授課講師學經歷

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授課內容摘要

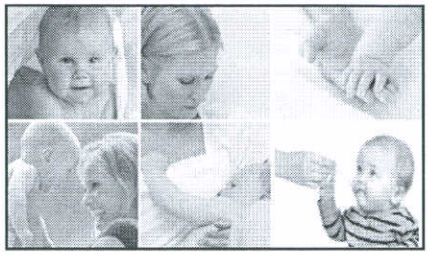
母乳依產後分泌時間分為初乳、過渡乳，及成熟乳，特別是初乳具有許多較高濃度與生長發育有關之調節因子，如乳鐵蛋白、分泌型免疫球蛋白 A (secretary IgA; sIgA)、生長因子，而這些調節因子會隨產後時間增長而減少於母乳中之濃度。母乳中有許多調節因子，如抗微生物因子、抗發炎因子、免疫調節因子，這些調節因子可能會受飲食因素而影響其濃度。

哺乳期間母親的營養狀態會影響母乳品質，進而影響餵補母乳寶寶的營養狀態。研究發現母體攝取的營養素會影響母乳品質與分泌量，母乳中的某些營養素含量，會因母親在飲食中增加攝取而增加，像是如蛋白質、維生素 A、維生素 B 群、維生素 E、錳、碘、鎂等。哺乳期間適當減重婦女，每天平均減少 538 大卡，並不會影響母乳分泌量與品量。但對中度營養不良的哺乳婦女每天增加 500 大卡熱量攝取者較每天僅增加 140 kcal 熱量攝取者明顯增加母乳中 sIgA 含量，對乳鐵蛋白含量則無影響。降低肉類、蛋、乳製品，及高油脂食物攝取量，而增加米飯、蔬菜、豆類，及海草攝取量會降低 2~5 個月產後婦女母乳中總蛋白質含量。

雞精為一種傳統高蛋白補充品，由於其所含蛋白質分子量較小，因此較易被人體吸收。研究發現懷孕後期(37 週)至產後 3 天補充雞精會影響哺乳婦女乳汁蛋白組成。實驗期間，雞精組受試者每天分別於早、中，及晚餐後 30 分鐘內飲用一瓶雞精(70 mL/瓶)，每日 3 瓶。雞精組平均補充雞精為 18 ± 5 天。控制組於研究進行期間，則限制其高蛋白飲食攝取。雞精組初乳中乳鐵蛋白、上皮生長因子、轉形生長因子-β2 含量分別顯著較控制組高 34%、62%，及 196%。綜合上述，補充雞精可提高哺乳婦女乳汁中乳鐵蛋白、上皮生長因子，及轉形生長因子-β2 含量，可能對胎兒改善免疫功能和刺激生長發育有所助益。

嬰兒副食品的添加主要是滿足嬰兒成長發育所需，特別是熱量、鐵質、維生素的需求，世界衛生組織建議 0-6 個月大嬰兒單純只餵哺母乳，6 個月大之後可添加固體食物。最先開始的副食品通常是五穀根莖類與蔬果類，最後才添加的副食品通常是蛋豆魚肉類。

母乳哺餵與哺乳婦健康



趙振瑞 教授
臺北醫學大學保健營養學系

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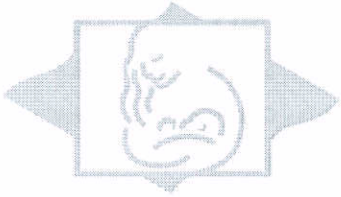
Contents

- Nutrient requirements for infants
- Human milk
- Effects of nutritional factors on milk proteins
- Nutrition for breast-feeding mom



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Nutrient Requirements for Infants

- Energy requirement is determined by size, rate of growth, activity, and energy needed for metabolic activities
- Protein requirement:
  - 50% for growth in the first 2 mo
  - declines to 11% by 2-3 years of age
- Fat provides 40-50% calorie supplies (EFA)
- Carbohydrate: primarily lactose
- Water requirement: adequate human milk or formula

3

Dietary Reference Intakes

Age	Energy (kcal/kg)	Protein (g/kg)	Calcium (mg)
0 mo~	110-120	2.4	200
3 mo~	110-120	2.2	300
6 mo~	100	2.0	400
9 mo~	100	1.7	400

DOH, Taiwan, 2002

4

Water Requirements for Infants

Age	Body weight (kg)	Water (ml/d)	Water (ml/kg/d)
3 days	3.0	250-300	80-100
10 days	3.2	400-500	125-150
3 mo	5.4	750-850	140-160
6 mo	7.3	950-1,100	130-155
9 mo	8.6	1,100-1,250	125-145
12 mo	9.5	1,150-1,300	120-135

Barness, 1987

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Lactogenesis

- colostrum

  6-12 h~2-3 d postpartum
- transitional milk

  1-2 wk postpartum
- mature milk

  > 3 wk postpartum

6

Human Milk Composition

- Immunoglobulins
- lactoferrin
- proline-rich polypeptide
- growth factors
- growth hormone
- leukocytes
- enzymes
- cytokines and lymphokines
- glycoproteins
- carbohydrate, fat, vitamins, and minerals

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Various Milk Compositions

	Protein (g/100 g)	Fat (g/100 g)	Carbohydrate (g/100 g)	Energy (kcal/100 g)
Human	1.1-1.2	3.8-4.5	6.8-7.0	66-73
Cow	3.1-3.9	3.5-4.9	4.6-5.1	62-80
Goat	2.9-3.4	3.5-4.1	4.6-4.7	62-69

Webb *et al.* 1974, Jensen 1995

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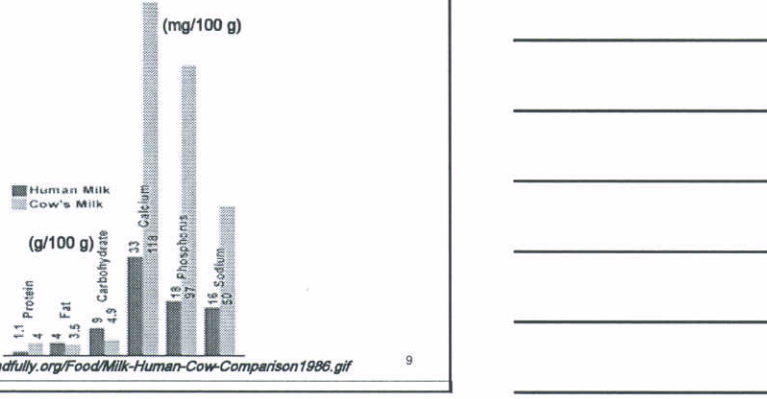
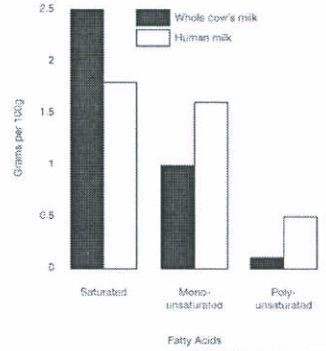
Various Milk Compositions



http://www.mindfully.org/Food/Milk-Human-Cow-Comparison1986.gif

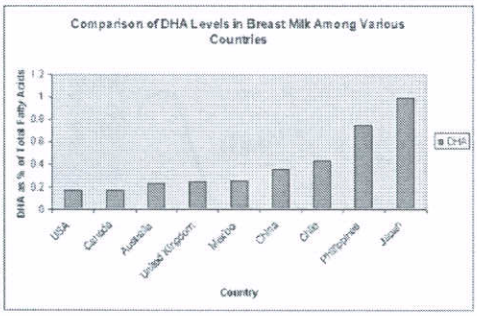
9

Various Milk Compositions in Fatty Acids



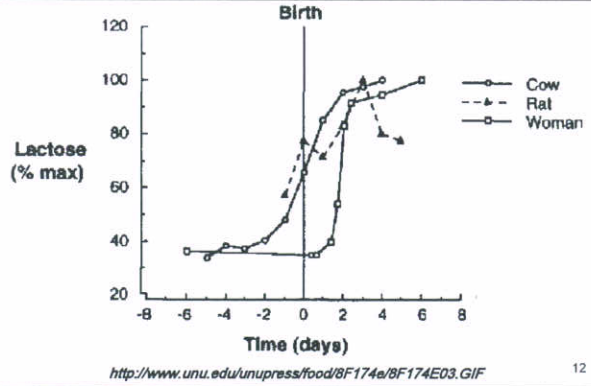
Food Science Association, 2002

Various Milk Compositions in DHA



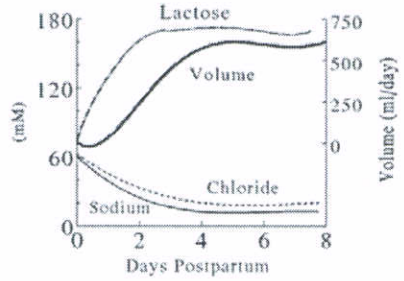
http://dhaomega3.org/images/compare_breast_milk.jpg

Changes in Milk Lactose



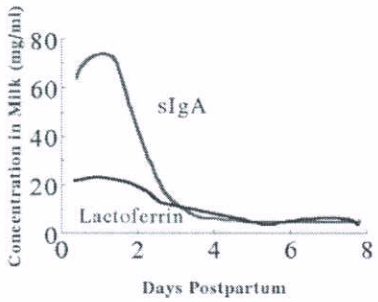
http://www.unu.edu/unupress/food/8F174e/8F174E03.GIF

Changes in Human Milk Compositions



http://mammary.nih.gov/Reviews/lactation/Neville001/index.html#lactogenesis

Changes in Human Milk Compositions

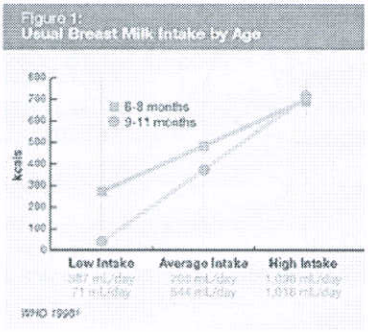


http://mammary.nih.gov/Reviews/lactation/Neville001/index.html#lactogenesis

Growth Factors in Human Milk

- insulin-like growth factor (IGF)-I, -II
- epidermal growth factor (EGF)
- nerve growth factor (NGF)
- transforming growth factors (TGF-α, -β1, -β2)
- platelet-derived growth factor (PDGF)
- hepatocyte growth factor (HGF)
- colony-stimulating growth factor (CSGF)
- vascular endothelial growth factor (VEGF)

Breast Milk Intake for Infants



http://media.gerber.com/nir/fcm2/upload/074FF5FE-6DA9-4E8F-A5C9-DF3A0DD4AB96/107_02-fig1.jpg

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Nutritional Factors Affecting Milk Proteins

Weight loss
2303 kcal → ↓ 538 kcal
↓ 4.8 ± 1.2 kg
In 10 weeks

↓ Milk quantity and quality

Dusdieker *et al.* 1994

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Nutritional Factors Affecting Milk Proteins

Moderately undernourished mother
caloric supplement
500 kcal/d *vs* 140 kcal/d

↑ secretory IgA ↓ lactoferrin

Herias *et al.* 1993

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Nutritional Factors Affecting Milk Proteins

↓ meat, egg,dairy products, food prepared with oil

↑ rice, vegetables, beans, seaweed

↓ total protein at 2-5 mo postpartum

Yoneyama *et al.* 1994

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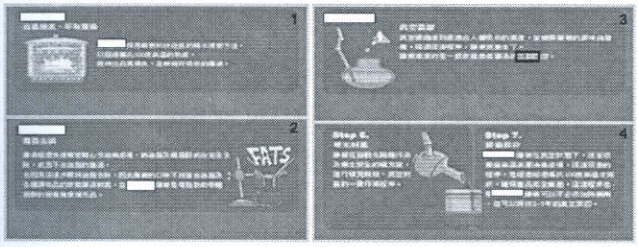
Manufacture of Chicken Extract



http://www.brands.com.tw/cms.www/main.aspx?sid=415

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Chicken Extract Composition

Ingredient	Amount
	weight/70 g (1 bottle)
Protein	5.4 g
Purine	63 mg 中普林
Minerals	
Sodium	63 mg 低鈉
Potassium	155 mg 半根香蕉
Chloride	92 mg
Phosphorus	52 mg
Calcium	2.4 mg

普林：Japan Food Research Laboratories －日本政府授權之實驗室
蛋白質及礦物質：新竹食品工業研究所

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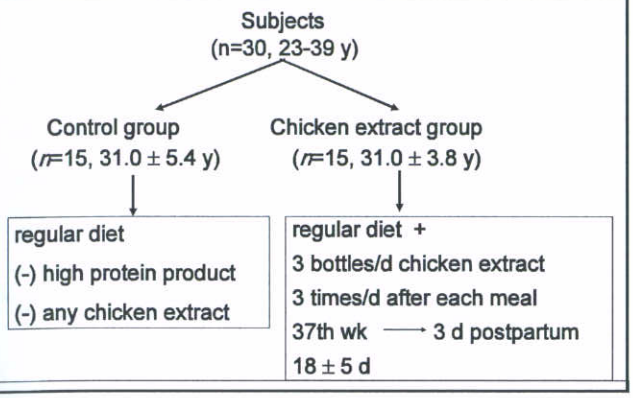
Experimental Designs



Demographic and Clinical Characteristics

	Control	Chicken extract
Gestational weight gain, kg	16.4 ± 5.2	15.8 ± 4.9
Gestational age, weeks	38.9 ± 1.0	38.9 ± 0.9
Parity, n	1.4 ± 0.5	1.1 ± 0.4
Primiparous, n	9 (60.0%)	13 (86.7%)
Infant sex	9M, 6F	6M, 9F
Infant birth length, cm	51.3 ± 2.5	54.4 ± 2.3
Infant birth weight, g	3438 ± 205	3250 ± 397
Infant birth head circumference, cm	33.7 ± 0.9	33.4 ± 1.1

Chao *et al.* 2004 23

Daily Dietary Intake

	Control		Chicken extract			
			Exclude	Include	Exclude	Include
	Pregnancy	Postpartum	Pregnancy		Postpartum	
Energy						
kcal/d	1986 ± 293‡	2081 ± 373	2097 ± 449	2168 ± 449	1923 ± 206#	1994 ± 206
Carbohydrate						
g/d	257 ± 63	257 ± 78	246 ± 77	246 ± 77	228 ± 52	228 ± 52
% energy	51.5 ± 8.1‡	49.0 ± 9.9	46.4 ± 9.0*	44.8 ± 8.8	47.5 ± 9.9	45.8 ± 9.6
Protein						
g/d	82 ± 18‡	101 ± 18‡#	91 ± 20	109 ± 20†	107 ± 30#	125 ± 30†
% energy	16.7 ± 3.4‡	20.1 ± 5.7‡#	17.7 ± 4.3	20.6 ± 4.6†	22.4 ± 6.4#	25.2 ± 6.3
Fat						
g/d	71 ± 16‡	73 ± 25‡	85 ± 24*	85 ± 24	61 ± 17*#	61 ± 17
% energy	32.4 ± 6.8	31.3 ± 7.7	36.3 ± 7.0†	35.0 ± 6.8	28.3 ± 7.1#	27.3 ± 6.8

* *vs* control, † *vs* exclude, ‡ *vs* include, # *vs* pregnancy ($P<0.05$)

Chao *et al.* 2004 24

Milk Protein Concentrations

	Control	Chicken extract	
Total protein, g/L	64.9 ± 26.1	75.6 ± 47.5	
Lactoferrin, g/L	7.3 ± 3.0	9.8 ± 3.5*	↑ 34%
Epidermal growth factor, μg/L	146.8 ± 73.5	237.6 ± 144.6*	↑ 62%
Transforming growth factor-β2, μg/L	7.8 ± 5.8	23.1 ± 17.4*	↑ 196%
Secretory immunoglobulin A, g/L	4.1 ± 1.3	4.8 ± 1.5	

**vs* control ($P<0.05$)

Chao *et al.* 2004

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Effects of Chicken Extract on Human Milk

Protein compositions of human milk can be altered by diet. Supplementation with chicken extract increases colostrum levels of lactoferrin, EGF, and TGF-β2, which are important for the growth and immune functions of the infants, in lactating women.

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Benefits of Breastfeeding

babies	moms
• balance of nutrients with high bioavailability • good hormones • cognitive development • less infections • less diseases • less food allergies	• contracts the uterus • delays menstruation • conserves iron stores • may protect against breast cancer • convenient • bonding time with baby

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Protective effect of breastfeeding on infant morbidity

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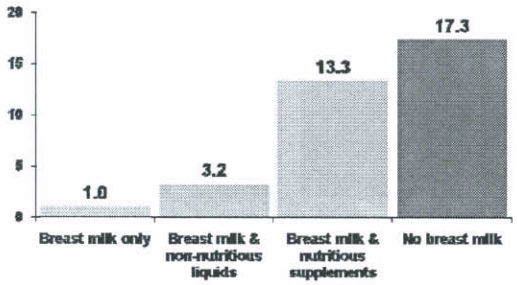
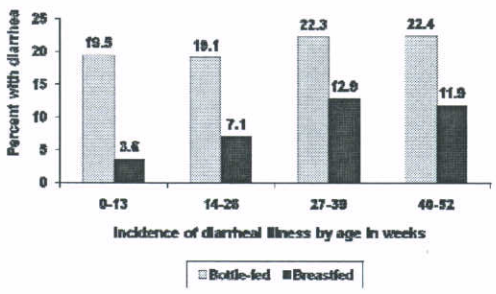
Risk of diarrhea by feeding method for infants aged 0-2 months, Philippines



Adapted from: Popkin BM, Adair L, Akin JS, Black R, et al. Breastfeeding and diarrheal morbidity. *Pediatrics* 1990;86:874-882.

Slide 2.29

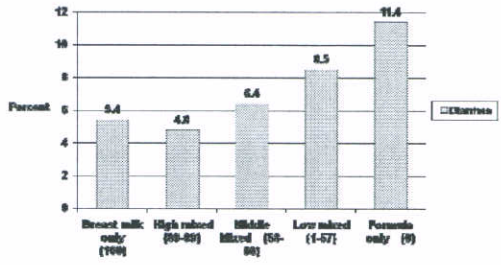
Percentage of babies bottle-fed and breastfed for the first 13 weeks that had diarrheal illness at various weeks of age during the first year, Scotland



Adapted from: Howie PW, Forsyth JS, Ogston SA, Clark A, Florey CV. Protective effect of breastfeeding against infection. *Br Med J* 1990;300:11-15.

Slide 2.30

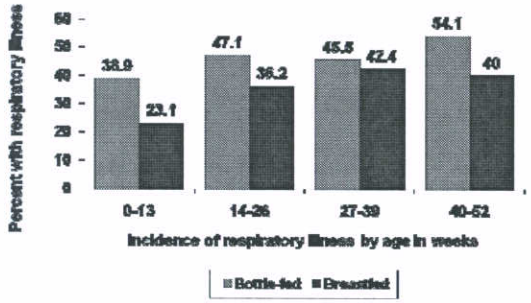
Percentage of infants 2-7 months of age reported as experiencing diarrhea, by feeding category in the preceding month in the U.S.



Adapted from: Scariati PD, Grummer-Strawn LM, Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. *Pediatrics*,1997;99:E5.

Slide 2.31

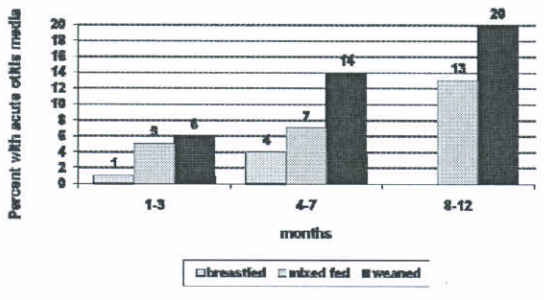
Percentage of babies bottle-fed and breastfed for the first 13 weeks that had respiratory illness at various weeks of age during the first year, Scotland



Adapted from: Howie PW, Forsyth JS, Ogston SA, Clark A, Florey CV. Protective effect of breastfeeding against infection. *Br Med J* 1990;300:11-15.

Slide 2.32

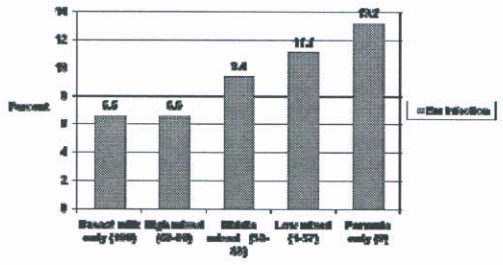
Frequency of acute otitis media in relation to feeding pattern and age, Sweden



Adapted from: Aniansson G, Alm B, Andersson B, Hakansson A et al. A prospective coherent study on breast-feeding and otitis media in Swedish infants. *Pediat Infect Dis J 1994*;13:183-188.

Slide 2.33

Percentage of infants 2-7 months of age reported as experiencing ear infections, by feeding category in the preceding month in the U.S.



Adapted from: Scariati PD, Grummer-Strawn LM, Fein SB. A longitudinal analysis of infant morbidity and the extent of breastfeeding in the United States. *Pediatrics* 1997;99:E5.

Slide 2.34

Nutrition in Pregnancy & Lactation

Good maternal nutrition is vital for the health and reproductive performance of women and the health, survival, and development of their children.

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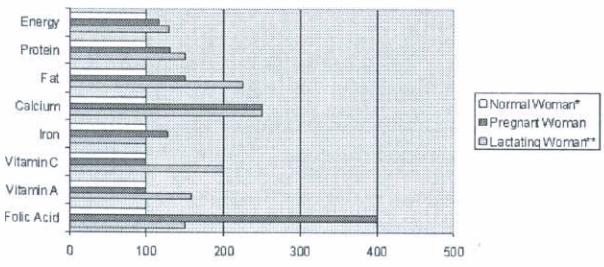
Nutritional Requirement for Normal, Pregnant, and Lactating Women



http://www.horlicksnutritionacademy.com/women_nutrition/images/nutrition_during_pregnancy_lactation_chart.gif 36

Nutritional Requirements During Lactation

- Breastfeeding is an anabolic state, resulting in increased energy and nutrient needs:
  - 500 kcal/day (birth to 6 mo)
  - 400 kcal/day (7 - 9 mo)
- Protein requirements for breastfeeding mothers, about 65 g daily (birth to 6 mo), 62 g thereafter
- Calcium requirements for breastfeeding mothers, at least 1200 mg per day
- Iron requirements for breastfeeding mothers, about 15 mg daily
- Adequate liquid: 2~3 L/day (water, milk, soy milk)
- Chronically low maternal iron, vitamin B, C, D, thiamin, and folate intake leads to low content in breast milk

Omega-3 Fatty Acids

- compose 60% of dry weight of fetal brain
  half is omega-6, and half is omega-3
- DHA important for growth and development of fetal central nervous system and the retina. Prenatal diet should include adequate amounts of preformed DHA
- DRIs specify 1.4 g/day during pregnancy and 1.3 g/day during lactation
- Main food source of DHA – fatty cold water fish and 2-3 meals fish/wk during pregnancy and lactation

國人膳食營養素參考攝取量
(Dietary Reference Intakes，DRIs)

營養素	身高	體重	熱量(2)(3)	蛋白質(4)	鈣	磷	鐵	碘	維生素B_2	維生素B_6	維生素B_{12}	菸鹼素(9)	葉酸	泛酸	生物素	維生素
年齡(1)	(cm)	(kg)	(kcal)	(g)	(mg)	(mg)	(mg)	(μg)	(mg)	(mg)	(μg)	(mg NE)	(μg)	(mg)	(μg)	(mg)
懷孕 第一期			+0	+0	+0	+0	+35	+60	+0	+0.4	+0.2	+0	+200	+1.0	+0	+20
第二期			+300	+10	+0	+0	+35	+60	+0.2	+0.4	+0.2	+2	+200	+1.0	+0	+20
第三期			+300	+10	+0	+0	+35	+60	+0.2	+0.4	+0.2	+2	+200	+1.0	+0	+20
哺乳期			+500	+15	+0	+0	+0	+110	+0.4	+0.4	+0.4	+4	+100	+2.0	+5.0	+140

*未標明AI(足夠攝取量Adequate Intakes)值者，即為RDA(建議量Recommended Dietary allowance)值

(註)

(1)年齡係以足歲計算。

(2)1大卡(Cal；kcal)=4.184萬萬焦耳(kj)；油脂熱量以不超過總熱量的30%為宜。

(3)「低、稍低、適度、高」表示工作勞動量之程度

(4)動物性蛋白在總蛋白質中的比例，1歲以下的嬰兒以佔2/3以上為宜

(5)日常國人膳食中之鐵質攝取量，不足以預補婦女懷孕，分娩失血及泌乳時之損失，建議自懷孕第三期至分娩後兩個月內每日另以鐵整供給30毫克之鐵質

(6)R.E.(Retinol Equivalent)即視網醇當量，1μg R.E.=1μg 視網醇(Retinol)=6μg β-胡蘿蔔素(β-Carotene)

(7)維生素D係以維生素D_3(Cholecalciferol)為計量標準，1μg=40 I.U.維生素D_3

(8)α-T.E.(α-Tocopherol Equivalent)即α-生育醇當量，1mg α-T.E.=1mg α-Tocopherol

(9)N.E.(Niacin Equivalent)即菸鹼素當量，菸鹼素包括菸鹼酸及菸鹼醯胺，以菸鹼素當量表示之

資料來源：行政院衛生署

哺乳婦飲食指南

- 五穀根莖類 4 - 6碗
- 奶類 2 - 3杯 (可以低脂奶代替，可降低熱量攝取)
- 蛋豆魚肉類 4 - 5份
- 蔬菜類 3 – 4份
- 水果類 3份
- 油脂類 3份

哺乳婦食譜舉例

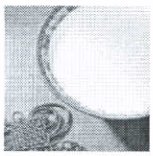
餐次	食物類別	份量(份)	食譜
早餐	五穀根莖類	1 / 2	饅頭 1/2個
	奶類	1	牛奶 1 杯
	蛋豆魚肉類	1	荷包蛋 1 個
	水果類	1	蕃石榴 1個
早點	五穀根莖類	1 / 2	米粉 1 碗
	蛋豆魚肉類	1	牛肉 1 兩
	蔬菜類	1 / 3	青菜 1 兩
午餐	五穀根莖類	1/2 - 2 1/2	飯 1/2 - 2碗
	蛋豆魚肉類	1	魚1 兩
	蔬菜類	1 / 3	洋蔥 胡蘿蔔 1 兩
		1	炒菠菜 3兩
	水果類	1	西瓜 1 片
午點	五穀根莖類	1 / 2	綠豆湯 1 碗
晚餐	五穀根莖類	1/2 - 2 1/2	飯 1/2 - 2 1/2碗
	蛋豆魚肉類	1	紅燒雞塊 雞 1 兩
		1 - 2	蝦仁 1 - 2兩
	蔬菜類	1 / 3	青豆 1兩
		1 - 2	胡蘿蔔 白蘿蔔 筍 小黃瓜 豌豆莢 洋菇
	水果類	1	柳丁 1個
晚點	五穀根莖類	1 / 2	麥片 2湯匙
	奶類	1	牛奶 1 杯

哺乳期中醫食療

- 產後乳汁少或全無乳汁者，中醫稱為「缺乳」、「產後乳少」
- 婦女產後乳少，常見的有兩種情況，一是體質虛弱氣血不足，或產時失血過多氣血虧虛所致；一是情志抑鬱使氣血不通暢所致
- 飲食宜增加營養，尤其富含蛋白質食物及新鮮蔬菜，充足湯水，要注意脾胃功能，少食肥甘厚味，以免妨礙脾胃，造成氣血不足而缺乳

海帶豆漿佛手湯

- 材料：豆漿500 mL、海帶100 g、佛手10 g
- 作法：以上材料加在一起煮湯
- 營養成分：熱量340 kcal、蛋白質14 g、脂肪8 g、醣類53 g、鈣142 mg、鐵2.2 mg
- 功效：健脾通乳

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豬蹄通草湯

- 材料：豬蹄2支（約1000 g）、通草5 g、蔥薑少許
- 作法：豬蹄洗淨，豬蹄膀需先燒炙去毛洗淨，先主燙去血水雜質。將藥物置入燉鍋，在放入蹄膀，以酒水各半燉煮至豬蹄熟軟。加水適量，加通草，入砂鍋加蔥薑少許，文火清燉至熟爛，加少許鹽調味
- 營養成分：熱量3310 kcal、蛋白質171 g、脂肪286 g、膽固醇940 mg、鈣50 mg、鐵10 mg
- 功效：產後氣血虛的乳少補益食療


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通乳四物湯

- 材料：生地20 g、當歸12 g、酒白芍6 g、川芎4 g、木通6 g、王不留行12 g、天花粉12 g、豬蹄膀一隻（500 g）
- 作法：豬蹄洗淨，豬蹄膀需先燒炙去毛洗淨，先主燙去血水雜質。將藥物置入燉鍋，在放入蹄膀，以酒水各半燉煮至豬蹄熟軟
- 營養成分：熱量1650 kcal、蛋白質85 g、脂肪143 g、膽固醇470 mg、鈣25 mg、鐵5 mg
- 功效：養血清熱，宣絡通乳。宜於血虛兼熱者

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陳砂豬蹄湯

- 材料：陳皮12克、砂仁8克、豬蹄膀一隻(500克)
- 作法：將藥材與豬蹄同燉煮即可
- 營養成分：熱量1650 kcal、蛋白質85 g、脂肪143 g、膽固醇470 mg、鈣25 mg、鐵5 mg
- 功效：理氣，養陰，生乳