

Recommendations on Milk Intake for Young Children Information for Health Professionals

I. Background

Young children rely on a balanced diet to meet their nutritional needs for optimal growth and development as well as physical activities. While milk is rich in protein, calcium and other nutrients, it constitutes only part of a balanced diet. In 2010, a Dietary Survey of Hong Kong Infants & Young Children was conducted by the Department of Health (DH) and the Department of Medicine and Therapeutics and the Centre for Nutritional Studies of the Chinese University of Hong Kong. Preliminary findings revealed a prevalence of unbalanced dietary patterns with excessive milk consumption among a significant proportion of young children. The majority of the surveyed children relied on formula milk (FM) to obtain the major nutrients to meet their daily requirement. Besides, most of the two-year-olds and half of the four-year-olds surveyed still used the bottle to drink milk.

In view of the above, the DH has compiled a fact sheet for parents, putting forth recommendations on milk intake for young children. This document sets out all the considerations for making these recommendations, for the reference of health professionals.

II. Optimal Infant and Young Child Feeding

1. Breastfeeding (0-6 months)

- ◆ In the first 6 months, infants rely on a milk-based diet, and should preferably be exclusively breastfed. When breastfeeding is not opted for, infant formula is the only alternative for feeding babies below six months of age.

2. Transitional Feeding (6-24 months)

- ◆ From 6 months to 2 years, children enter the stage of transitional feeding and progress from a milk-only diet towards a balanced diet of variety and quality.
- ◆ It is an important stage for children to form good dietary habits through learning to enjoy a variety of foods of different textures, developing their skills in self-feeding and following the family meal routines. Good transitional feeding practices help reduce subsequent picky eating and feeding problems.
- ◆ Complementary foods should first be introduced at around 6 months of age. Offering children a wide range of foods in different combinations of colours, tastes and age-appropriate textures stimulates their appetite and promotes food acceptance. Children will progress to eating a balanced diet, and obtaining sufficient energy and optimal nutrients from the 5 major food groups, namely grains; vegetables; fruits; meat along with fish, eggs & legumes; and milk & milk products.
- ◆ In the initial period of transitional feeding, milk remains the main source of energy and nutrients. As children develop their feeding skills (e.g. oro-motor and chewing ability) and consume a

substantial amount and a variety of complementary foods, milk intake can gradually decrease.

- ◆ Breastfeeding should continue for optimal growth and development. The World Health Organization (WHO) recommends breastfeeding to be continued until 2 years of age or beyond¹. Mothers can breastfeed their child according to his/her needs.

2. *Eating family meals (2-5 years)*

- ◆ Children of 2 to 5 years should be having regular meals with the family and eating a balance diet. Eating with the family facilitates the following of family routines, social interaction and role-modelling of good eating behaviours by parents.

III. Recommendations on Milk Intake for Children 1-5 years

A. Recommended Volume of Milk

- ✧ *Milk constitutes only part of a balanced diet. A diet consisting of a daily intake of 360 – 480 ml of milk largely satisfies the calcium requirement of children of this age group.*
- ✧ *Children eating a diet consisting of ample green leafy vegetables, tofu made by traditional methodsⁱ or other calcium-rich foods will need less than this amount of milk.*
- ✧ *For children over 2 years who consume an adequate amount of calcium-rich foods (including fortified soy milk), milk may be not necessary.*
- ✧ *To enable children to eat a balanced diet of variety and quality, excessive milk intake (more than 480 ml/day) should be avoided as it displaces a child's appetite for other nutritious foods.*

Considerations:

a. Meeting the calcium requirement of young children

- ◆ Hong Kong does not have its own population-specific Dietary Reference Values (DRV) to inform the nutrient requirements of local children.
- ◆ Milk is often regarded as a convenient and good source of calcium. Health Authorities of various countries recommending milk intake for young children mainly consider milk as the major source of calcium in meeting the recommended calcium requirements. The recommended milk intakes range from 300 to 750 ml per day. (Table 1)
 - ✧ In UK, the Department of Health recommends that children above 1 year old consume up to 360 ml of milk per day², which largely fulfill the calcium requirement of UK children (e.g. 350 mg / day for 1 to 3-year-old children³).
 - ✧ In countries such as USA and Canada with higher recommended calcium intake (e.g. 700 mg / day for 1 to 3-year-olds, 1000 mg/day for 4 to 8-year-olds⁴), about 2 cups of milk a day (up to 480 ml) are recommended⁵.

ⁱ Calcium salts are used as the coagulants in making tofu in the traditional methods. However, some prepackaged tofu are prepared by other coagulants, thus the calcium content is low.

- ✧ The Adequate Intake (AI) for calcium set by the Chinese Nutrition Society is 600 mg and 800 mg for 1 – 3 years and 4 – 6 years respectively. The recommendation is not less than 350 ml/day for 1 – 2 years, and 300 – 600 ml /day for 3 – 6 years.^{6 7}
 - ✧ The Department of Health of Taiwan recommended a daily calcium intake of 500 mg and 600mg for 1 – 3 years and 4 – 6 years respectively⁸. Intake of 1.5 cups (240 ml / cup) of milk a day for children aged 1 – 6 years is recommended.⁹
 - ◆ Traditional Chinese diet is non-milk based but consists of a variety of foods that are rich in calcium¹⁰, such as green leafy vegetables, Tofu, and "dry shrimps". (Table 2).
 - ✧ Local green leafy vegetables have high calcium contents. Chinese Cabbage Flowering Leaf (Choy Sum, 菜心), Chinese Mustard Green (芥菜), Broccoli, Bok Choy petiole (小白菜) and Kale (芥蘭) are good sources of calcium. The calcium availability of these vegetables is comparable or even higher than that of milk.¹¹ Considering the calcium content and its bioavailability, 85 g of Chinese Cabbage Flowering Leaves, or 94 g Chinese Mustard Green is equal to 1 cup (240 ml) of milk. For vegetables with high oxalate content (e.g. Spinach), the bioavailability of calcium is poor.¹²
 - ◆ Chinese children and adolescents have been shown to have higher fractional calcium absorption when compared with the Caucasians.^{13,14,15} Thus, the reference calcium intake for Asians is likely to be unique and different from those of the Caucasians.¹⁶
 - ◆ The Dietary Survey of Hong Kong Infants & Young Children (DH) in 2010 showed that calcium intake of children having a milk intake within this recommended range was adequate (report in preparation). Among children who drank 360 – 480 ml per day in the 18-, 24- and 48-month-old groups (n=220), 83.2% had calcium intake at or above the RNIⁱⁱ set by WHO³⁰. The prevalence of inadequate calcium intake as defined by the proportion of children having intake below the estimated average daily requirement of 440mg/day³⁰ was also low, i.e. 5.0%.
- b. Milk also provides energy and other nutrients*
- ◆ As children adapt to a diet of variety, the proportion of calorie and other nutrients contributed by milk consumption should reduce.^{17 18}
 - ◆ The energy content of whole cow milk is about 0.61 Kcal/ml while formula milk is generally more energy-dense. The energy contents of locally available brands of FM range from 0.64 to 1 Kcal/ml (Table 3). Compared with cow milk, the same volume of FM contributes to a higher proportion of energy requirement of a child (Table 4).
 - ◆ Excessive milk (especially FM) intake tends to displace children's appetite for main meals.
 - ◆ Except for the younger age group (e.g. < 2 years) who may need a significant proportion of their diet in the form of energy-dense fluid, replacing milk by green leafy vegetables has the added benefits of a reduced energy and protein intake, which helps to tackle the emerging problem of childhood obesity.

ⁱⁱ WHO/FAO RNI of Calcium: 1 -3 years old children is 500mg /day, 4-6 years old children is 600mg /day.

B. Choice of milk

- ✧ *Breastfeeding should be continued for optimal growth and development. Children over 1 year who are not breastfed may take cow milk (such as chilled pasteurized cow milk or UHT milk) or formula milk.*
- ✧ *For the choice of cow milk, children under two years should take whole milk (i.e. full-fat milk, 3.25% or 3.5%). Children between 2 and 5 years can take low-fat (1-2%) milk and those above 5 years can take skimmed milk (0.5%).*
- ✧ *Children should have an adequate intake of iron-rich foods to prevent iron deficiency, especially during the period of transitional feeding. Iron fortified formula milk can be used in place of cow milk for those who may have inadequate intake of iron-rich foods.*

Considerations

- ◆ Cow milk generally provides about 110mg calcium/100 ml. An intake of 360 – 480 ml of cow milk per day provides a significant amount of calcium to meet the requirement of children 1-5 years. The calcium concentration of formula milk marketed locally for children above 1 year varies between 64 and 115 mg/100ml (Table 4). Taking the example of a FM with the lowest calcium content, 480 ml alone provides more than 60% of the calcium required per day. The rest can be met by eating other foods in the diet (e.g. vegetables and other staple foods; the sample menus in Table 6 provides around 190 mg Calcium)
- ◆ During the transition from milk feeding to eating family meals, iron deficiency is a common problem. Iron deficiency with or without anaemia during infancy and childhood may have long term adverse effects on neurodevelopment¹⁹. From 6 months onwards, infants should consume a variety of iron-rich foods, such as iron fortified cereals, meat and liver, fish, eggs, legumes, and green leafy vegetables. Cow milk is low in iron. Iron-fortified formula milk provides an additional source of iron for children not taking adequate iron-rich foods.
- ◆ One should also take the caloric content into consideration when choosing between cow milk and formula milk. Formula milk is more energy & nutrient-dense than cow milk, with a higher sugar level (Table 3 & 4). Thus, when compared to cow milk, formula milk may not only displace more of children's appetite for other foods with the same quantity consumed, but also increase their risk of becoming overweight or obese and developing dental caries. Moreover, children may get accustomed to the sweet taste of formula milk and refuse to drink water and eat foods with bland taste.

Choice of cow milk

- ◆ Children (above one year) can take cow milk (such as chilled pasteurized cow milk or UHT milk) if they are having a diet with adequate iron-rich foods. There are three types of cow milk according to fat content.
 - ✧ Children under two years should take whole milk (i.e. full-fat milk, 3.25% or 3.5%). With their small gastric capacity, they would require a nutrient and energy-dense diet with fat constituting 30 to 40% of energy. There should be no restriction on the amount of fat

intake for the group.

- ✧ Children between 2 and 5 years can take low-fat (1-2%) milk if they have a good intake of solid foods. Otherwise, they can take whole milk.
- ✧ Children above 5 years can take skimmed milk (<1.0%) as excessive energy and fat intake would increase the risk of later obesity and cardiovascular diseases (similar to adult recommendation).

Choice of formula milk

- ◆ Follow-on formulas are marketed for older infants (6m or above) and young children. With more knowledge about the contents and benefits of breastmilk, manufacturers start to add specific nutrients such as DHA, prebiotics, probiotics, etc. into formula milk to mimic the composition of breastmilk. However, as these additives are either synthetic or extracted from cow milk or other non-human sources, they are often structurally different from their breastmilk counterparts. There are considerable differences in bioavailability and metabolic effects between many nutrients found in breastmilk and those added to FM. Therefore, the additives in FM are unlikely to produce the same beneficial effects as breastmilk.
- ◆ In fact, these nutrients are readily available from natural food sources. Providing a balanced diet of a variety of foods from the 5 major food groups in appropriate proportions will supply optimal nutrition for children. Parents should not rely on formula milk to provide the various dietary nutrients. Refer to Table 5 for foods that naturally contain these nutrient additives.
- ◆ It should also be noted that nutrients taken in isolation (e.g. as a supplement) do not produce the same health effect as those taken as constituents of a food, as the interrelation and balance between constituents in foods are important. Thus consumption of whole foods is superior over isolated constituents from the nutrition perspective.²⁰

C. Transition from bottle feeding to drinking from a cup

- ✧ Children should be assisted to use a cup to drink from 7 to 9 months onwards
- ✧ They should stop using the bottle by 18 months of age

Considerations

- ◆ Children using bottles are likely to consume more milk than those not using bottles, resulting in overfeeding²¹. Besides, children will have a higher chance of developing dental caries especially if they use to fall asleep with a bottle.

IV. Implications for clinical practice:

- ◆ It should be noted that successful transition to a family diet depends on the child's development of oromotor skills (biological factors), ample opportunities to experience family foods and the quality of meal time interactions (psycho-social factor).
- ◆ When encountering children with difficulty in transitioning to a family diet, health care professionals should assess the child's growth and development, the parent (caregiver)-child

interaction and the diet consumed. An appropriate management plan, taking into consideration the above factors, should be formulated. Parents should be guided to improve the child's food acceptance, through the provision of a mealtime routine and conducive eating environment, facilitation of self-feeding and exposing the child to a variety of foods of good quality and the right texture.

- ◆ Dispensing fortified (or "Picky Eating") formula milk may ensure nutrient intake for the short term, but does not help the child to acquire the appropriate eating skills and establish a healthy eating habit in the long run. A sample menu is shown in Table 6 which meets the major nutrient requirements for 1-5 year old.

V. Strengths and Limitations

- ◆ This recommendation considers children's diet in totality (a balanced diet containing the recommended volume of 360 to 480 ml of milk per day) in meeting their nutritional requirement for health. While this volume of milk intake provides a significant proportion of the daily calcium requirement and a considerable amount of other nutrients and energy, is less likely to displace the children's appetite for main meals. The recommended milk intake is well within the national & international recommended range of intake.
- ◆ In the absence of local DRVs, the recommendation of daily milk intake of 360 – 480 ml for Hong Kong children 1 to 5 years was made with reference to national and international recommendations and taking into consideration the calcium requirement of young children, milk as a convenient and good source of calcium and other nutrients, the quality of traditional Chinese diet with ample supply of non-dairy calcium-rich foods, evidences of possible higher fractional absorption of calcium in Chinese (vs Caucasians) and the appropriate proportion of energy contributed by milk as part of a balanced diet.
- ◆ There is evidence from the Dietary Survey (DH, 2010) that the total calcium intake of children drinking this volume of milk was adequate.
- ◆ This is a practical guide, which gives flexibility and choices for parents of children with different needs, e.g. children who do not tolerate or dislike milk.
- ◆ The above recommendations will be subject to revision in future with better understanding of nutrient requirements and the changing dietary patterns of our young child population.

1 Feb 2012

Family Health Service, Department of Health

Table 1: Recommended calcium requirement[#] and milk intake in food-based dietary guidelines of Countries

	1 – 3 years		4 – 6 or 7 years	
	Calcium Requirement (mg / day)	Recommended Milk Intake	Calcium Requirement (mg / day)	Recommended Milk Intake
UK	350	Not less than 360 ml	450	Not specified
Australia	500 ²²	Not more than 600 ml ²³ (in consideration of iron intake)	700 ²³	480 ml ²⁴
New Zealand	500 ²³	Not more than 500ml ²⁵	700 ²³	500 ml (under 5y) ²⁶
USA	700 ⁴	2 cups ⁵	1000 ⁴	2 cups ⁵
China	600 ⁶	Not less than 350 ml (for 1-2 yrs) ⁷	800 ⁶	300-600 ml (for 3-6 yrs) ⁷
Taiwan	500 ⁸	1.5 cups ⁹ (240ml/cup)	600 ⁸	1.5 cups ⁹ (240ml/cup)
Singapore	500 ²⁷	750ml ²⁸	600 ²⁸	500ml ²⁹
WHO /FAO	500 ²⁹	Not specified	600 ³⁰	Not specified

[#]All are RNI, RDI, or RDA values except that China which is a level of Adequate Intake.

Table 2: Calcium Content of Selected Local Foods

食物名稱	Equivalent Portion to 100 g food	Calcium Content (mg/100 g food)
乳類及蛋食品 (Dairy & egg products)		
牛奶 (Whole cream milk)	約半杯(100 ml)	104
雞蛋 (Whole egg)	2 隻 (2 pieces)	60
豆類 (Lentils, nuts & seeds)		
芝麻 (Sesame)	兩湯匙 (2 tablespoon or 18 g)	176
布包豆腐 (Beancurd)	約半磚 (1/2 cube)	285
黃豆 (Soy bean, dried)	約大半碗 (3/4 medium bowl)	191
加鈣豆漿 (Soy Beverage, Calcium Added) [#]	約半杯(100 ml)	119
深綠色蔬菜 (Dark green vegetables)		
莧菜 (Chinese spinach)	約 1 碗 (1 medium bowl)	187
芥菜 (Mustard)	約 1 碗 (1 medium bowl)	132
小白菜 (Chinese cabbage, Bok Choi, petiole)	約 1 碗 (1 medium bowl)	113
魚類及海產類 (Fish & Shellfish)		
茄汁沙甸魚 (Canned sardine in tomato sauce)	2 條 (2 pieces)	240
海蝦 (大) (Prawn, large)	5 隻 (5 pieces)	146
乾瑤柱 (Dried Scallops)	約 10 粒 (10 pieces)	77
菌藻類 (Mushroom & fungus)		
木耳 (已浸) (Wood ear, soaked)	約 1 碗 (1 medium bowl)	34
香蕈 · 冬菇(乾) (Shitake mushroom, dried)	10 隻(大)(10 pieces, big size) 20 隻(中)(20 pieces, medium size)	83

[#] Food Standards Australia New Zealand. NUTTAB 2010 Online Searchable Database. Food ID:13B20193. Soy beverage, regular fat (~3%), unflavoured, added calcium.

Table 3: Proportion of energy requirement contributed by 360 & 480 ml of Whole Cow Milk and a Formula providing 100 kcal/100ml in a hypothetical Male child of 12, 24, & 48 months of age with Body Weight at 50th percentile

	Median BW for male #	Daily Energy Requirement [@] (kcal/kg/day)	Energy Requirement Kcal /day	% of energy requirement contributed by whole cow milk		% of energy requirement contributed by FM with 100 kcal/100ml	
				360 ml	480 ml	360 ml	480 ml
12 month	9.4	82	771	28.5%	38.0%	46.7%	62.3%
24 month	12.0	84	1008	21.8%	29.0%	35.7%	47.6%
48 month	15.6	77	1201	18.3%	24.4%	30.0%	40.0%

50th percentile weight-for-age according to Hong Kong 1993 Growth Reference

@ Human Energy Requirements. Report of a Joint FAO/WHO/UNU Expert Consultation. Rome October 2001.

Table 4: Comparison between Whole Cow Milk and Some Formulae Targeted for children > 1 year.

Per 100 ml	Whole milk	FM 1-3 years					FM > 1 year		FM (>3 years)	
		Gain Plus	Friso 3	Enfagrow	Nan HA3	Wyeth Progress	Wyeth PE Gold	Pedisure	Friso 4	Wyeth Promise
Energy (kcal)	61	74	73	64	67	80	87	100	100	94
Protein (g)	3.15	2.58	2.7	2.5	2.01	2.6	3.0	3.0	3.3	3.5
Total fat (g)	3.72	3.62	2.5	1.82	2.99	3.0	3.0	3.9	3.1	3.2
Saturated fat (g)	1.865	NS	1.0	NS	NS	NS	0.7	NS	1.3	0.7
Carbohydrate (g)	4.78	7.59	9.9	9.9	7.99	10	11.7	13.2	14.5	12.7
Sugar (g)	5.26	NS	NS	NS	NS	NS	7.8	NS	7.9	8.1
Calcium (mg)	113	115	92	64	75	91	113	96	115	110
Iron (mg)	0.03	1.19	1.2	1.03	0.98	1.2	1.7	1.4	1.6	1.7
Zn (mg)	0.37	0.56	0.5	0.68	0.58	0.5	1.0	0.7	0.65	0.83

◆ #Nutrient Information Enquiry. Centre for Food Safety. The Nutrient Data Laboratory, United States Department of Agriculture (SR22) (Milk, whole, 3.25% milk fat, without added vitamin A and vitamin D)

Link: <http://www.cfs.gov.hk/english/nutrient/fc-introduction.shtml>

◆ Composition of the formulae was accessed from www.mims.com/Hongkong/drug/info on 4 November 2011

Table 5: Nutrients commonly added to Formula Milk to Mimic Human Milk

Nutrient	Functions in human milk	Natural food sources
DHA(Docosahexaenoic acid/ AA or ARA (Arachidonic acid)	Aid brain and eye development.	Fish, such as salmon and flatfish, are the best sources of DHA. Avoid deep sea fishes that may be high in mercury.
Taurine	Aids vision development, hearing and helps the absorption of fats and amino acids ³⁰ .	Fish and animal protein.
Lutein	Aids in protecting the eyes from oxidative damage.	Fruits and vegetables, especially dark green leafy vegetables, such as kale, spinach, bok choy and broccoli ³¹ .
Choline	Important in the formation of cells and brain function.	Many types of foods are rich in choline, among them, animal liver, milk, egg, beef broccoli and brussel sprouts are good sources ³² .
Beta-carotene	Converts into Vitamin A in the body, a potent antioxidant.	Yellow and orange fruits and dark green leafy vegetables
Prebiotics / FOS (Fructooligosaccharides)	Can improve bowel health and immune function ³³ . However, there is no evidence to suggest its function in preventing allergy. ³⁴	Rich in fruits, soy and soy products, and whole grains.
Iron	Involves in various body functions, including the delivery of oxygen throughout the body.	Meat, especially red meat, is a good source of haem iron with high bioavailability. Non-heme iron in soy, green leafy vegetable, nuts and iron fortified grain cereals are better absorbed by the body when consumed with vitamin C rich fruits.
Calcium	An essential mineral in building strong bones and teeth.	Milk and dairy products (e.g. cheese, yoghurt). Some green leafy vegetables. Calcium added Tofu prepared by calcium salt. Vitamin D in the body can aid absorption of calcium. Moderate exposure to sunlight, and consumption of vitamin D rich foods like egg and fish will improve vitamin D status in the body.
Zinc	A mineral that helps the child's development of immune system and help prevent illnesses.	Rich in most protein sources, such as milk, meats, egg and soy products.
Remarks:		
Probiotics	Probiotic bacteria have been added to milk formulae to manipulate the intestinal flora of formula-fed babies to mimic that of breastfed babies, with the anticipated benefits of enhancing the immature immune system and protecting against infections and allergies. The long term clinical benefits have not been demonstrated based on current evidence. ³⁵	

Table 6: A Sample One-day Menu (from a typical family diet) for meeting the RNIs of Major Nutrients of 2 to 5-year-olds

			Calories	Protein (g)	Ca (mg)	Fe (mg)	Zn (mg)
Breakfast	Tomato (1/4)	30g	4.32	0.228	2.64	0.1632	0.03
	Egg (1/2pc)	25g	35.5	3.13	13.25	0.4575	0.28
	Bread (1 pc)	47g	111.9	4.1	42.3	1.0	0.56
	Cow milk	120ml	80.4	3.96	140.4	0	0.48
Snack	Cracker	2 pc	40.8	0.84	0	0.16	0.04
	Cow milk	120ml	80.4	3.96	140.4	0	0.48
Lunch	Chinese Zucchini	40g	8.4	0.4	10	0.3	0.20
	Pork (1.5 tbsp)	25g	35.75	5.075	1.5	0.75	0.75
	Macaroni	100g	124	5.33	15	1.06	0.81
Snack	Apple 0.5pc	50g	24.5	0.35	1.5	0.35	0.08
	Yogurt	100ml	85	5.7	185	0.1	0.60
Dinner	Choy Sum	40g	11.2	1.12	38.4	1.12	0.35
	Carrot (3 slice)	10g	2.2	0.1	1.1	0.28	0.07
	Fish (1.5-2tbsp)	30g	30.3	5.58	30.6	0.42	0.20
	Rice (1/2bowl)	100g	133	2.3	6	0.3	0.00
	Banana (half)	50g	44.5	0.545	2.5	0.13	0.08
Snack	Bread (1/2 pc)	24g	55.9	2.1	21.2	0.5	0.3
	Oil for cooking	10 ml	90				
Total			998.1	44.8	651.7	7.1	5.3

	RNI (WHO)				
	Average Energy Requirement	Protein	Calcium	Iron	Zinc
	Moderate Physical Activity level (Boys)			12% bio-availability	Moderate bio-availability
1- 3 y	82-84 kcal/kg/day	0.90 - 1.14 g/kg	500 mg/day	5 mg/day	4.1 mg/day
4 - 6 y	74-80 kcal/kg/day	0.86 - 0.89 g/kg	600 mg/day	5 mg/day	5.1 mg/day

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