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Dunedin

Toddler Nutrition - Making Every Bite Count Today for Tomorrow - Concurrent Workshop Repeated

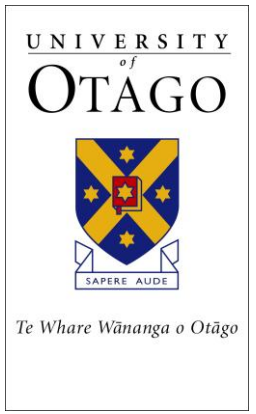
Friday, 21 June 2013	Start 11:00am	Duration: 55mins	Kandinsky
	Start 12:05pm	Duration: 55mins	Kandinsky

UNIVERSITY OF OTAGO
DEPARTMENT OF HUMAN NUTRITION

Toddler nutrition – making every bite count today for tomorrow

Anne-Louise Heath, Szymlek-Gay E, Ferguson E, Hope E, Gray A, Houghton L, Skeaff S, Gibson R

Disclosure slide



Outline

- **Micronutrient deficiency**
  - **The problem**
  - **What works?**
- **Overweight and obesity**
  - **The problem**
  - **What we can do about it?**
- **Resources**

Outline

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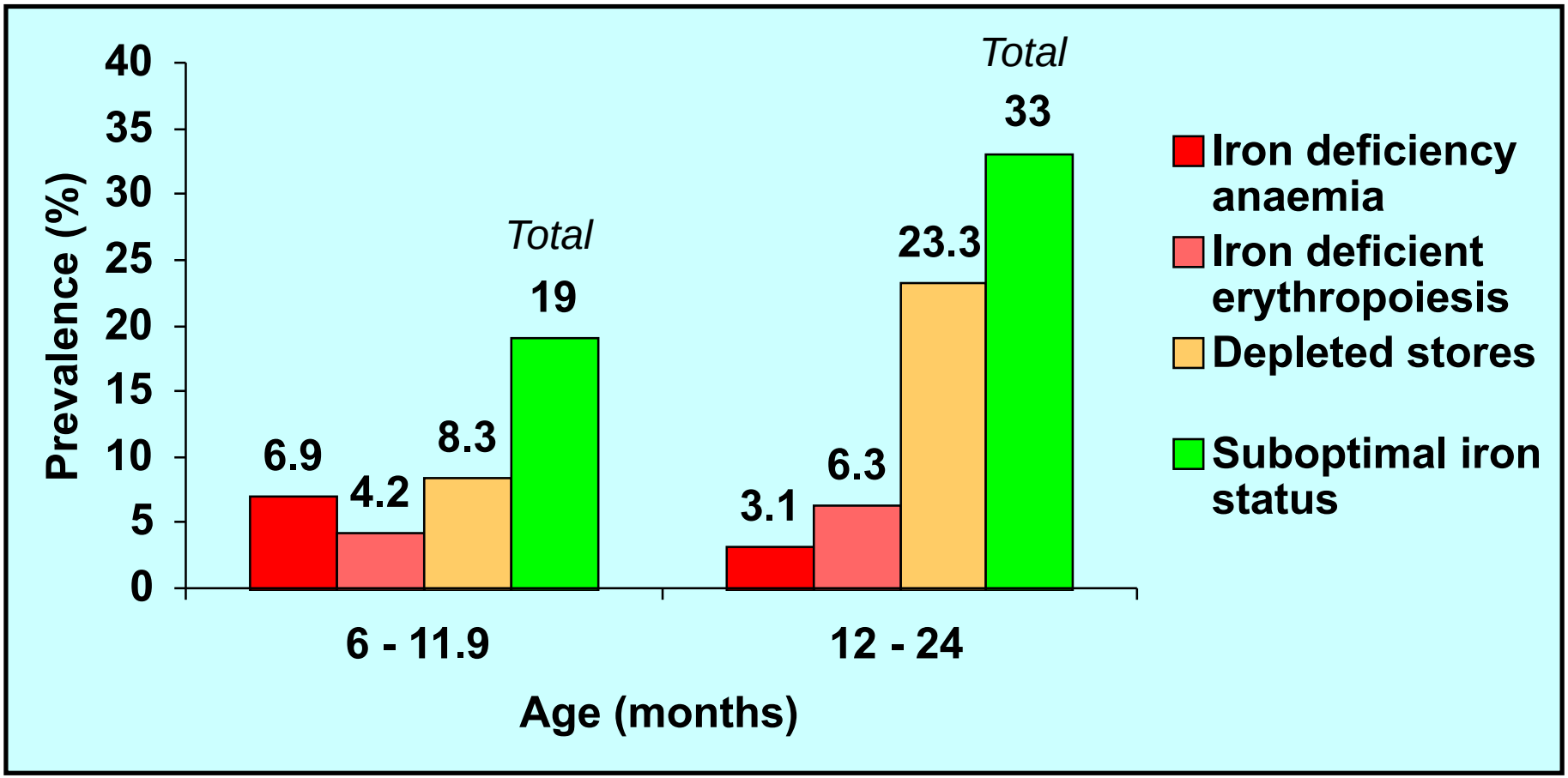
1 in 3 NZ toddlers have suboptimal iron status



(Soh et al, 2004)

Consequences of iron deficiency

Iron deficiency anaemia is assoc with:

- **Poorer mental, motor & behavioural development**
- **Slower weight velocity**
- ***And may increase morbidity (fever, respiratory infections, diarrhoea)***

Non-anaemic iron deficiency may be assoc with

- **Subtle -ve effects on cognitive function, fatigue**
- **Increased risk of iron deficiency anaemia**

Other micronutrients are also low

- **Zinc – 38% toddlers suboptimal serum zinc (Morgan et al., 2010)**
- **Vitamin D - 43% toddlers suboptimal serum 25(OH)D (Houghton et al., 2011)**
- **Iodine - 54% toddlers suboptimal urinary iodine (Skeaff S, personal communication, 2011)**

Outline

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  - **What works?**
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Options

- **Supplementation**
- **Fortification**
- **Dietary change**

Food-based intervention

Food-based interventions are preferable when mild rather than severe deficiency common:

- **No screening required**
- **No risk of accidental overdose**
- **Avoids supplement effects**
- **May improve overall diet quality**

Which foods?

Red meat:

- **High in iron and zinc**
- **Contains haem iron**
- **Enhances iron and zinc absorption**

Fortified toddler milk:

- **High in iron, zinc, vitamin D, iodine**
- **No behaviour change (toddler)**

Toddler Food Study

To test the efficacy of an increased intake of red meat or the use of a fortified milk for improving the iron (and zinc, vitamin D and iodine) status of healthy 12-20 month old New Zealand children

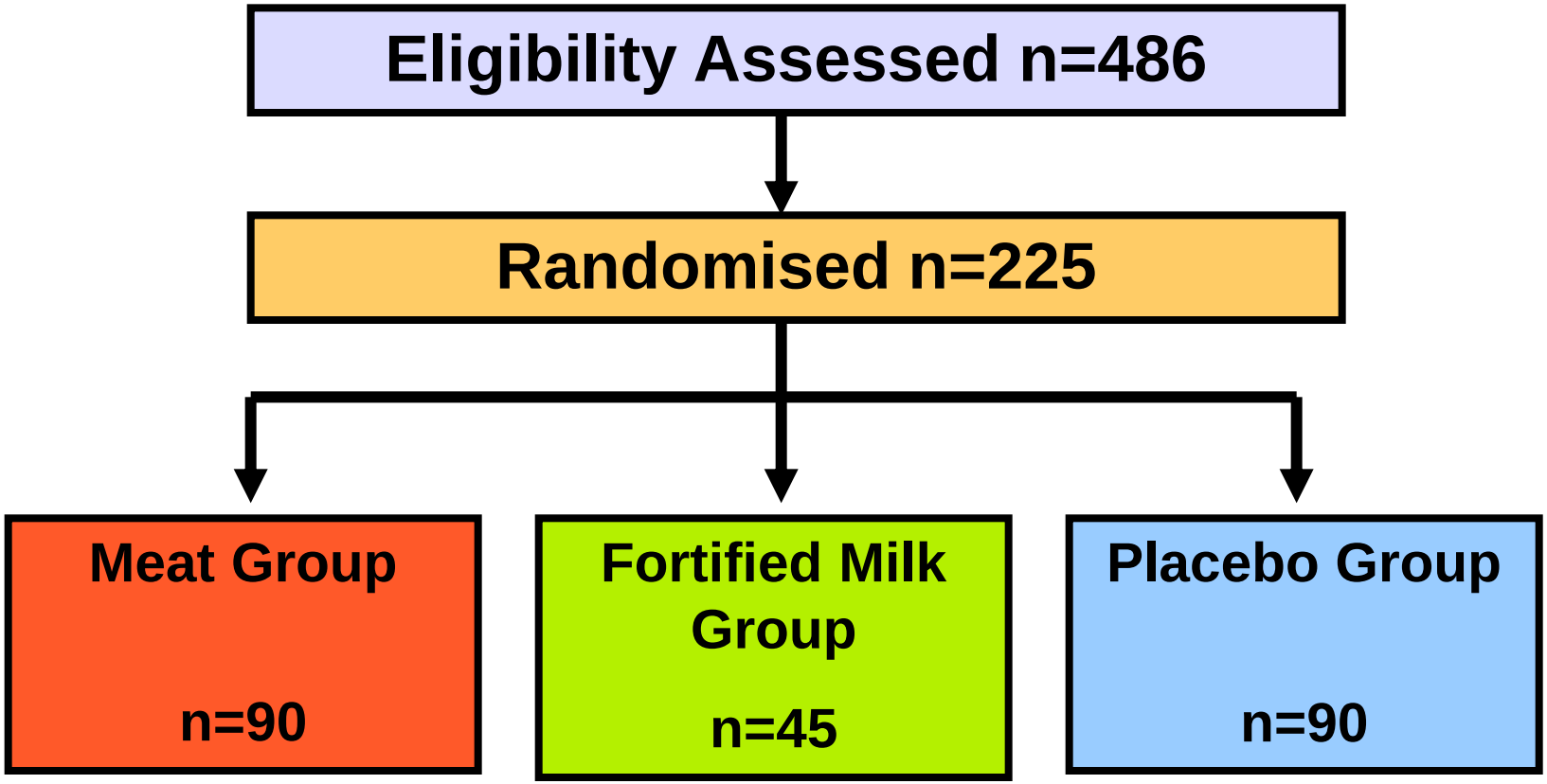
Inclusion criteria

- **12-20 months old**
- **Apparently healthy**
- **Parent prepared to offer:**
  - **Meat**
  - **Cow's milk**

Exclusion criteria

- **Haemoglobin <105g/L**
- **Haemoglobin <110g/L & serum ferritin <12µg/L**
- **Currently consuming Fe or Zn-containing supplements**
- **Currently consuming toddler milk or infant formula**

Randomised controlled trial



Interventions

Meat group

Two red meat dishes per day (~2.6 mg iron/day)

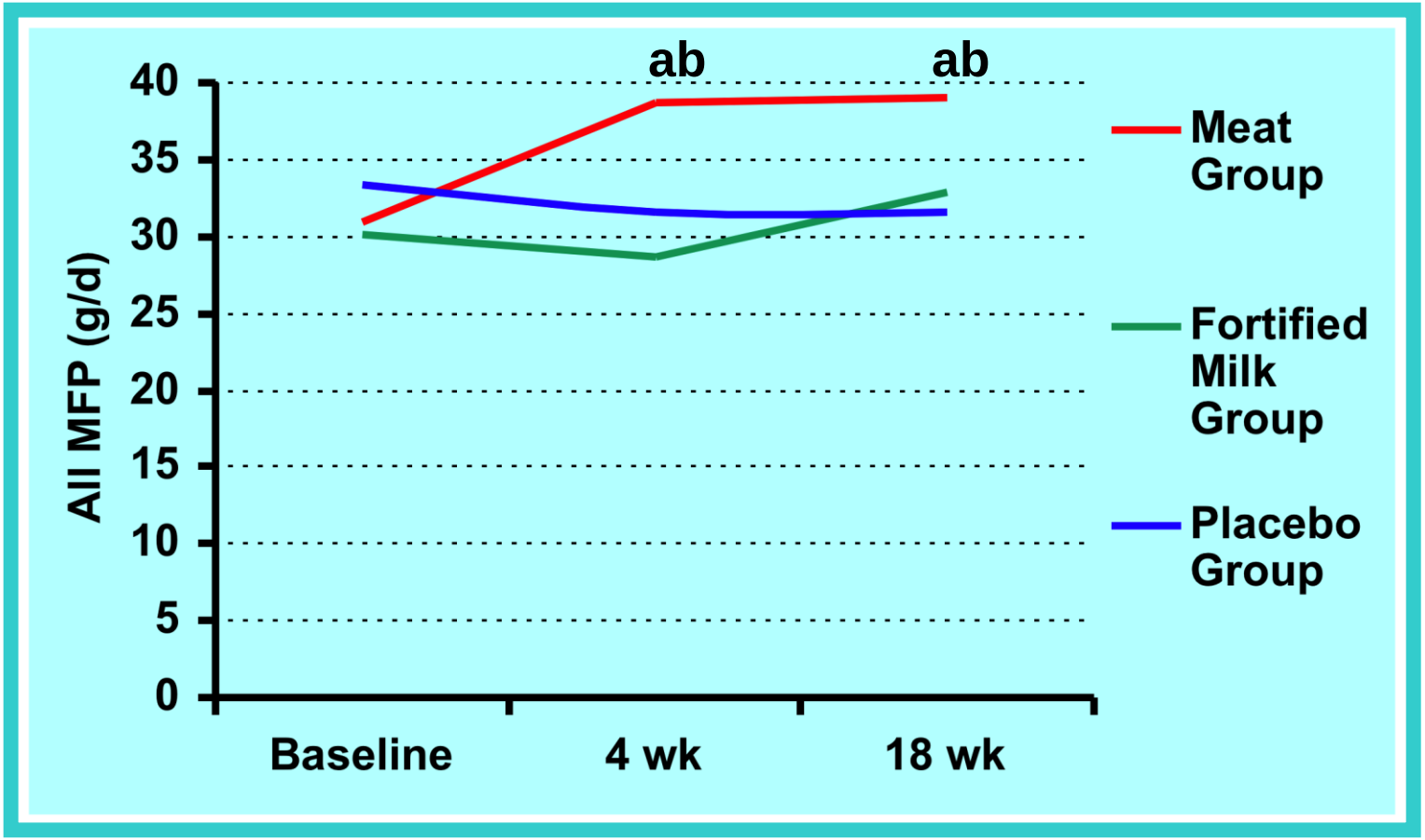
Fortified milk group

Regular milk replaced with iron-fortified cow's milk (1.5 mg iron/100g)

Placebo group

Regular milk replaced with non-fortified cow's milk (0.01 mg iron/100g)

“Meat/fish/poultry” intake increased

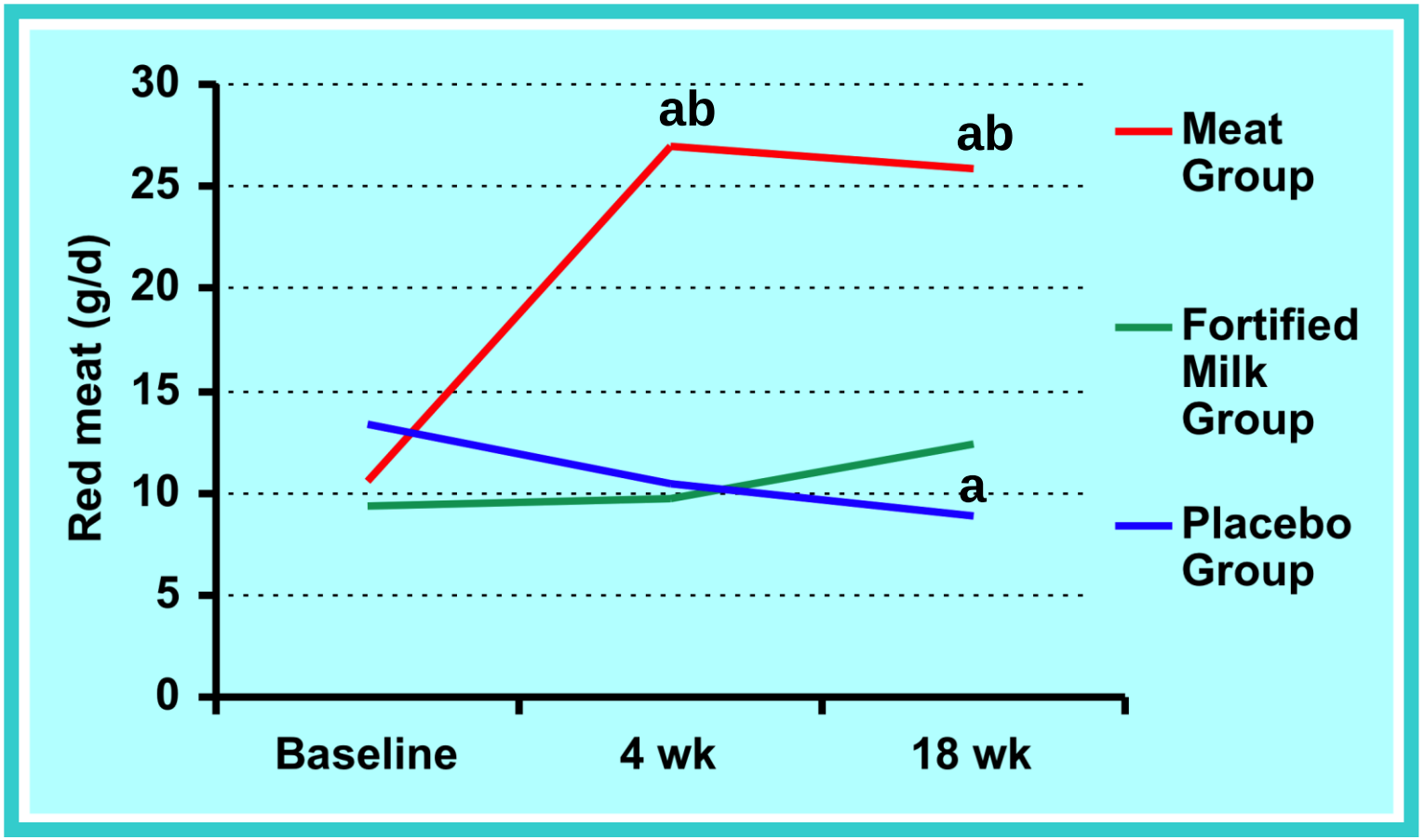


Adjusted for age, sex, education, income, ethnicity

[a] Significant difference from baseline $P<0.05$

[b] Significant change compared to Placebo Group $P<0.05$

Red meat intake increased

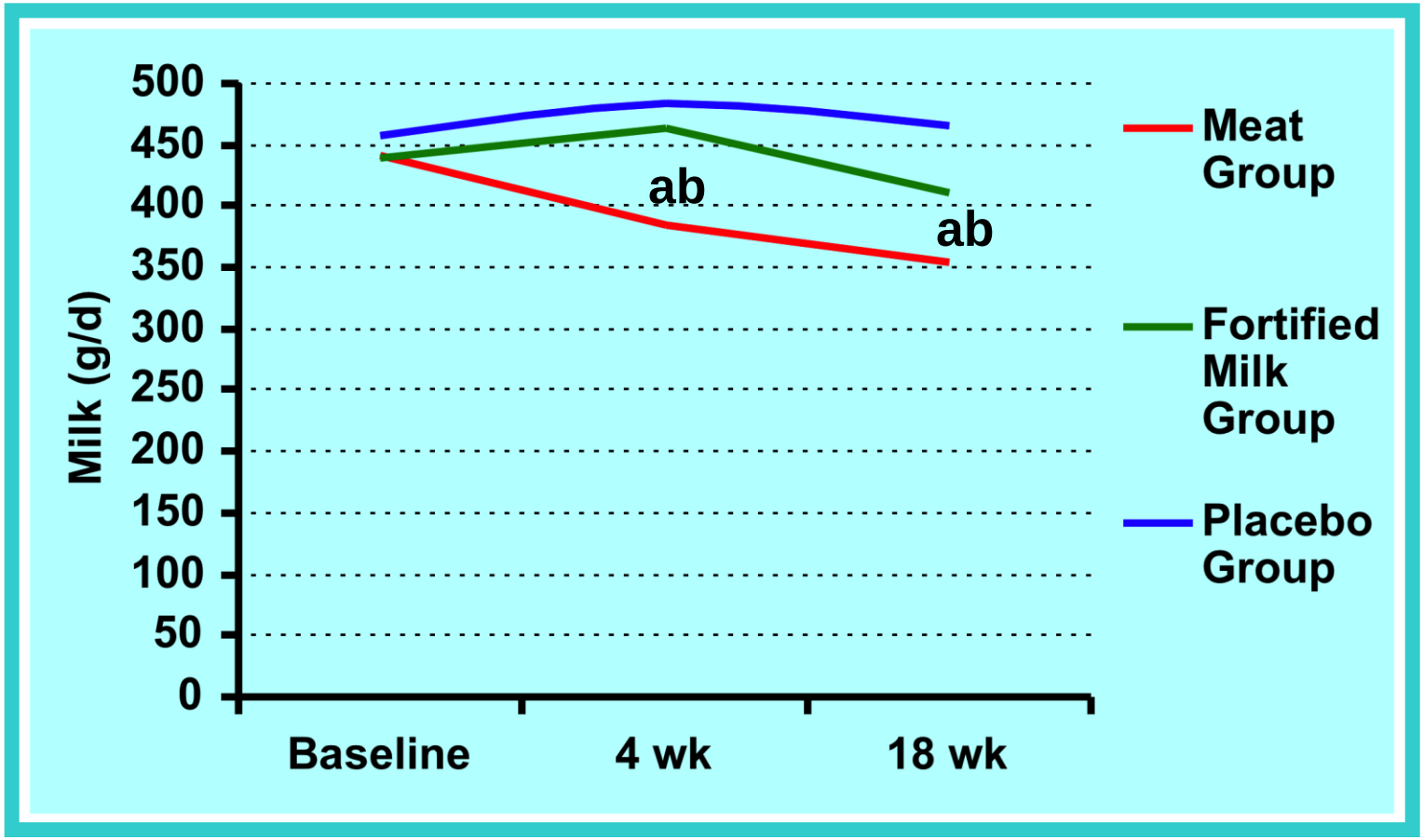


Adjusted for age, sex, education, income, ethnicity

[a] Significant difference from baseline $P<0.05$

[b] Significant change compared to Placebo Group $P<0.05$

Milk intake unchanged in milk groups

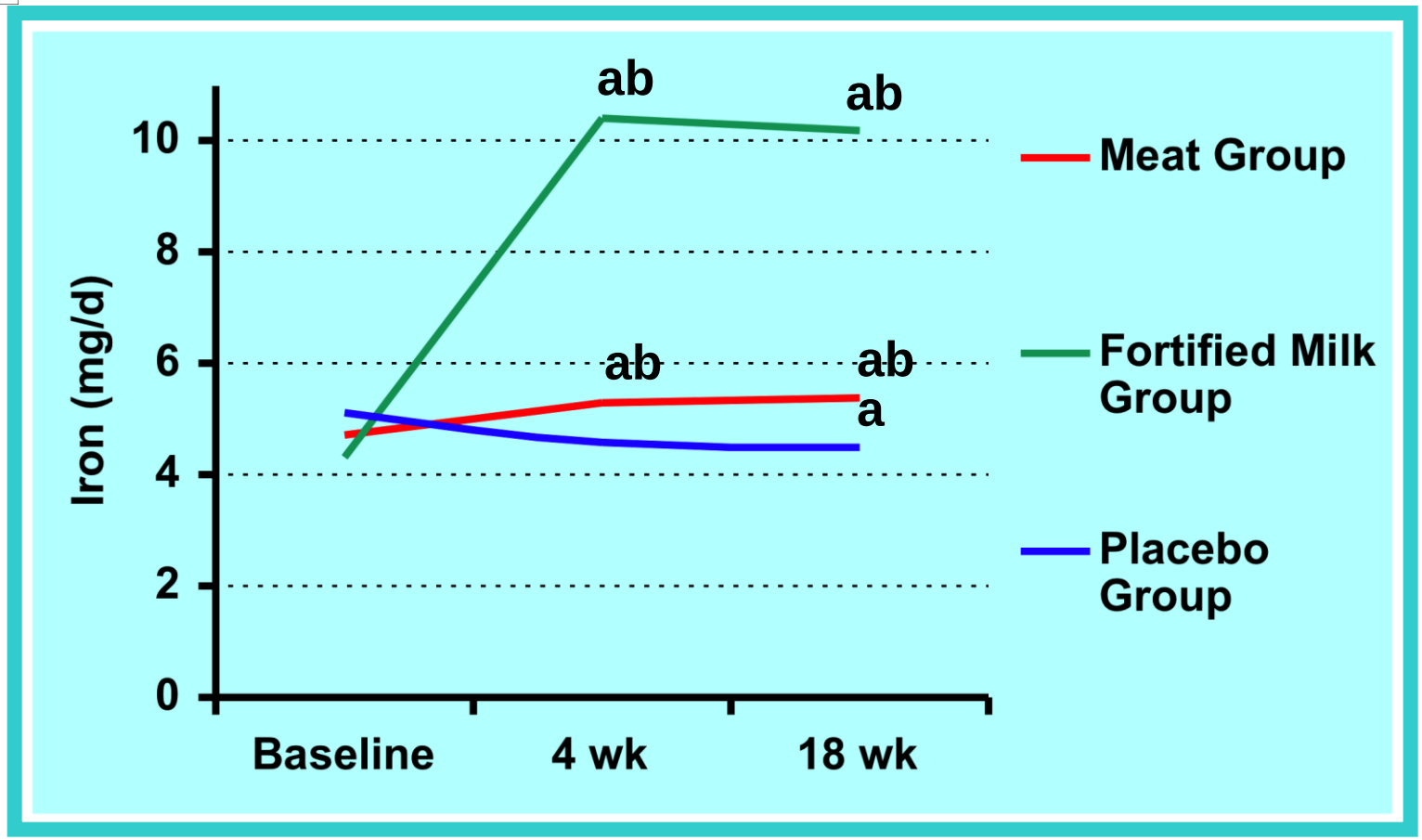


Adjusted for age, sex, education, income, ethnicity

[a] Significant difference from baseline $P<0.05$

[b] Significant change compared to Placebo Group $P<0.05$

Total iron intake increased



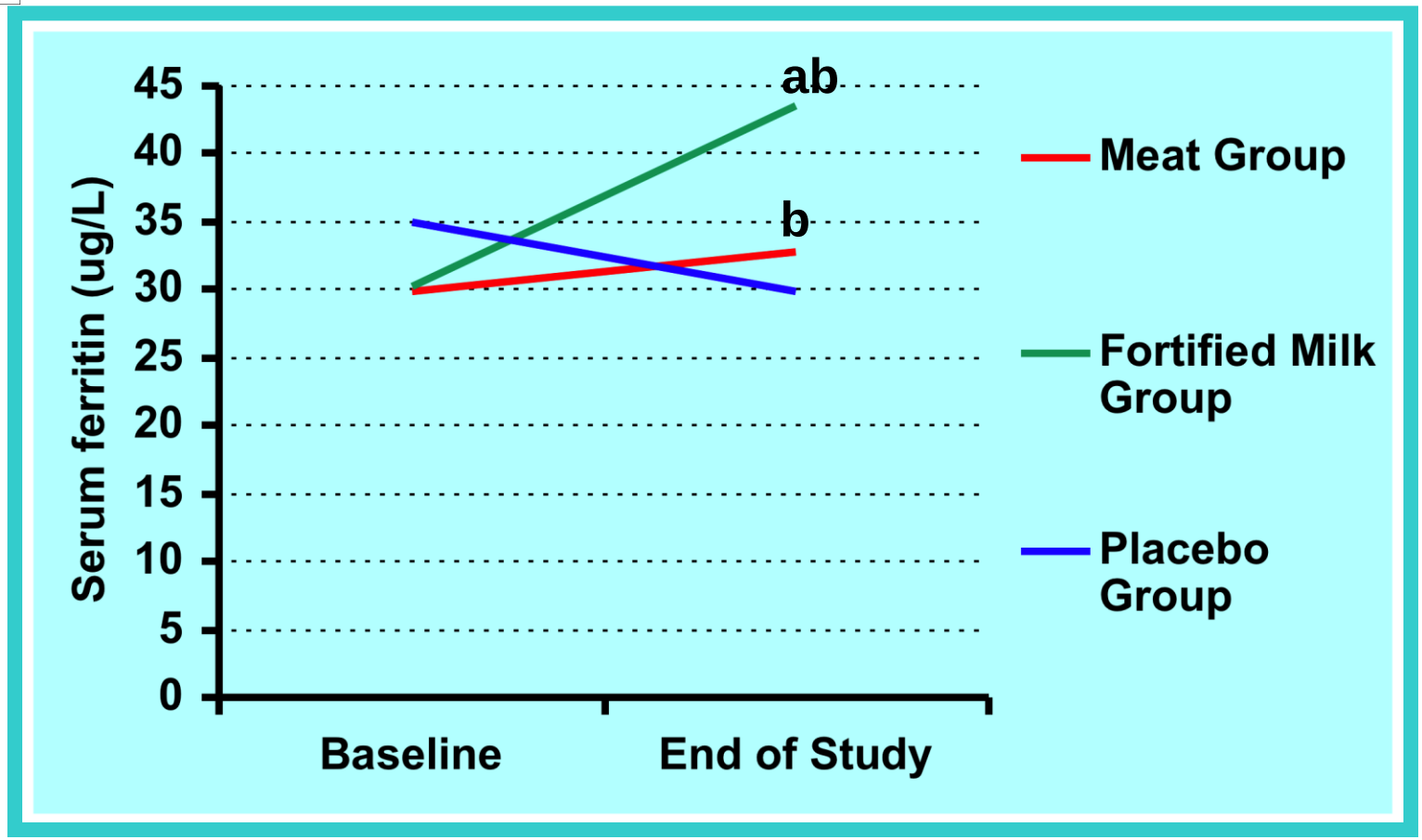
Adjusted for age, sex, education, income, ethnicity

[a] Significant difference from baseline $P<0.05$

[b] Significant change compared to Placebo Group $P<0.05$

- **Meat group ↑ red meat intake**
- **Milk groups did not change their milk intake**
- **Both the meat group and the iron-fortified milk group ↑ total iron intake**

Change in serum ferritin



Adjusted for age, sex, age x sex, infection, education, income, ethnicity

[a] Significant change from baseline *P*=0.002

[b] Significant change compared to Placebo Group *P*<0.05

- **Iron stores ↓ during the second year of life**
- **Both ↑ red meat intake and using an iron-fortified milk prevent this ↓ in iron stores**
- **Iron-fortified milk increases iron stores in 12-20 month old NZ children**

What can parents do?

- **Provide iron rich foods**
  - Red meat prevents drop in iron stores
  - Fortified milk increases iron stores
- **Maximise amount of iron absorbed**
- **Red meat dishes must be toddler-friendly**
- **Offer refused foods at least 10 times**
- **Make sure toddler not full before the meal**

Food-based strategies improve iron status in toddlers: a randomized controlled trial[1–3]

Ewa A Szymlek-Gay, Elaine L Ferguson, Anne-Louise M Heath, Andrew R Gray, and Rosalind S Gibson

The American Journal of Clinical Nutrition

ABSTRACT

Background: Nonanemic iron deficiency is common in toddlers in developed countries. Food-based strategies are safe methods to control and prevent mild micronutrient deficiencies.

Objective: Our objective was to determine the efficacy of an increased intake of red meat, or the consumption of iron-fortified milk, in improvement of iron status in toddlers at a population level.

Design: In this 20-wk randomized placebo-controlled trial, 225 healthy nonanemic 12–20-mo-old children were assigned to 1 of 3 groups: red meat (toddlers encouraged to consume ≈2.6 mg iron from red meat dishes daily), fortified milk [toddlers' regular milk replaced with iron-fortified (1.5 mg iron/100 g prepared milk) cow milk], or control [toddlers' regular milk replaced with nonfortified (0.01 mg iron/100 g prepared milk) cow milk]. Blood samples were collected at baseline and at 20 wk for hemoglobin, serum ferritin, serum transferrin receptor, and C-reactive protein. The prevalence of suboptimal iron status (ie, depleted iron stores, iron-deficient erythropoiesis, and iron deficiency anemia) was determined, and body iron was calculated.

Results: No intervention effects were shown on the prevalence of suboptimal iron status. Serum ferritin increased by 44% (95% CI: 14%, 82%; $P = 0.002$) in the fortified milk group, did not change (+10%) in the red meat group (95% CI: −7%, 30%; $P = 0.241$), and tended to decrease (−14%) in the control group (95% CI: −27%, 1%; $P = 0.063$). By 20 wk, in comparison with the control group, serum ferritin and body iron were significantly higher in the fortified milk group (both $P < 0.001$), and serum ferritin was significantly higher in the red meat group ($P = 0.033$).

Conclusions: Consumption of iron-fortified milk can increase iron stores in healthy nonanemic toddlers, whereas increased intakes of red meat can prevent their decline. This trial was registered at actr.org.au as ACTRN12605000487617. *Am J Clin Nutr* 2009; 90:1541–51.

In populations such as New Zealand's, where mild iron deficiency is common and iron deficiency anemia is rare (1–7), universal biochemical screening is not recommended (15). It is also not appropriate to use universal iron supplementation because of its cost and possible side effects, including adverse effects on growth in young children who do not have anemia (16, 17). Food-based strategies are preferred to supplementation in this setting because they are more sustainable, do not require universal screening for iron deficiency, avoid the risk of accidental iron overdose and poor utilization of other trace minerals such as zinc and copper (18, 19), and appear to be safe for children who are iron sufficient.

Observational studies suggest a positive association between consumption of flesh foods (7, 20–22) or iron-fortified milk (1, 6, 23) and iron stores in toddlers. However, no intervention studies have yet investigated the effects of meat intake on iron status in this age group. Furthermore, randomized trials that examined the effects of iron-fortified milk on iron status in toddlers are few, and the results have been inconsistent (8, 10–12, 24). All but one of the randomized trials investigated the effects on toddler iron status of iron-fortified milk initiated in infancy, and the one study that began at 12 mo was weakened by a high attrition rate (11). None of these studies report estimates of body iron (25).

In this study we determined the efficacy of an increased intake of red meat, or the consumption of iron-fortified milk, in improvement of iron status in New Zealand toddlers at a population level. Our hypothesis was that an increased intake of red meat, or

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IRON
ESSENTIAL FOR YOUR TODDLER'S WELLBEING

Zinc status unchanged

The Journal of Nutrition
Nutritional Epidemiology

Red Meat and a Fortified Manufactured Toddler Milk Drink Increase Dietary Zinc Intakes without Affecting Zinc Status of New Zealand Toddlers[1–4]

Emily J. Morgan,[5] Anne-Louise M. Heath,[5] Ewa A. Szymlek-Gay,[5,7] Rosalind S. Gibson,[5] Andrew R. Gray,[6] Karl B. Bailey,[5] and Elaine L. Ferguson[5,8]*

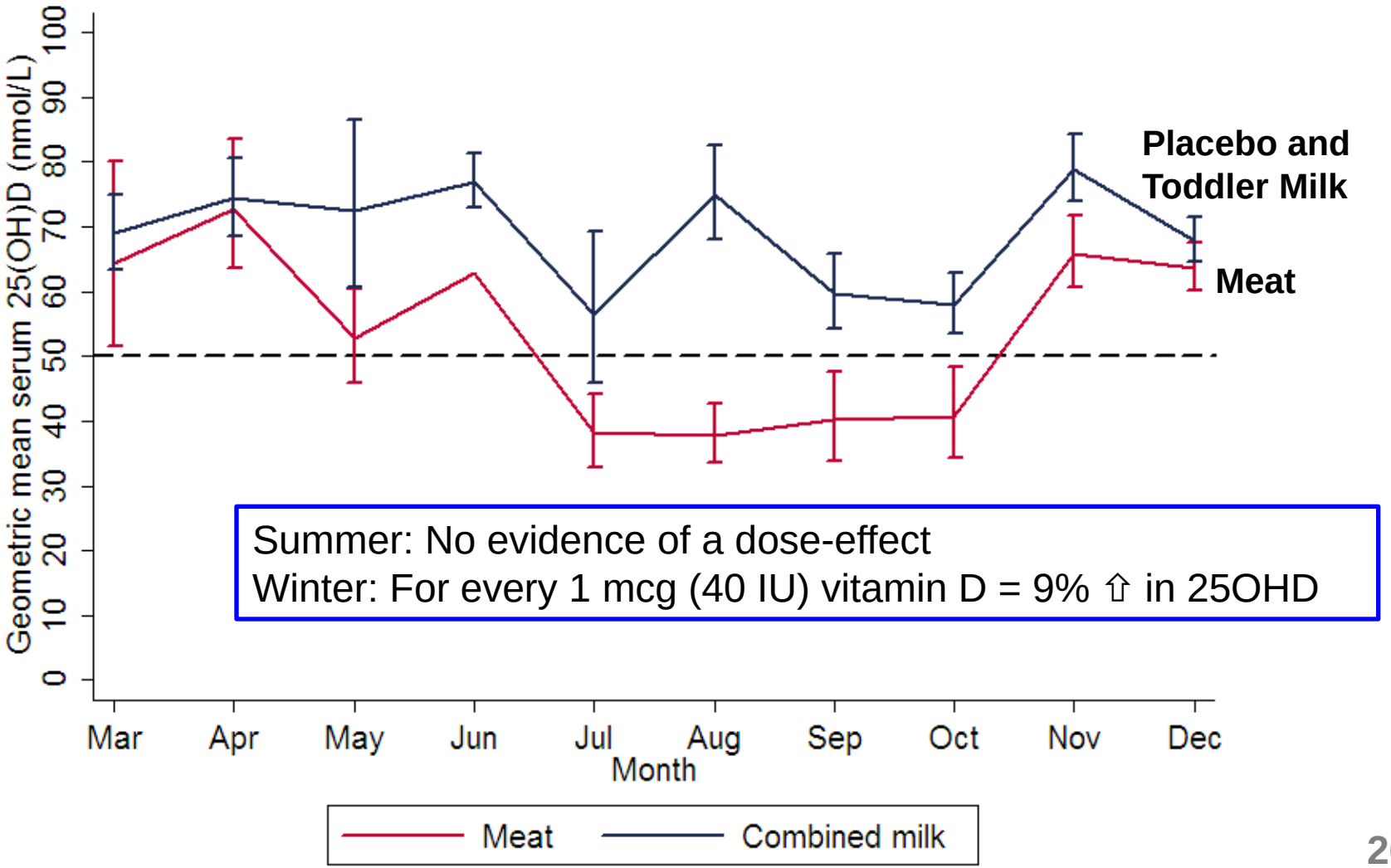
[5]Department of Human Nutrition and [6]Department of Preventive and Social Medicine, University of Otago, Dunedin, New Zealand; [7]Department of Clinical Sciences, Pediatrics, Umeå University, SE-901 85 Umeå, Sweden; and [8]Nutrition and Public Health Intervention Research Unit, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK

Abstract

Evidence suggests that New Zealand (NZ) children are mildly zinc deficient and may respond to dietary change. A 20-wk randomized intervention trial was therefore conducted to determine whether an increased intake of red meat or consumption of a fortified manufactured toddler milk drink (FTMD, fortified with zinc and other micronutrients) would increase dietary zinc intakes and improve the biochemical zinc status of 12- to 20-mo-old NZ toddlers. Toddlers were randomized to a red meat intervention (n = 90), FTMD intervention (n = 45), or nonfortified milk placebo (n = 90). Study foods were provided. Adherence was assessed via monthly 7-d meat or milk recording diaries. Hair and serum zinc concentrations, and length and weight were measured at baseline and postintervention. Nutrient intakes were assessed via 3-d weighed food records at baseline, wk 4, and wk 18. At baseline, 38% of participants had low serum zinc concentrations despite seemingly adequate dietary zinc intakes (<4% below the Estimated Average Requirement). Dietary zinc intakes significantly increased by 0.8 mg/d (95% CI: 0.5, 1.1) in the meat group and 0.7 mg/d (95% CI: 0.2, 1.1) in the FTMD group compared with a decrease of −0.5 (95% CI: −0.8, −0.2) mg/d in the placebo group. No corresponding increases in serum or hair zinc concentrations were observed. Dietary zinc intakes achievable via interventions based on red meat or a FTMD are unlikely to improve biochemical zinc status in NZ toddlers. These results also question cutoffs used to define zinc deficiency in toddlers. J. Nutr. 140: 2221–2226, 2010.

JN THE JOURNAL OF NUTRITION

Vitamin D status improved



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The Journal of Nutrition
Nutrient Requirements and Optimal Nutrition

Vitamin D-Fortified Milk Achieves the Targeted Serum 25-Hydroxyvitamin D Concentration without Affecting That of Parathyroid Hormone in New Zealand Toddlers[1–3]

[AQ1]

Lisa A. Houghton,[4]* Andrew R. Gray,[5] Ewa A. Szymlek-Gay,[6] Anne-Louise M. Heath,[4] and Elaine L. Ferguson[7]

[4]Department of Human Nutrition, and [5]Department of Preventive and Social Medicine, University of Otago, Dunedin, New Zealand; [6]Department of Clinical Sciences, Pediatrics, Umeå University, Umeå, Sweden; and [7]Department of Nutrition and Public Health Intervention Research, London School of Hygiene and Tropical Medicine, London, UK

Abstract

For young children, the level of vitamin D required to ensure that most achieve targeted serum 25(OH)D ≥ 50 nmol/L has not been studied. We aimed to investigate the effect of vitamin D-fortified milk on serum 25(OH)D and parathyroid hormone (PTH) concentrations and to examine the dose-response relationship between vitamin D intake from study milks and serum 25(OH)D concentrations in healthy toddlers aged 12–20 mo living in Dunedin, New Zealand (latitude 46°S). Data from a 20-wk, partially blinded, randomized trial that investigated the effect of providing red meat or fortified toddler milk on the iron, zinc, iodine, and vitamin D status in young New Zealand children (n = 181; mean age 17 mo) were used. Adherence to the intervention was assessed by 7-d weighed diaries at wk 2, 7, 11, 15, and 19. Serum 25(OH)D concentration was measured at baseline and wk 20. Mean vitamin D intake provided by fortified milk was 3.7 μg/d (range, 0–10.4 μg/d). After 20 wk, serum 25(OH)D concentrations but not PTH were significantly different in the milk groups. The prevalence of having a serum 25(OH)D < 50 nmol/L remained relatively unchanged at 43% in the meat group, whereas it significantly decreased to between 11 and 15% in those consuming fortified study milk. In New Zealand, vitamin D intake in young children is minimal. Our findings indicate that habitual consumption of vitamin D-fortified milk providing a mean intake of nearly 4 μg/d was effective in achieving adequate year-round serum 25(OH)D for most children. J. Nutr. 141: 1–7, 2011.

Iodine status improved

% with Urinary Iodine Concentration <50µg/L

	Baseline	20 weeks	P-value
Placebo	42%	50%	NS
Fortified milk	**66%**	**29%**	<0.01

(Skeaff S, personal communication, 2011)

THE NEW ZEALAND MEDICAL JOURNAL
Journal of the New Zealand Medical Association

Rates of common communicable illnesses in non-anaemic 12–24 month old South Island, New Zealand children

Andrea J Cross, Anne-Louise M Heath, Elaine L Ferguson, Andrew R Gray, Ewa A Szymlek-Gay

Abstract

Aims To describe the incidence of parentally reported illness in otherwise healthy South Island toddlers; characterise the predictors of illness; and determine whether there was a relationship between teething and illness in this population.

Methods A 20-week randomised controlled trial was conducted on 1-year-old children (n=225) from Otago and Southland between February 2004 and December 2005. Information on symptoms of morbidity, occurrence of teething, and childcare attendance were recorded daily throughout the intervention period. Morbidity symptoms were categorised into respiratory illness (RI), gastrointestinal illness (GII), ear infection, and total illness, and the number and duration of events were determined.

Results The mean (SD) number of total illnesses was 3.4 (2.3) per 20 weeks, with an average duration of 4.5 days. Episodes of RI were most common (50% of total illness events), and tended to be the longest in duration (mean of 3.7 days). Having siblings aged less than 5 years (23% increase, 95%CI 6%–42%, p=0.007) and attending childcare (72% increase, 95%CI 38%–113%, p<0.001)), were positively associated with the number of total illness events but not duration. In addition, teething was positively associated with total events (OR 1.94, 95%CI 1.45–2.60, p<0.001), RI events (OR 2.03, 95%CI 1.41–2.93, p<0.001) and GII events (OR 1.90, 95%CI 1.36–2.67, p<0.001).

Conclusion This study has shown that illness (particularly RI) is common in the second year of life. It has also confirmed that attending childcare and having siblings aged under 5 years increases the number of illness events. An association between teething and the occurrence of illness was also seen but the exact nature of this relationship requires verification.

Outline

- Micronutrient deficiency
  - The problem
  - What works?
- **Overweight and obesity**
  - **The problem**
  - What we can do about it?
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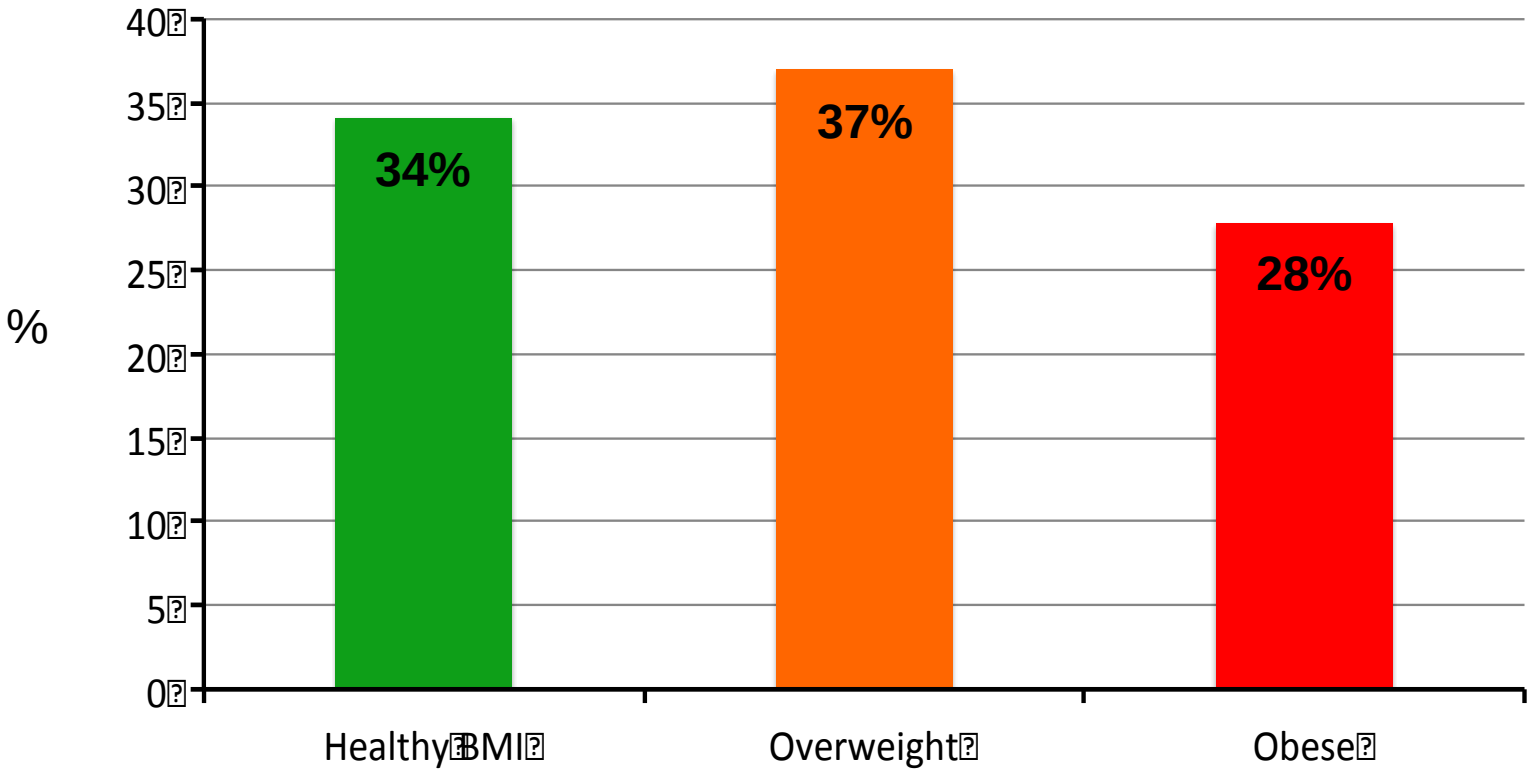
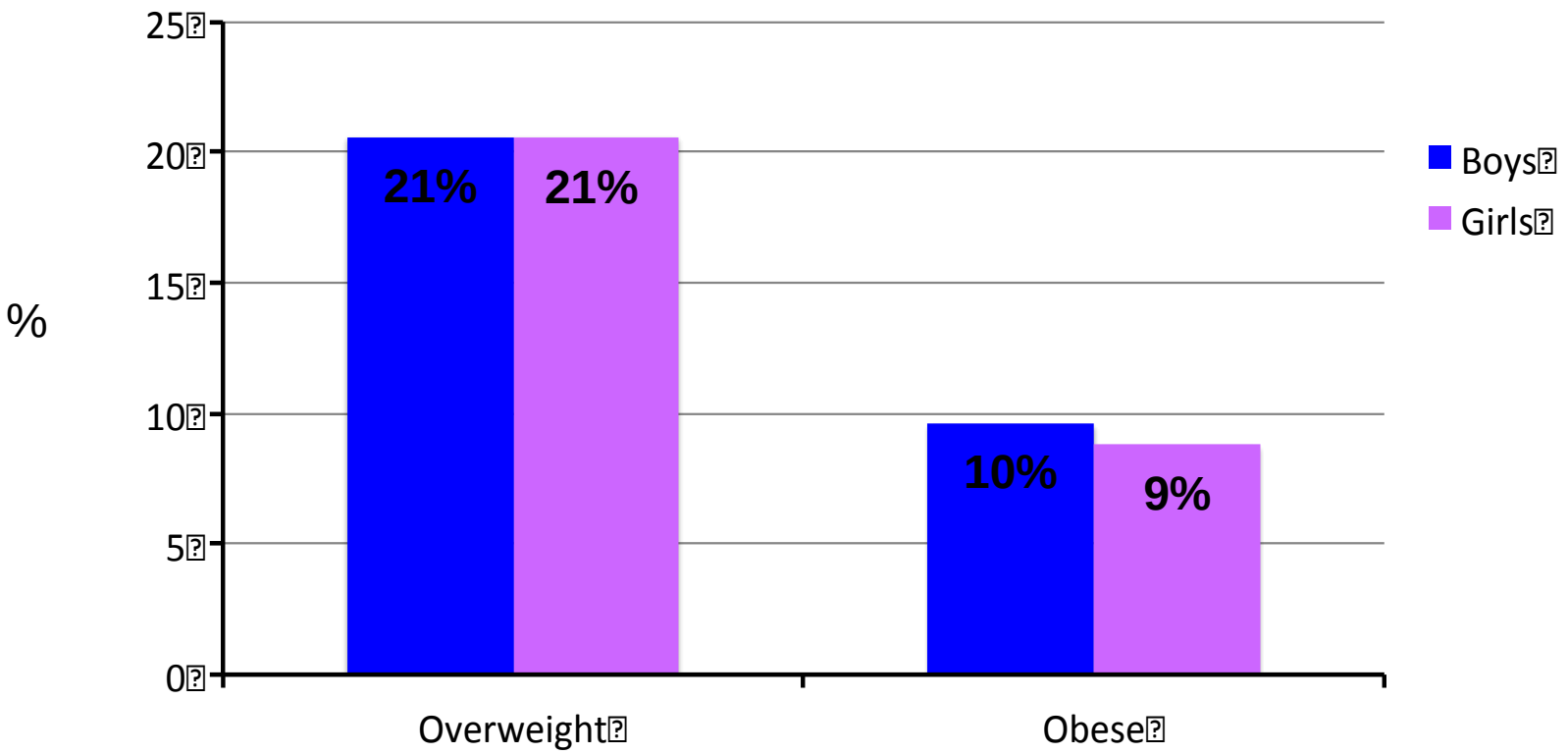
Overweight & obesity - NZ adults



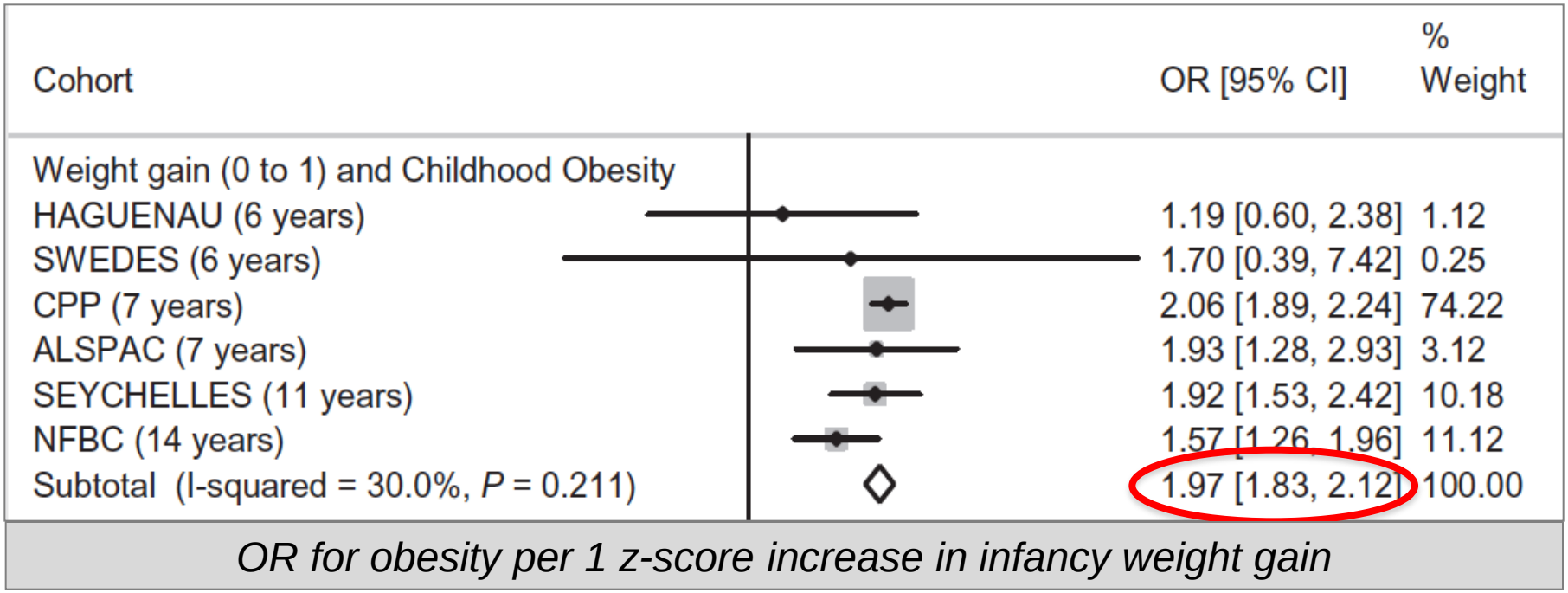
(Univ of Otago, MoH, NZ Adult Nutrition Survey 2008/09)

Overweight & obesity - NZ 2-4 year olds



(MoH 2011/12 NZ Health Survey)

Infant weight gain risk factor for later obesity

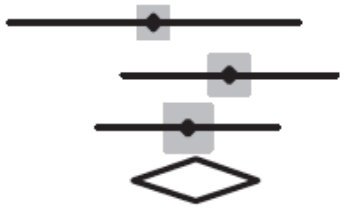


- Individual level meta-analysis using 10 large cohort studies (n > 47,000)

(Druet et al., 2012)

Risk stronger for weight gain 0-2 years

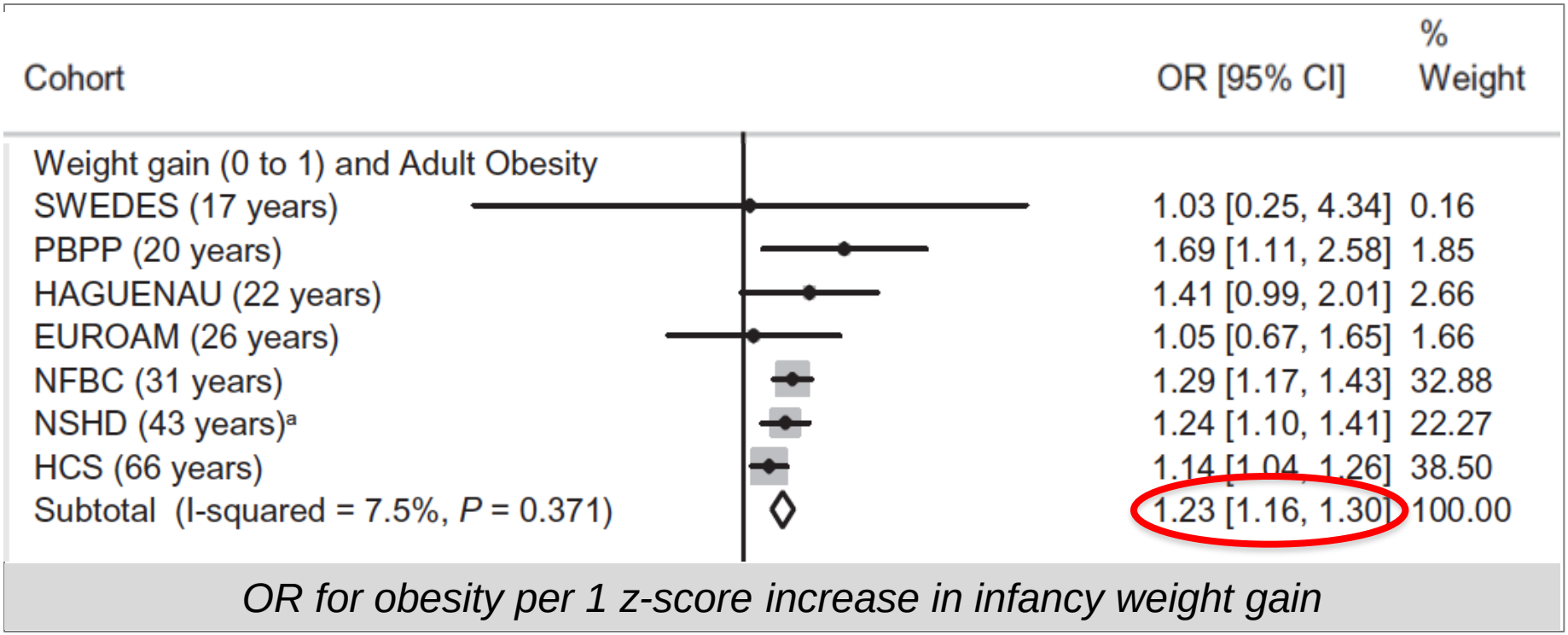
Cohort	OR [95% CI]	% Weight
Weight gain (0 to 2) and Childhood Obesity		
HAGUENAU (6 years)	2.05 [1.10, 3.82]	18.54
ALSPAC (7 years)	2.84 [1.79, 4.51]	33.78
NSHD (7 years)	2.37 [1.61, 3.50]	47.68
Subtotal (I-squared = 0.0%, *P* = 0.691)	2.46 [1.88, 3.21]	100.00



OR for obesity per 1 z-score increase in infancy weight gain

(Druet et al., 2012)

Higher risk into adulthood – although much reduced



OR for obesity per 1 z-score increase in infancy weight gain

(Druet et al., 2012)

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EPOCH – Early Prevention of Obesity in CHildren

- Prospective meta-analysis of early obesity prevention initiatives
- Does early intervention impact on BMI z-score at 18-24 months of age?
- ~1800 infants

(Askie et al., 2010)

Early intervention can make a difference – "Healthy Beginnings" trial

Outcomes at 2 years	Intn – Control (95% CI)	P
BMI – complete cases (n = 483)	-0.38 (-0.68, -0.08)	0.01
BMI – imputation (n = 667)	**-0.29 (-0.55, -0.02)**	**0.04**
Secondary outcomes – yes *vs* no	% difference (95% CI)	
Vegetables ≥ 1 serve/d	**7 (1, 13)**	**0.03**
Fruit ≥ 2 serve/d	-2 (-7, 3)	0.43
Food for reward	**-9 (-17, -1)**	**0.03**
Sweet drinks	-3 (-10, 5)	0.48
Water > 3 cups/d	6 (-1, 13)	0.12
Outdoor play ≥ 2 h/d	1 (-8, 9)	0.90
TV > 60 mins/d	**-8 (15, -1)**	**0.02**

(Wen et al., 2012)

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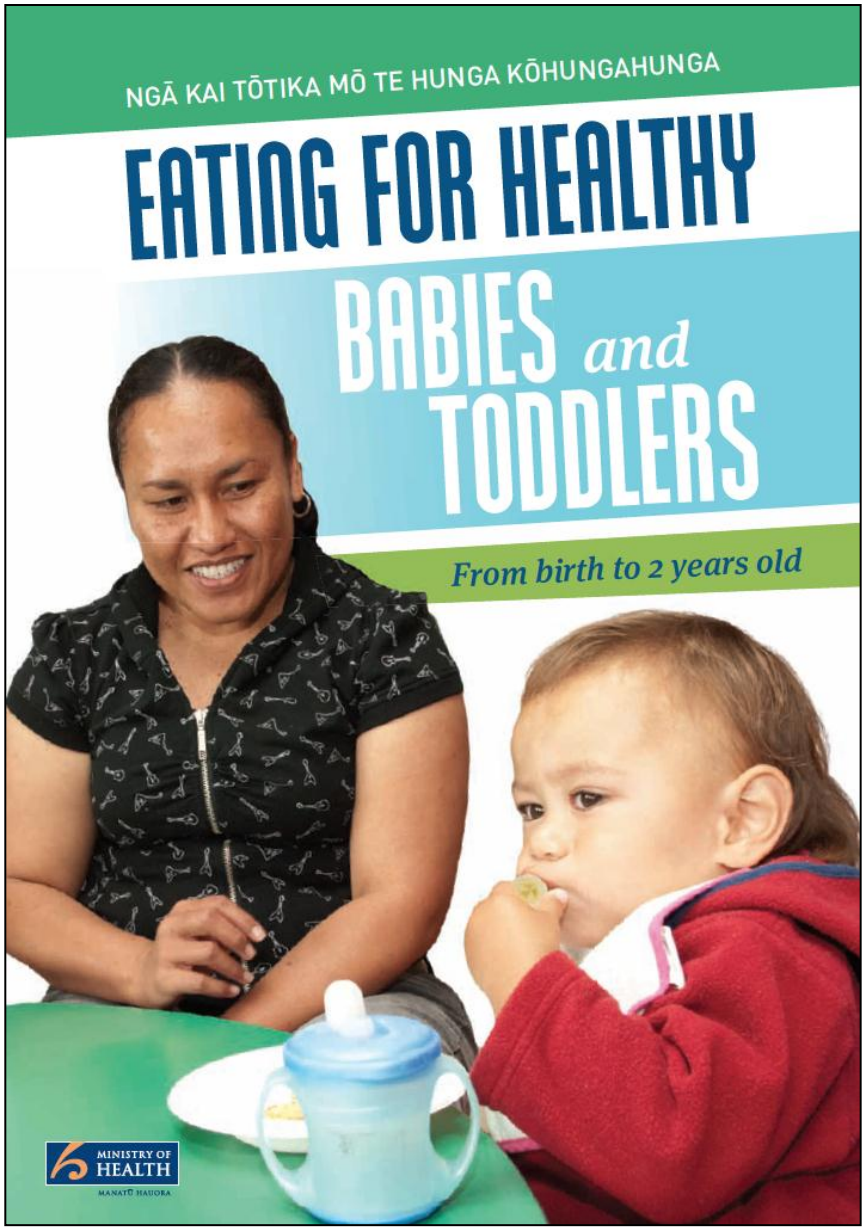
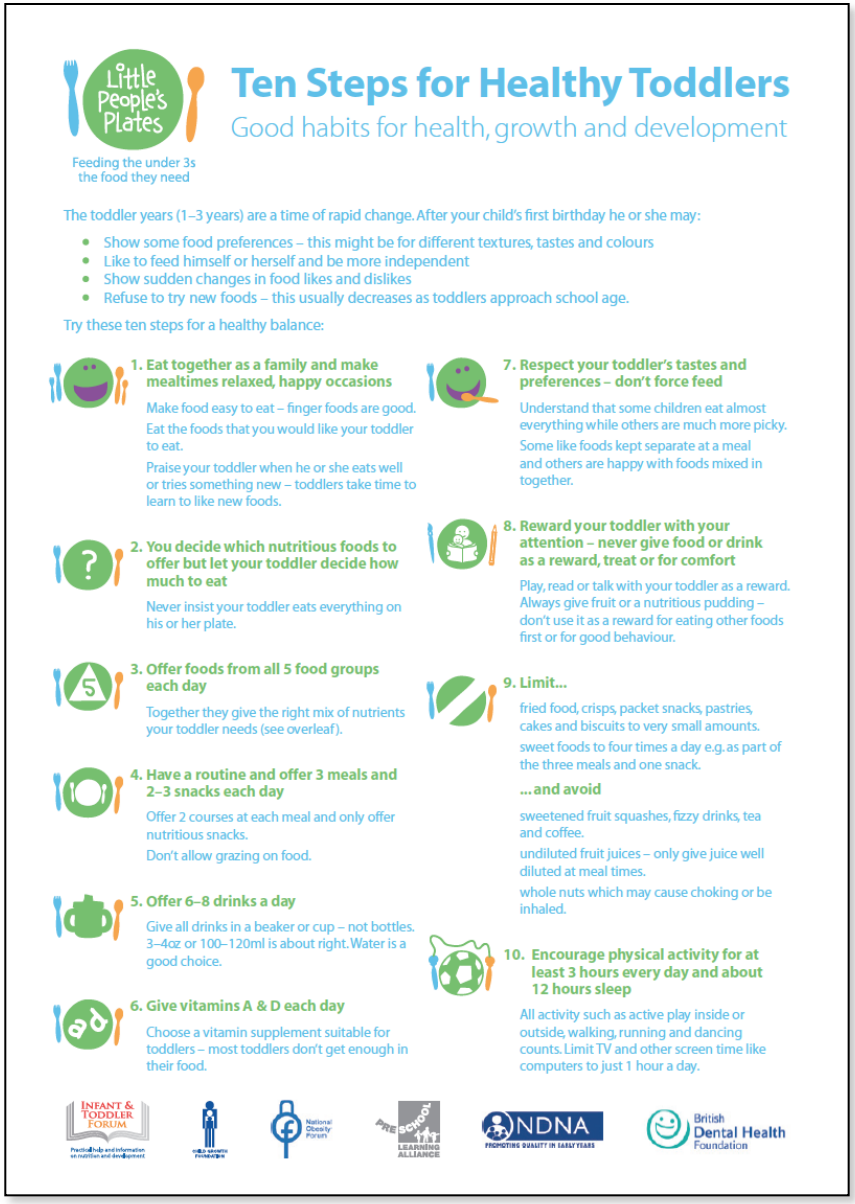
enquiries@beeflambnz.co.nz



www.health.govt.nz

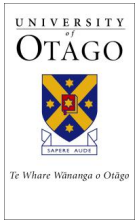


www.infantandtoddlerforum.org

10 steps for healthy NZ toddlers

1. **Eat together as a family** and make mealtimes relaxed, happy occasions
2. "**You provide, they decide**"
3. Offer foods from **all 5 food groups** each day
4. Offer **3 meals and 2-3 nutritious snacks** a day
5. Offer **6-8 drinks a day** (ideally water)
6. *Use **toddler milk** instead of cow's milk*
7. *Offer a **new food ≥10 times** before deciding what your toddler thinks of it*
8. Reward your toddler with **your attention** – never food or drink
9. Limit: **fried foods**, **cakes**, **biscuits** to very small amounts; and **sweet foods** to 4 times a day

   Avoid: **sweetened drinks**, **undiluted fruit juice**, **whole nuts**
10. Encourage physical activity for **≥3 hours every day** and ~12 hours sleep.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