

Aprovechando el potencial del huevo para mejorar el crecimiento y desarrollo del niño pequeño

Chessa Lutter, PhD

Senior Nutrition Researcher, RTI International

Visiting Research Professor, UMD School of Public Health

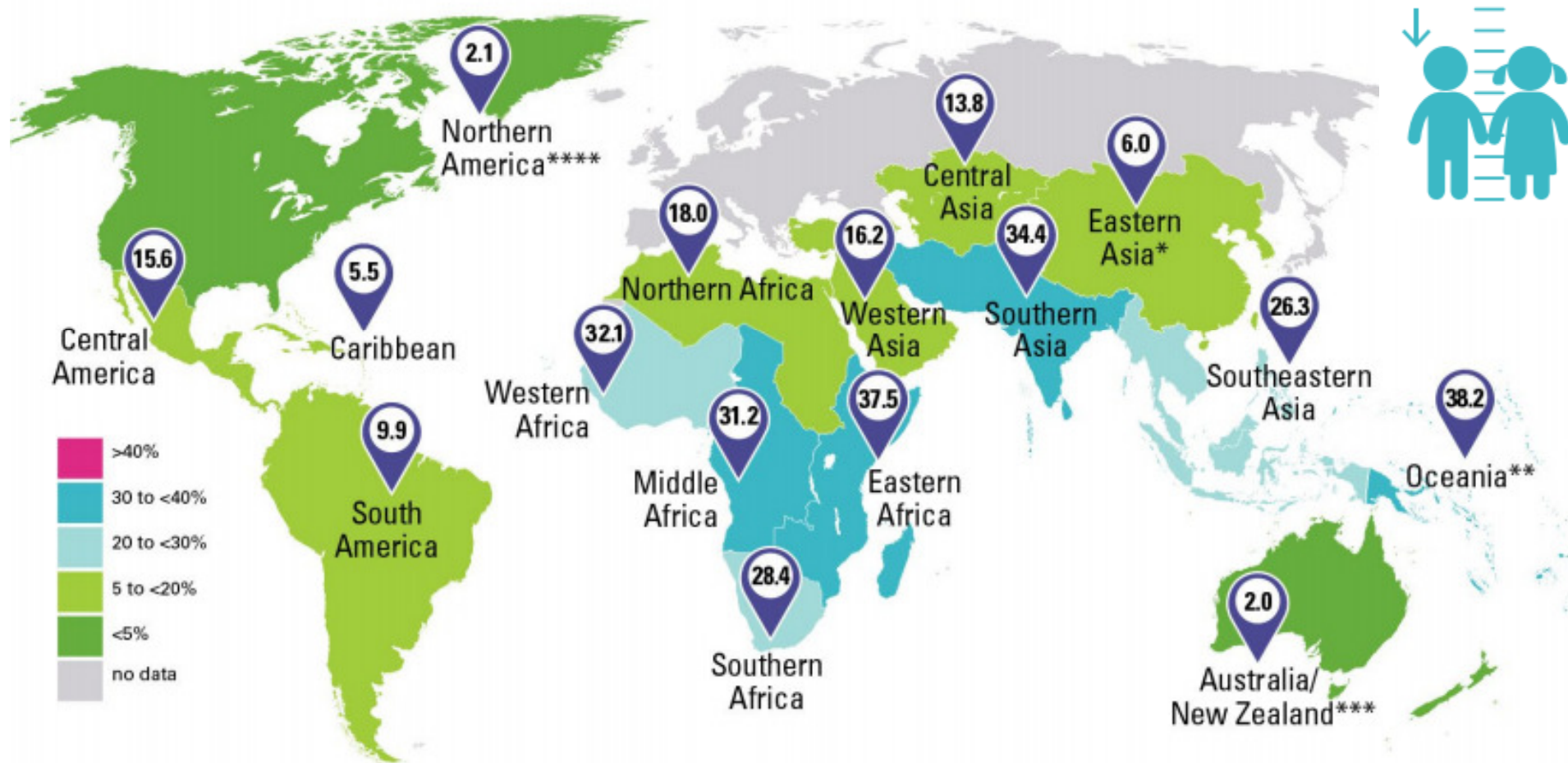
Congreso Argentino de Lactancia Materna 2018

Buenos Aires, 27 de abril 2018



Prevalencia de la desnutrición crónica 2015

Porcentaje de niños < 5 años con desnutrición crónica, por sub región de las NNUU

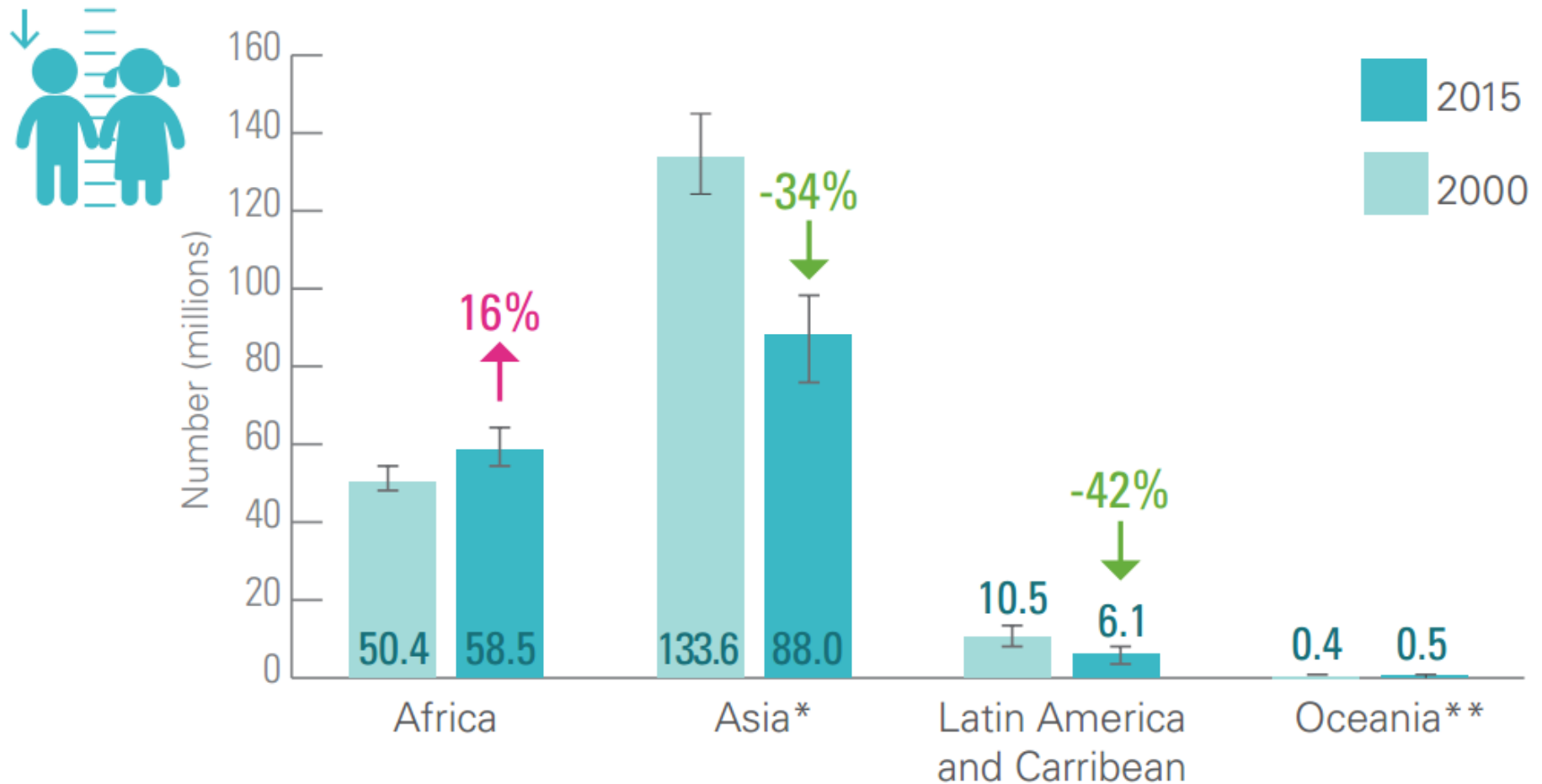


Source: UNICEF, WHO, World Bank Group joint malnutrition estimates, 2016 edition.

Note: *Eastern Asia excluding Japan; **Oceania excluding Australia and New Zealand, *** Australia and New Zealand, regional average based on Australian data, ****Northern America regional average based on United States data. These maps are stylized and not to scale and do not reflect a position by UNICEF, WHO or World Bank Group on the legal status of any country or territory or the delimitation of any frontiers.

Tendencias regionales – número de niños afectados

Número (millones) de niños < 5 años, 2000 a 2015



Source: UNICEF, WHO, World Bank Group joint malnutrition estimates, 2016 edition.

Note: *Asia excluding Japan; **Oceania excluding Australia and New Zealand.

Períodos de mayor riesgo para la desnutrición coincidiendo con los períodos mas sensibles para el desarrollo del cerebro

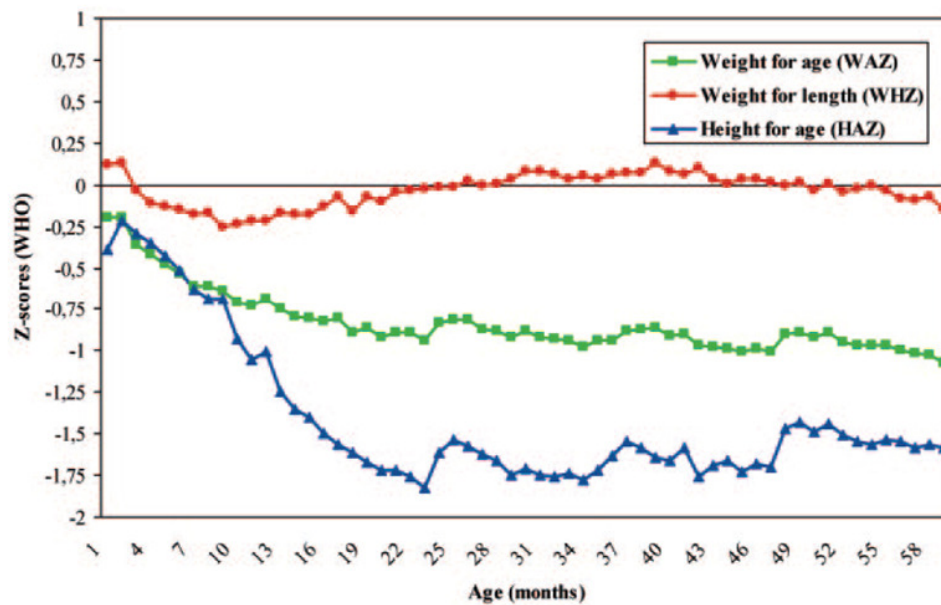
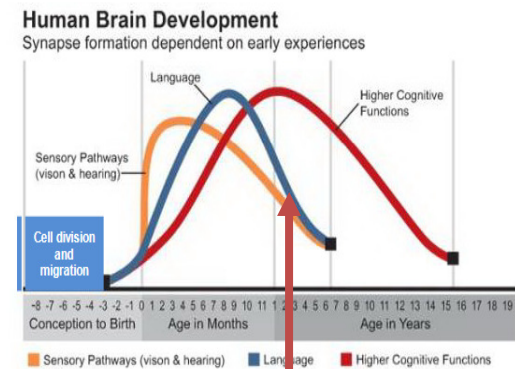
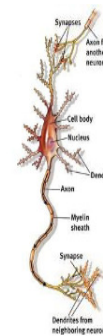


FIGURE 1 Mean anthropometric z scores according to age for all 54 studies, relative to the WHO standard (1 to 59 months).

Fuente: Victora et al., Timing of growth faltering: revisiting implications for interventions. Pediatrics 2010.

Sensitive periods and the developing brain



THE LANCET

Advancing Early Childhood Development: from Science to Scale

24 meses

Dietas de alimentación complementaria con almidón y prácticas inadecuadas de alimentación



Credit: Reyna Lira (Peru)



Credit: PAHO (Colombia)



Credit: PAHO

Productos alimenticios utilizados para reducir la desnutrición



Alimento complementario fortificado, Ecuador



Nutrientes a base de lípido (Plumpy Nut)

No usar este sobre si está dañado o roto. Mantener en lugar fresco y seco.

Dosis: Un sobre diario

Forma de uso: Mezcle todo el contenido del sobre en una porción individual de comida, inmediatamente antes de servirse.



Formulación para mujeres embarazadas

Ingrediente	Cantidad
Hierro (Fumarato Ferroso)	15 mg
Zinc (Gluconato de zinc)	15 mg
Acido fólico	400 µg
Vitamina C (Ácido Ascórbico)	100 mg
Yodo (Potasio de yodo)	100 µg
Vitamina E (como Acetato)	10 mg ET
Vitamina B12 (Cyanocobalamina)	2.6 µg
Maltodextrina	

1.0 g SPRINKLES®

Fabricado por Ped-Med Ltd. Canadá



Micronutrientes en polvo

Efectos de las intervenciones de alimentación complementaria

En general, la provisión de alimentos complementarios en poblaciones con inseguridad alimentaria se asoció con ganancias significativas en LAZ (DME 0,39; IC del 95% : 0,05-0,73)

Fuente: Evidence based interventions for improvement of maternal and child nutrition: what can be done and at what cost? Bhutta et al., The Lancet 2013

“Las intervenciones complementarias de complementos alimenticios con o sin educación nutricional también tuvieron un efecto pequeño y significativo en los entornos con inseguridad alimentaria en ambos LAZ (DME: 0.08, IC del 95%: 0.04, 0.13) y WLZ (DME: 0.05; IC del 95% : 0.01, 0.08).”

Fuente: Complementary feeding interventions have a small but significant impact on linear and ponderal growth of children in low- and middle-income countries: a systematic review and meta-analysis. Panjwani and Heidkamp, J Nutrition 2017

Concepto de que la comida es mas que la suma de sus nutrientes: el concepto de matriz alimentaria

The Summer meeting of the Nutrition Society hosted by the Irish Section was held at Queen's University, Belfast on 16–19 July 2012

Conference on 'Translating nutrition: integrating research, practice and policy' Plenary Lecture II

Food synergy: the key to a healthy diet*

David R. Jacobs Jr^{1†} and Linda C. Tapsell²

¹*Division of Epidemiology and Community Health, School of Public Health, University of Minnesota, Minneapolis, MN 55454, USA*

²*School of Health Sciences, University of Wollongong, Wollongong, NSW 2522, Australia*

Food synergy is the concept that the non-random mixture of food constituents operates in concert for the life of the organism eaten and presumably for the life of the eater. Isolated nutrients have been extensively studied in well-designed, long-term, large randomised clinical trials, typically with null and sometimes with harmful effects. Therefore, although nutrient deficiency is a known phenomenon, serious for the sufferer, and curable by taking the isolated nutrient, the effect of isolated nutrients or other chemicals derived from food on chronic disease, when that chemical is not deficient, may not have the same beneficial effect. It appears that the focus on nutrients rather than foods is in many ways counterproductive. This observation is the basis for the argument that nutrition research should focus more strongly on foods and on dietary patterns. Unlike many dietary phenomena in nutritional epidemiology, diet pattern appears to be highly correlated over time within person. A consistent and robust conclusion is that certain types of beneficial diet patterns, notably described with words such as 'Mediterranean' and 'prudent', or adverse patterns, often described by the word 'Western', predict chronic disease. Food is much more complex than drugs, but essentially uninvestigated as food or pattern. The concept of food synergy leads to new thinking in nutrition science and can help to forge rational nutrition policy-making and to determine future nutrition research strategies.

- La comida es biológicamente compleja. Consiste en células, otros materiales no celulares y sus componentes moleculares.
- Alimentos son mezclas complejas y o aleatorias de compuestos naturales, desarrollados bajo control biológico evolutivo.

Eggs: the uncracked potential for improving maternal and young child nutrition among the world's poor

Lora L Iannotti, Chessa K Lutter, David A Bunn, and Christine P Stewart

Eggs have been consumed throughout human history, though the full potential of this nutritionally complete food has yet to be realized in many resource-poor settings around the world. Eggs provide essential fatty acids, proteins, choline, vitamins A and B₁₂, selenium, and other critical nutrients at levels above or comparable to those found in other animal-source foods, but they are relatively more affordable. Cultural beliefs about the digestibility and cleanliness of eggs, as well as environmental concerns arising from hygiene practices and toxin exposures, remain as barriers to widespread egg consumption. There is also regional variability in egg intake levels. In Latin American countries, on average, greater proportions of young children consume eggs than in Asian or African countries. In China and Indonesia, nutrition education and social marketing have been associated with greater amounts of eggs in the diets of young children, though generally, evidence from interventions is minimal. Homestead chicken-and-egg production with appropriate vaccination, extension service, and other supports can simultaneously address poverty and nutrition in very poor rural households. With undernutrition remaining a significant problem in many parts of the world, eggs may be an uncracked part of the solution.

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Nutrition Reviews, 2014

Cracking the Egg Potential During Pregnancy and Lactation

Chessa K Lutter

Pan American Health Organization,
World Health Organization, Washington DC, USA

Lora L Iannotti

Brown School, Institute for Public Health,
Washington University in St. Louis, St. Louis, MO, USA

Christine P Stewart

Department of Nutrition, University of California

> Chicken production and egg consumption may be a locally available and feasible option to improve maternal diets during pregnancy and lactation.

The value of a simple egg

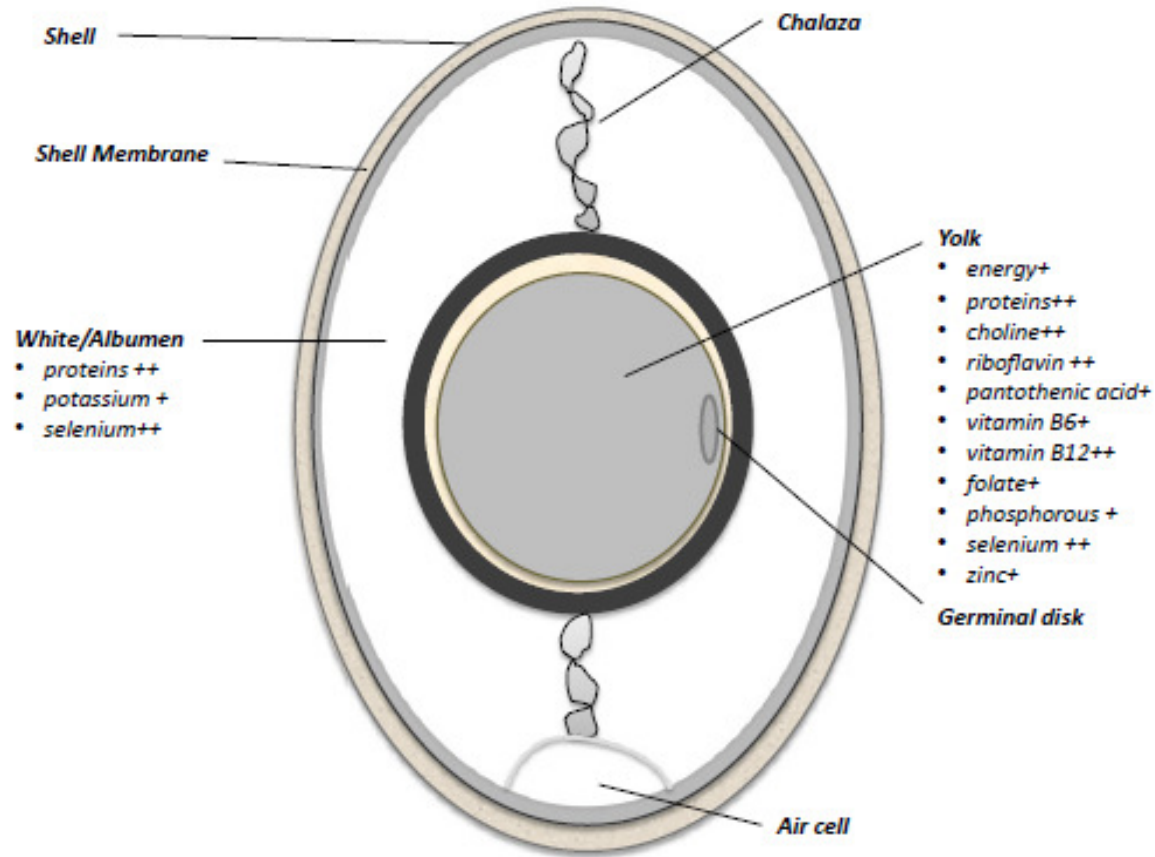
It should not be surprising that a simple egg, which provides a chicken embryo nutritive support from conception to the time it hatches, might also be an important food to support fetal growth

Sight & Life, 2016

“Los huevos se han consumido a lo largo de la historia de la humanidad, aunque el potencial total de este alimento nutricionalmente completo aun no se ha materializado en muchos entornos de escasos recursos en todo el mundo.”

“No debería sorprender que un huevo simple, que proporciona un apoyo nutritivo a los embriones de pollo desde la concepción hasta el momento en que nace, también sea un alimento importante para apoyar el crecimiento y desarrollo del feto durante el embarazo.”

Huevos: proporciona > 50% de nutrientes (++) y 20-50% (+) para bebés amamantados 7-12 meses



Iannotti, Lutter et al. *Nutrition Reviews* 2014

Proporción de requerimiento diario de nutrientes proporcionada por dos huevos de 50 g durante el embarazo y la lactancia

Embarazo		Lactancia	
=>15 - <25%	=>25%	=>15 - <25%	=>25%
Proteína	Riboflavina	Proteína	Riboflavina
Vitamina A	Pantothenic Acid	Pantothenic Acid	Vitamina B12
	Vitamina B12	Hierro	Phosphorus
	Phosphorus		Selenium
	Selenium		Colina
	Colina		

Lutter et al., Sight & Life 2016

Colina



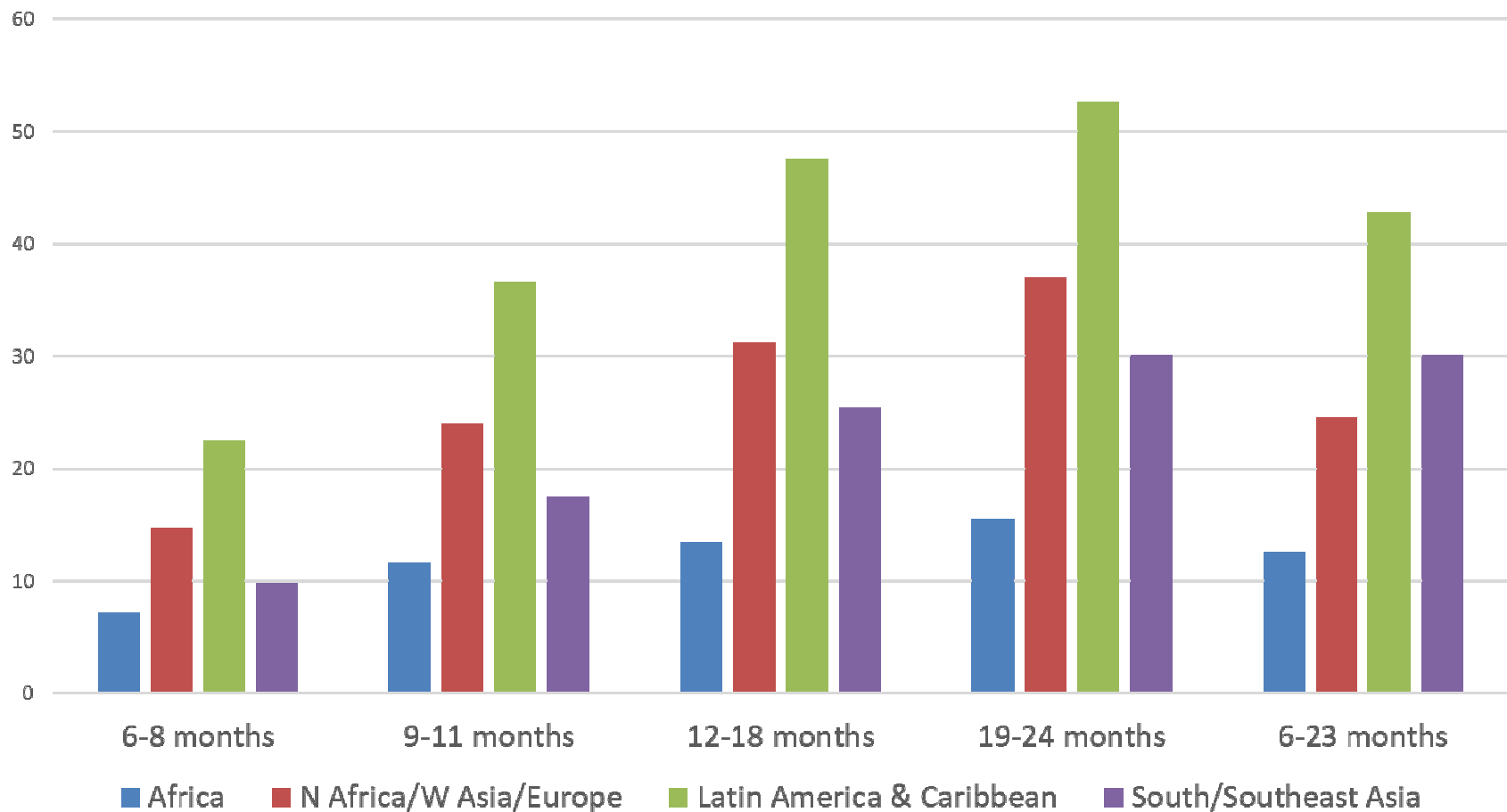
- Nutriente condicionalmente esencial. Los requisitos son mas altos durante el embarazo y la primera infancia.
- Intrínseco al neurotransmisor acetilcolina y juega un papel importante en el desarrollo del hipocampo, crítico para la formación de memoria declarativa.
- Participa en el ciclo metabólico de un carbono para la metilación del ADN y puede ser particularmente importante en el contexto de la deficiencia de B12.

Acido Docosahexaenoico (DHA)



- Acido graso omega-3 poliinsaturado de cadena larga
- Puede producirse en una serie de pasos de elongación, desaturación y β -oxidación a partir del acido alfa-linolenil (ALA)
- AGPI omega-3 predominante en el cerebro
- Neurogénesis, neurotransmisor, mielinización, plasticidad sináptica, entre otras funciones

Prevalencia regional ponderada (%) del consumo de huevos en las últimas 24 horas entre niños menores de 2 años de edad, encuestas representativas a nivel nacional realizados en 2006-2017



Lutter et al., por salir

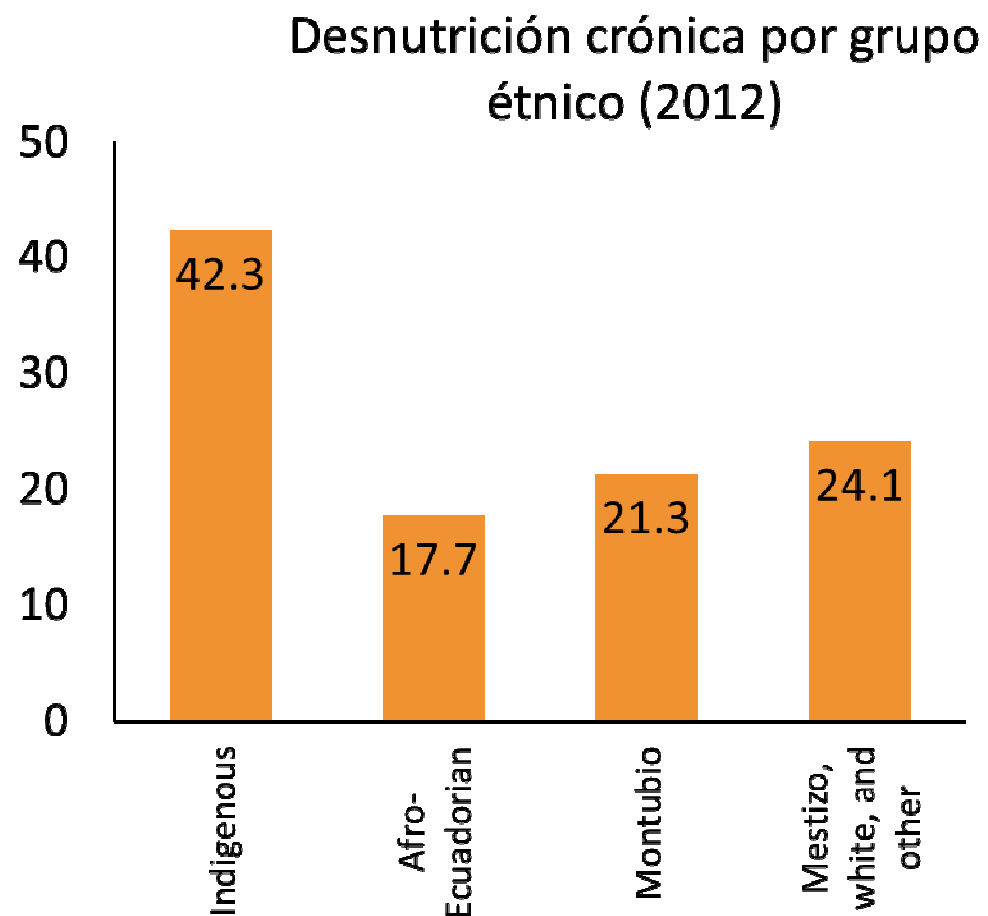


Fotos: G. Reinhart

Prevalencia de la desnutrición crónica en el Ecuador



Foto: UNICEF, Peru



Fuente: Encuesta nacional de salud y nutrición, 2012

Lulun Project



- **Objetivo:** Evaluar la eficacia de los huevos introducidos tempranamente en el periodo de alimentación complementaria sobre el crecimiento y biomarcadores de nutrientes (n=163)
 - **Resultados primarios:** biomarcadores de colina, betaine, vitamina B12, ácidos grasos, antropometría y crecimiento
 - **Resultados secundarios:** aceptabilidad, ingestas dietéticas y morbilidades, aminoácidos, factores de crecimiento
- Aprobado por los Comités de ética en la Universidad San Francisco de Quito, Washington University y OPS

Lulun Project: diseño del estudio



- Ensayo controlado aleatorizado (Marzo–Diciembre 2015)
 - **Provincia de Cotopaxi:** comunidad indígena mixta, alto retraso en el crecimiento inicial
 - Intervención: 1 huevo por día durante 6 meses (huevos comprados localmente y entregados semanalmente durante las visitas de vigilancia))
 - **Seguimiento longitudinal: línea base** (6-9 meses) y línea final (12-15 meses)

- Métodos mixtos
 - **Cualitativo:** teoría fundamentada, observaciones estructuradas, grupos focales y entrevistas en profundidad
 - **Cuantitativo:** encuestas de cuidadores, antropometría, muestras de sangre
 - **Biomarcadores:** Washington University en St. Louis y NETLAB (Quito, Ecuador)



Resultados medidos



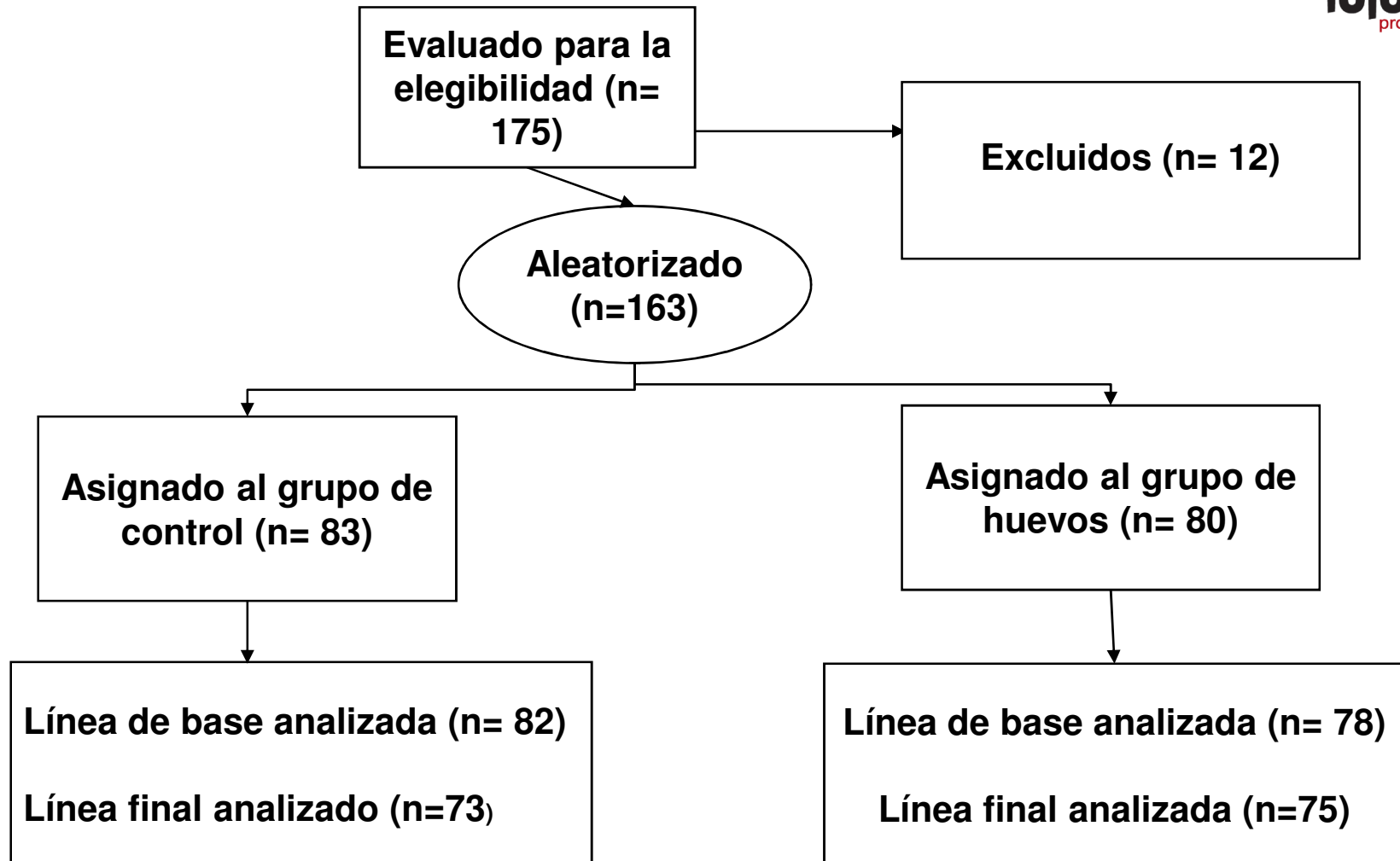
- Longitud y peso
- Biomarcadores: colina, betaina, aminoácidos, TMAO, ácidos grasos, retinol fosfatidilcolinas, esfingomielinas, vitamina B12

Marketing social; propiedad, participación y adherencia



Universidad San Francisco de Quito | Washington University in St. Louis
Pan American Health Organization | University of California, Davis | The Mathile Institute

Diagrama de consorte



Efectos de crecimiento: el modelo lineal generalizado



TABLE 2 Effect of the Intervention on Child Growth in a Randomized Controlled Trial of Eggs in Ecuador

	Baseline		End Point		Effect Size or PR		Effect Size or PR	
	Control (<i>n</i> = 82)	Egg (<i>n</i> = 78)	Control (<i>n</i> = 73)	Egg (<i>n</i> = 75)	Unadjusted		Adjusted ^a	
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	β (95% CI)	<i>P</i>	β (95% CI)	<i>P</i>
LAZ (SD)	-1.71 (0.92)	-2.09 (1.08)	-1.71 (1.00)	-1.39 (1.35)	.64 (0.40–0.89)	<.001	.63 (0.38–0.88)	<.001
WAZ (SD)	-0.40 (0.92)	-0.91 (1.24)	-0.55 (0.85)	-0.34 (1.06)	.71 (0.53–0.90)	<.001	.61 (0.45–0.77)	<.001
WLZ (SD)	0.86 (0.99)	0.55 (0.99)	0.36 (0.81)	0.45 (0.84)	.42 (0.20–0.65)	<.001	.33 (0.14–0.51)	<.001
BMIz (SD)	0.80 (1.00)	0.42 (1.10)	0.64 (0.82)	0.68 (0.86)	.45 (0.20–0.70)	<.001	.29 (0.08–0.49)	.006
	%	%	%	%	PR (95% CI) ^b	<i>P</i>	PR (95% CI) ^b	<i>P</i>
Stunted	26 (32)	37 (47)	29 (40)	21 (28)	0.70 (0.44–1.12)	.14	0.53 (0.37–0.77)	.001
Underweight	4 (5)	10 (13)	5 (7)	4 (5)	0.78 (0.22–2.80)	.70	0.26 (0.10–0.70)	.008

Table shows results for end-point mean (SD) anthropometric measures and prevalence (no. [%], of undernutrition), as well as GLM modeling for unadjusted and adjusted effect size and PR for anthropometric outcomes, by group.

^a Adjusted for child age, sex of the child, and baseline anthropometry for the same dependent variable.

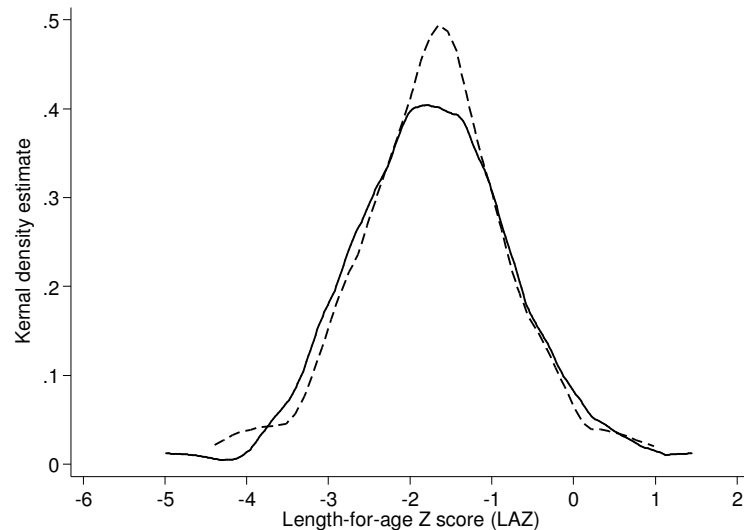
^b PR was estimated using GLM with robust Poisson.

Reducción en desnutrición cónica en 47% y en bajo peso en 74%

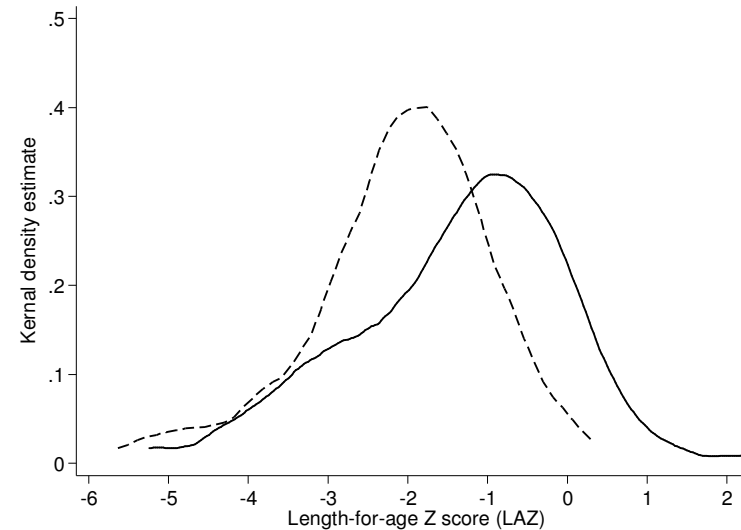
Efecto de crecimiento: cambio en la puntuación Z de longitud y edad (LAZ), línea base (línea discontinua a línea final (sólida)



Grupo control



Grupo de intervención

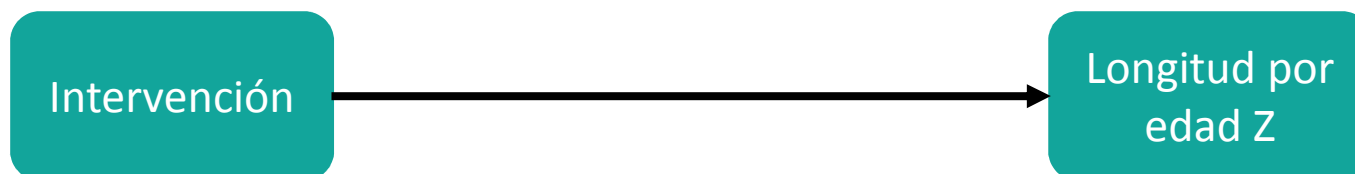


Efectos en las vías de la colina y DHA

	Effect size	(95% CI)	p-value	Corrected p-value
Fatty acids				
Docosahexaenoic acid (DHA)	0.42	(0.13,0.71)	0.005	0.015
Linoleic acid (LA)	0.23	(-0.05,0.50)	0.108	0.162
Alpha-linolenic acid (ALA)	0.10	(-0.17,0.38)	0.459	0.459
Choline pathways				
Dimethylamine	0.40	(0.11,0.71)	0.009	0.034
Choline	0.34	(0.11,0.55)	0.004	0.032
Trimethylamine-N-oxide	0.33	(0.07,0.58)	0.013	0.034
Betaine	0.29	(0.01,0.56)	0.041	0.082
Dimethylglycine	0.03	(-0.20,0.27)	0.769	0.772
Trimethylamine	-0.04	(-0.4,0.26)	0.772	0.772



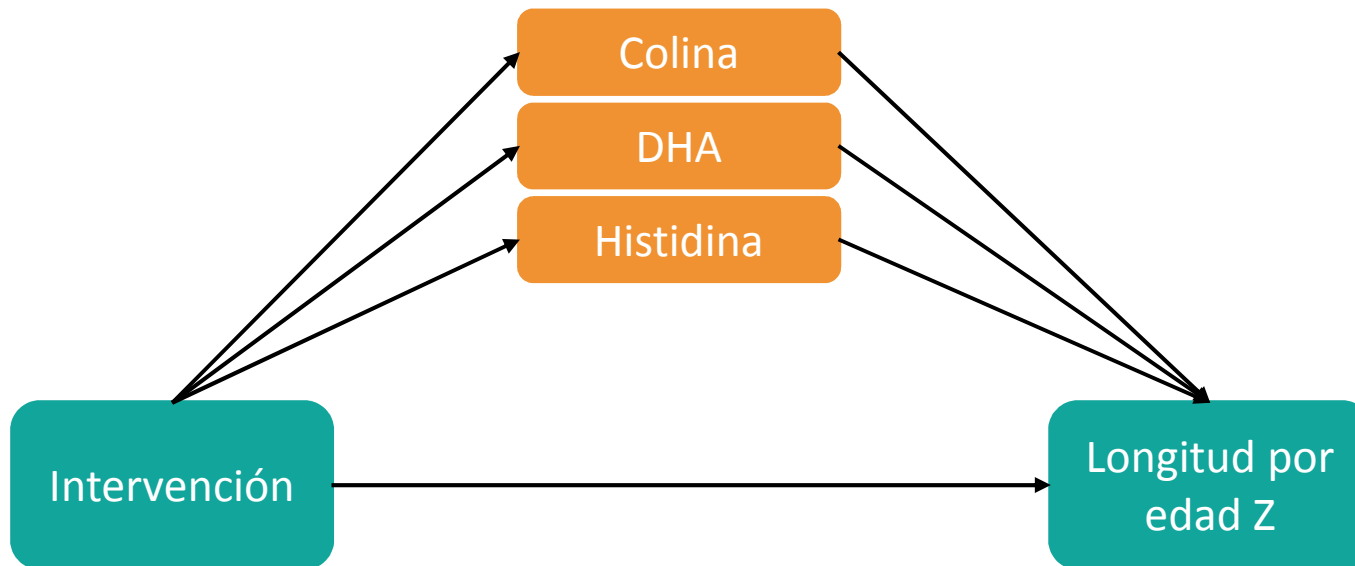
Caminos que median el efecto del crecimiento



Diferencia en longitud por edad Z: 0.63 (0.38, 0.88), $p < 0.001$

Stewart et al., por salir

Análisis de mediación



Diferencia en longitud por edad Z: 0.63 (0.38, 0.88), $p < 0.001$

15% del efecto de la intervención podría atribuirse a la colina ($p = 0.007$)

4.5% del efecto atribuido a DHA ($p = 0.07$)

4.2% del efecto atribuido a la histidina ($p = 0.10$)

Combinado: el 24% del efecto atribuido a colina, DHA e histidina juntos

Stewart et al., por salir

Resumen



- El Lulun Project mostró un efecto significativo en longitud por edad Z (0.63) reducción de desnutrición crónica (47%)
 - Comparativamente mucho mas grande que el promedio global para otras intervenciones de la alimentación complementaria
- Los análisis de biomarcadores sugieren importantes vías asociadas con el desarrollo cerebral afectado
 - Vías de colina, varios aminoácidos y DHA



Conclusiones

- Los huevos se encuentran entre los primeros alimentos de la naturaleza, proporcionando un paquete holístico de nutrientes y otros factores bioactivos
 - Los huevos fueron parte integral de nuestra historia evolutiva
- Los huevos pueden ser una opción localmente disponible y factible para los hogares pobres, con un potencial sin fisuras para abordar los problemas mas importantes de la desnutrición

Eggs in Early Complementary Feeding and Child Growth: A Randomized Controlled Trial

Lora L. Iannotti, PhD,^a Chessa K. Lutter, PhD,^b Christine P. Stewart, PhD,^c Carlos Andres Gallegos Riofrio, MA,^d Carla Malo, BS,^d Gregory Reinhart, PhD,^e Ana Palacios, MD, MA,^f Celia Karp, BS,^d Melissa Chapnick, RD, MS, MPH,^g Katherine Cox, BA,^h William F. Waters, PhD^d

BACKGROUND: Eggs are a good source of nutrients for growth and development. We hypothesized that introducing eggs early during complementary feeding would improve child nutrition.

METHODS: A randomized controlled trial was conducted in Cotopaxi Province, Ecuador, from March to December 2015. Children ages 6 to 9 months were randomly assigned to treatment (1 egg per day for 6 months [$n = 83$]) and control (no intervention [$n = 80$]) groups. Both arms received social marketing messages to encourage participation in the Lulun Project (*lulun* meaning “egg” in Kichwa). All households were visited once per week to monitor morbidity symptoms, distribute eggs, and monitor egg intakes (for egg group only). Baseline and end point outcome measures included anthropometry, dietary intake frequencies, and morbidity symptoms.

RESULTS: Mothers or other caregivers reported no allergic reactions to the eggs. Generalized

abstract

Eggs early in complementary feeding increase choline pathway biomarkers and DHA: a randomized controlled trial in Ecuador

Lora L Iannotti,¹ Chessa K Lutter,^{3,4} William F Waters,⁵ Carlos Andres Gallegos Riofrio,^{1,5} Carla Malo,⁵ Gregory Reinhart,⁶ Ana Palacios,^{6,7} Celia Karp,⁸ Melissa Chapnick,¹ Katherine Cox,¹ Santiago Aguirre,⁹ Luis Narvaez,⁹ Fernando López,⁹ Rohini Sidhu,² Pamela Kell,² Xuntian Jiang,² Hideji Fujiwara,² Daniel S Ory,² Rebecca Young,¹⁰ and Christine P Stewart¹⁰

¹Brown School, Institute for Public Health, and ²Diabetic Cardiovascular Disease Center, Washington University in St. Louis, St. Louis, MO; ³School of Public Health, University of Maryland, College Park, MD; ⁴RTI International, Research Triangle Park, NC; ⁵Institute for Research in Health and Nutrition, Universidad San Francisco de Quito, Quito, Ecuador; ⁶The Mathile Institute for the Advancement of Human Nutrition, Dayton, OH; ⁷Department of Nutritional Sciences, The University of Texas at Austin, Austin, TX; ⁸Johns Hopkins Bloomberg School of Public Health, Baltimore, MD; ⁹NETLAB Laboratorios Especializados, Quito, Ecuador; and ¹⁰Department of Nutrition, University of California, Davis, Davis, CA

ABSTRACT

Background: Choline status has been associated with stunting among young children. Findings from this study showed that an egg intervention improved linear growth by a length-for-age z score of 0.63. **Objective:** We aimed to test the efficacy of eggs introduced early in complementary feeding on plasma concentrations of biomarkers in choline pathways, vitamins B-12 and A, and essential fatty acids. **Design:** A randomized controlled trial, the Lulun (“egg” in Kichwa) Project, was conducted in a rural indigenous population of Ecuador. **From April 6, 2015, we were randomly assigned to treatment (1 egg per day for 6 months) and control (no intervention) groups. Both arms received social marketing messages to encourage participation in the Lulun Project. All households were visited once per week to monitor morbidity symptoms, distribute eggs, and monitor egg intakes (for egg group only). Baseline and end point outcome measures included anthropometry, dietary intake frequencies, and morbidity symptoms.**

INTRODUCTION

Multiple biological pathways influence early growth and development and depend on the adequate intake and metabolism of essential nutrients during infancy and early childhood. Choline is necessary for the production of phospholipids, cell membrane integrity, and in the conversion of acetylcholine and sphingomyelin in brain development and function. Alternatively, choline may be converted to betaine, which plays a crucial role as a methyl donor, converting homocysteine to methionine in remethylation

Original Article

Cracking the Egg Potential: Traditional Knowledge, Attitudes, and Practices in a Food-Based Nutrition Intervention in Highland Ecuador

William F. Waters¹, Carlos Andres Gallegos^{1,2}, Celia Karp³, Chessa Lutter^{4,5}, Christine Stewart⁶, and Lora Iannotti²

Abstract

Background: Food-based interventions can reduce the prevalence of undernutrition and improve household food security, but nutritious and accessible foods may be underutilized. In Ecuador, eggs are inexpensive and widely available, but while they are a valuable source of essential nutrients for infants and young children, medical advice and community-based information have limited their inclusion in infants’ diets.

Objective: A qualitative component was conducted to understand local perceptions, knowledge, and

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Estudios/proyectos en curso

- **Lulun II**: Seguimiento de niños en el estudio a los 3 años para evaluar el crecimiento y la recolección de mensajes
- Análisis de metabolómica de muestras de plasma Lulun restantes para biomarcadores en crecimiento crítico y vías inmunes
- Estudio **Mazira** en Malawi: Diseño similar a Lulun pero con recordatorios dietéticos detallados y resultados adicionales del desarrollo infantil y salud intestinal (BMGF)
- Estudio de métodos mixtos para evaluar facilitadores/barreras contextuales para la producción avícola a pequeña escala en Ecuador (WUSTL)
- Estudio cualitativo sobre las percepciones de consumo de huevos durante el embarazo en Kenia (RTI)
- Suplemento en Maternal & Child Nutrition por salir (CIFI)

Intereses futuros

- Estudio de eficacia (prueba de concepto) sobre el consumo de huevos durante el embarazo en nutrición materna, peso al nacer y crecimiento infantil
- Estudio de efectividad de un modelo diferente de producción avícola y un modelo de comunicación de cambio de comportamiento/mercadeo social sobre:
 - Tamaño de la parvada y producción de huevos
 - Exposiciones de agentes patógenos virales y bacterianos asociados con la producción avícola
 - Consumo de huevo entre mujeres y niños pequeños
 - Crecimiento y desarrollo infantil
 - Mejora de los medios de vida y el empoderamiento de las mujeres

Gracias



chessa.lutter@gmail.com