girls and 227 boys (aged > or =10 years at entry or during follow-up assessments, or aged 11-14 years at entry) followed for 4 years from entry at ages 8, 11, or 14 years. At baseline and anniversary examinations, trained interviewers used a questionnaire to assess time spent daily in moderate-to-vigorous physical activity (MVPA), sedentary behavior, and energy intake (kcal/day). Sexual maturation was assessed by direct observation of pubic-hair development (Tanner Stages 1-5). Triplicate recordings of height and weight were used to estimate BMI by the standard formula (kg/m(2)); bioelectric impedance was used to estimate percent body fat for calculating FFMI and FMI (kg/m(2)). Multilevel models were used to examine the association of MVPA, energy intake, and sedentary behavior with BMI, FFMI, and FMI. Data were analyzed in 2007-2008.

RESULTS: Energy intake was unrelated to FMI or FFMI in models adjusted for age or sexual maturation or in any model to BMI. Sedentary behavior was unrelated to FMI in any model or to FFMI or BMI in models adjusted for age or sexual maturation. MVPA was inversely related to FMI.

CONCLUSIONS: In children aged 10-18 years, MVPA was inversely associated with fat mass and with BMI. Investigations in youth of dietary intake and physical activity, including interventions to prevent or reverse overweight as represented by BMI, should address its fat and lean components and not BMI alone.

EN SÍNTESIS

- **El suelo se está moviendo en la explicación de las causas de la obesidad**
- **No parece que un exceso de ingesta sea la causa de la obesidad de los niños españoles**
- **Hay varias hipótesis que apuntan a que el modelo de balance energético como causa de la obesidad no se sostiene**
- **Las razones genéticas parecen explicar hasta el 30% de la probabilidad de llegar a ser obeso**
- **Pero podemos modificar la expresión genética: PARECE QUE SÍ.**
- **¿Cómo? La actividad física modifica uno de los predictores (FTO), incluso en la vida adulta. Ahora queda:**
  - Consolidar este conocimiento
  - Establecer más vías genéticas
  - Establecer qué patrones de actividad física
  - No está claro que le va a quedar al sedentarismo
  - …. Más preguntas que respuestas, como siempre

Y ahora qué hace el grupo MOVI

MOVI-KIDS

Efectividad de una intervención de actividad física en escolares para prevenir la obesidad y mejorar el rendimiento académico durante el rebote adiposo: ensayo cruzado aleatorizado por clusters

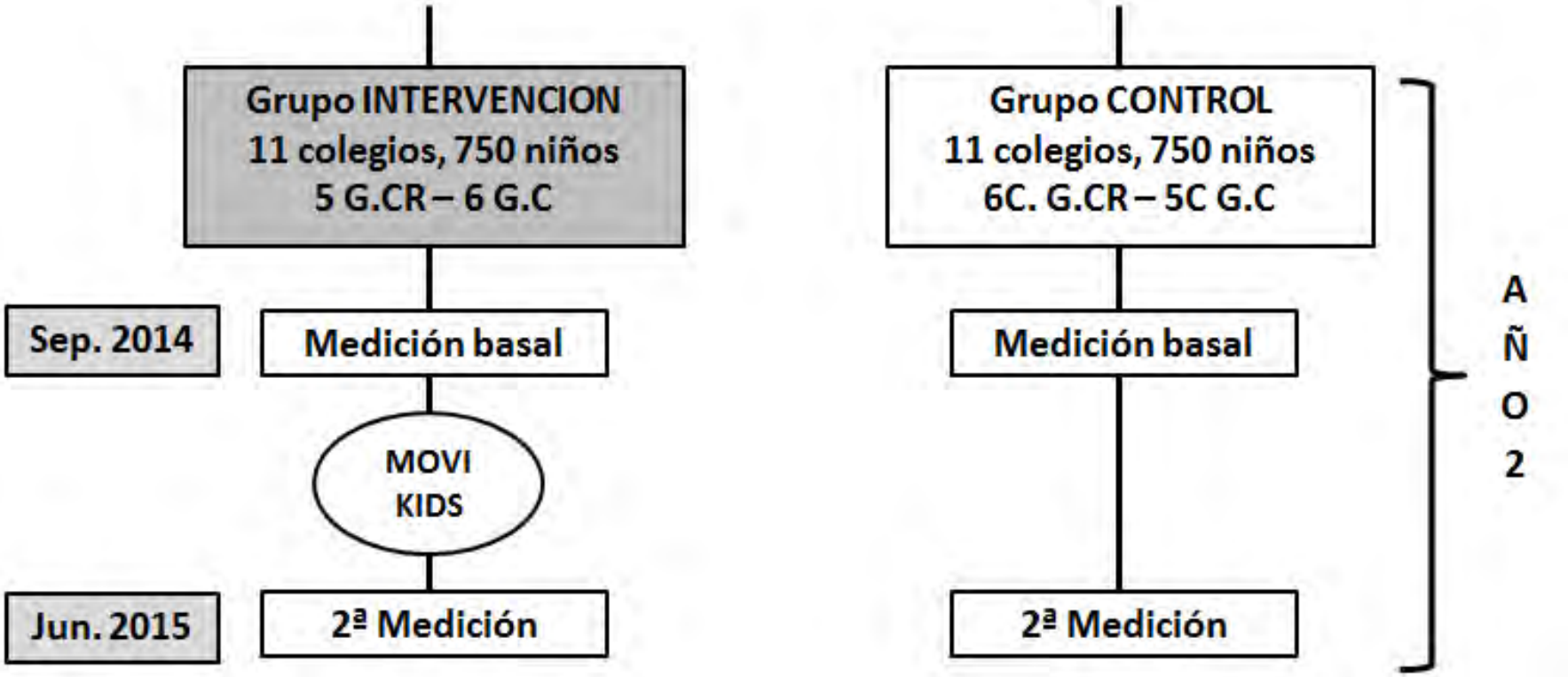
Director:
Vicente Martínez Vizcaíno

Coordinadora del programa de actividad física:
Mairena Sánchez López

Financiado: Instituto de Salud Carlos III

Colabora: UCLM, CESS, Junta de Comunidades de Castilla-La Mancha

Diseño MOVI-KIDS



GRACIAS

A los 1070 escolares participantes en MOVI2, a sus padres, y a sus maestros.

Y a los que participarán en futuros MOVI's

www.movidavida.org