

Review Article

Dairy foods and health in Asians: Taiwanese considerations

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The health relevance of dairy products has mostly been judged by their abundant nutrients (protein, calcium and riboflavin) and recommendations for these derived in lactase-persistent Caucasian populations. Extrapolation to Asians who are generally lactase non-persisters may not be biologically, culturally or environmentally sound. A number of studies, especially among north-east Asians as in Taiwan, provide guidance for their optimal dairy intakes. In Taiwan, the NAHSIT (Nutrition and Health Surveys in Taiwan) linked to the National Health Insurance and Death Registry data bases provide most of the evidence. Cultural and socio-economic barriers create population resistance to increase dairy consumption beyond one serving per day as reflected in food balance sheet and repeat survey trend analyses. For the morbidity and mortality patterns principally seen in Asia, some, but not too much, dairy is to be preferred. This applies to all-cause and cardiovascular, especially stroke, mortality, to the risk of overfatness (by BMI and abdominal circumference) and diabetes and very likely to fracture and its sequelae. In Taiwan, there is no apparent association with total cancer mortality, but among Europeans, there may be protection. Historically, while fermented mammalian milks have been consumed in south Asia and various Asian sub-groups and regions, most of the uptake of dairy in Asia after World War 2 has been from imported powdered milk or fresh liquid milk, encouraged further by the use of yogurts and popularization of milk teas and coffee. Asian dietary guidelines and clinical nutrition protocols need to encourage a modest, asymptomatic dairy intake.

Key Words: dairy, health, stroke, lactase persistence, Taiwan

NUTRITIONAL VALUE OF DAIRY FOODS IN ASIAN DIETS

Oriental Asians and many indigenous peoples of Asia do not have persistent lactase activity beyond early childhood. For this reason, it has been thought, mammalian milk has not formed a significant part of their food culture. Historically, while fermented mammalian milks have been consumed in Asian sub-groups (e.g. western China and Mongolia) and regions (e.g. south Asia), most of the uptake of dairy in north-east (NE) and south-east (SE) Asia after World War II has been from imported powdered milk or fresh liquid milk (about 80%), encouraged further by the popularization of milk teas and coffee.

Perceived nutrient vulnerabilities in Asian diets especially for protein and amino acids, the vitamin riboflavin (B-2) and the divalent cations calcium and magnesium are often used as an argument for the inclusion of dairy foods. However, the recommendations by which these arguments are put are almost exclusively based on studies in Caucasians. We have recently assessed survival in relation to food-based vitamin intakes in Taiwan with its dominantly Chinese population of lactase non-persisters and find that it has an optimal range of intake not contin-

gent on dairy foods.¹ Nevertheless riboflavin deficiency is seen in adolescent Chinese with its classical features of angular stomatitis and seborrheic dermatitis in relation to dietary quality, especially the refinement of rice.^{2,3} Likewise, in empirical step-wise risk assessment, with calcium intakes for women above 2/3rds DRIs (about 500 mg per day) combined with other dairy and dietary characteristics in Taiwan as reference, not more than 1 serve (1 cup of 240 ml with about 240 mg calcium) is required for an optimal diet (Table 1).⁴ It is clear that the acceptability and utility of dairy foods depends on their food and nutritional synergy, not simply a question of nutrient content. Part of this acceptability will be predicated on the dose of lactose and how it is distributed across the day.⁵⁻⁷

The nutrient almost unique to milk is galactose, one of

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the 2 monosaccharides in lactose; it is also found in sugar beet and, of course, is synthesized by mammals, not only in breast tissue. It is an interesting question whether the ability to absorb galactose early, but not later in life among non-lactase persisters has physiological significance. It is rapidly metabolized with the metabolite, UDP-galactose, found in various tissues including liver, brain, the lens and ovary. People with galactosemia have a defect in its metabolism attributable to UDP-galactose 4'-epimerase (GALE) enzyme activity in forms which may be autosomal recessive and fatal or mild. Galactose is involved in antigen metabolism and in the development of meat allergy after tick bites.⁸

FOOD-BASED DIETARY GUIDELINES (FBDGS) FOR ASIAN COUNTRIES

FBDGs were articulated and promulgated by FAO and WHO in their Cyprus report of 1995^{9,10} and adapted for the Asia Pacific region.¹¹ They encourage as prime guidelines breast feeding and food diversity, the first with an obligatory lactose intake and the second the indication that dairy can contribute to the diversity, but in the expectation that its appropriateness, type and amount will be determined locally.^{12,13}

HEALTH IMPACTS OF DAIRY FOOD

The effects of dairy can be evaluated in acute and medium-term metabolic or risk factor studies, but the intermediates evaluated may or may not translate into ultimate health outcomes. Few if any such studies of dairy foods are available. A biomarker for dairy foods which would be available for such studies is erythrocyte trans-18:1 fatty acid which has been shown to be favorably associated with less incident diabetes.¹⁴ This is a naturally occurring trans-fatty acid unlike those produced during fat hydrogenation and which are a risk for more diabetes. Yet this evidence is often regarded as of the most instructive. Clinical studies can provide evidence for symptomatic interventions, as with lactose inclusion or exclusion diets,¹⁵ but again are few.

For population health, epidemiological case-control or cohort studies, preferably the latter, are required and can take account of a number of covariates. There are several cohort studies in Asians and Europeans which have examined the associations of dairy intakes with health outcomes. For all-cause mortality, meta-analyses do not support an association.¹⁶ The same applies in Taiwan, although the point estimates in an adult cohort study before low fat products were in vogue were favourable.¹⁷ Reduced risk of cardiovascular (CVD) mortality is a consistent finding irrespective of location.^{16,17} Of particular note, because of its high incidence in NE Asia, a modest dairy intake of 3-7 servings per week is associated with a major risk reduction in adult Taiwanese.¹⁷ In support of these CVD mortality findings, dairy food intake is associated with less risk of myocardial infarction in women, although not with all products, cheese (a good source of vitamin K-2) being the protective item.^{18,19} Likewise, higher dairy intakes are associated with less arterial stiffness and hypertension.^{20,21} In Taiwan, there is no apparent association with total cancer mortality, but in North America²² there is. A protective association is seen

for colorectal cancer in North America²² and Sweden,²³ but not for breast cancer.²⁴ Less than one serving per day also reduces the risk of type 2 diabetes in Chinese.²⁵ Lactase non-persistence, which maintains the availability of absorbable galactose (toxic to oocytes) has been of particular interest as protective against galactosemia which may be a risk factor for ovarian cancer beyond infancy. However, one meta-analysis does not support a relationship between dairy consumption and ovarian cancer, although it did not distinguish between lactase persistence and non-persistence²⁶ and the risk may be dose-related above 30 g lactose per day as a threshold.²⁷

TRENDS IN DAIRY FOOD CONSUMPTION

*Disappearance data of the world and Asian countries*²⁸

The highest dairy consumptions are to be found in countries with major European populations, although declining in Australia (Figure 1, data updated to 2010). The global average consumption is less than one serving per day. The highest dairy consumptions in Asia are in South Asia, climbing most steeply in Pakistan. For NE Asia, where lactase non-persistence is prevalent, the highest consumption is in Japan, followed by Taiwan (Figure 2, data updated to 2010). But the intakes seem capped at less than 1 serving per day, suggesting barriers (Figure 3).⁴ The dairy consumption in Taiwan went down markedly in 2008-2009 at the time of the melamine adulteration fiasco and has since not fully recovered. It is of interest that, for liquid milk, the upper single dose of lactose tolerance seems to be about 25 g, which is the most that a single serve of dairy might provide. It is also the amount of dairy which provides the greatest health protection.

Taiwan: availability, self-sufficiency & servings

In Taiwan the most prevalent dairy consumptions are to be found among children and the elderly (Figure 4).⁴ Barriers to consumption are therefore more likely in adolescence and adulthood. Even though lactose digestion may decline with age, it may be asymptomatic.⁵⁻⁷ This may account for the relative acceptability of dairy products among the aged at a time when the benefit may also be considerable in terms of CVD.¹⁷

LIMITS TO DAIRY INTAKE IN ASIA

The NAHSIT study of 2005-2008 enquired about the non-use of dairy foods (unpublished data). More than a quarter (26.5%) of participants claimed this was for physiological reasons. Two thirds (66.7%) of participants claimed that dairy was not part of their diet, including those with "no such habit" (32.2%), "dislike" (17.1%), "no right time" (10.3%) and "dare not to" (7.11%). There were 4.81% for whom dairy was not accessible usually because the price was too high (3.04%), especially for the Eastern region and Indigenous people.

As indicated, it was found that most people did not regard dairy as a normal part of the diet, followed by physiological reasons as the basis for dairy avoidance. This was confirmed by the finding in Taiwan that dietary diversity, including dairy, costs were greater²⁹ and made more consequential by the fact that this in turn affects mortality.³⁰ Indigenous Taiwanese had problems with accessibility since they were often located in remote areas.

Table 1. Hierarchical determination of optimal dairy recommendations for elderly women in Taiwan

Criteria	Corresponding daily dairy intake frequencies for various factors															
Gender	Older adult women															
Osteoporosis [†]	No								Yes							
No of participants	327								308							
Dairy intake freq/d	0.86								0.76							
Calcium intake	≥2/3 DRIs				<2/3 DRIs				≥2/3 DRIs				<2/3 DRIs			
% of participants	40				60				31				69			
Dairy intake freq/d	1.11				0.69				1.10				0.62			
Serum EGRAC [‡]	Normal		Deficient		Normal		Deficient		Normal		Deficient		Normal		Deficient	
% of participants	99		1		97		3		98		2		93		7	
Dairy intake freq/d	1.11		1.00		0.70		0.57		1.08		0.95		0.65		0.29	
The metabolic syndrome	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
% of participants	52	48	100	0	53	47	50	50	63	37	50	50	60	40	67	33
Dairy intake freq/d	1.11	1.11	1.00	0	0.78	0.61	0.60	0.53	1.17	0.87	1.00	0.07	0.64	0.65	0.43	0.06

[†]BUA T-SCORE ≤-2.5 SD

[‡]EGRAC (erythrocyte glutathione reductase activation) <1.4: normal; ≥1.4: vitamin B-2 deficiency indicator

DRIs: Dietary Reference Intakes

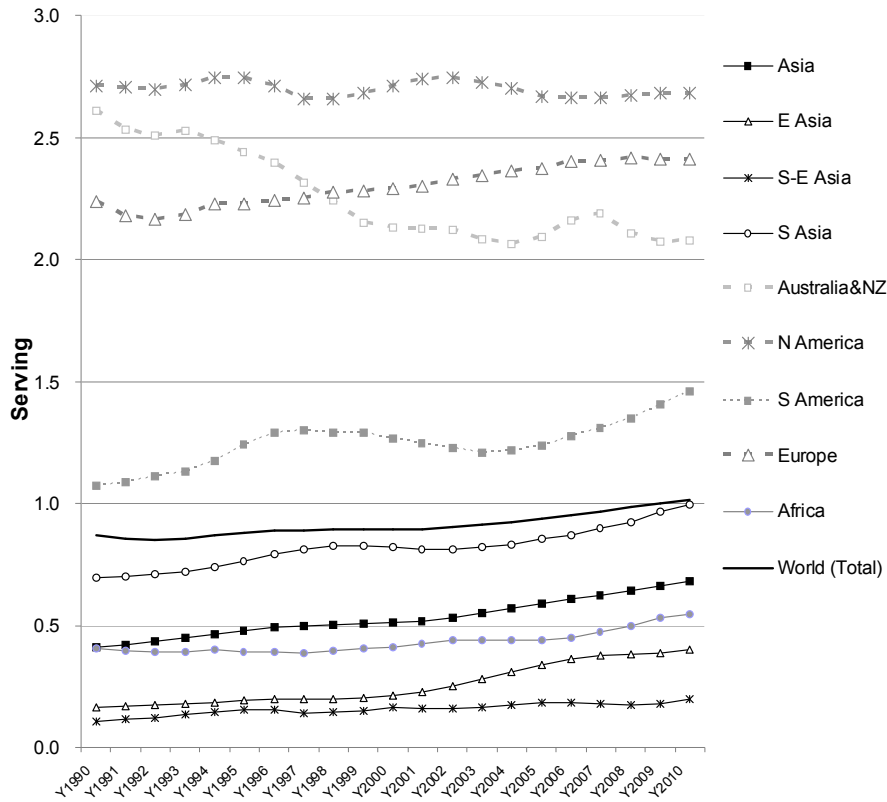


Figure 1. Global and continental daily dairy food availability for the period 1991 to 2010.

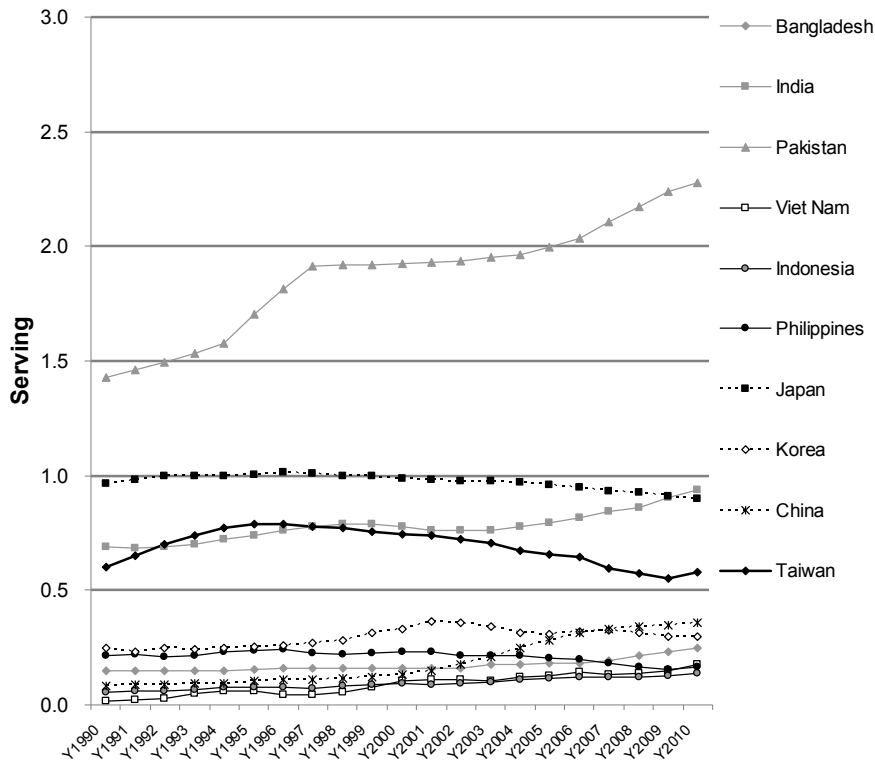


Figure 2. Daily dairy food availability in Asian countries for the period 1991 to 2010.

Those who used dairy, used less supplements, smoked less and chewed betel nut less.

Projections that dairy consumption in Asia will continue to rise are based on income and population growth and not necessarily on individual consumption. However, it is

also argued that technological advances in Asia may reduce world dairy price.³¹

CONCLUSIONS

Low or moderate dairy intakes, less than one serving a

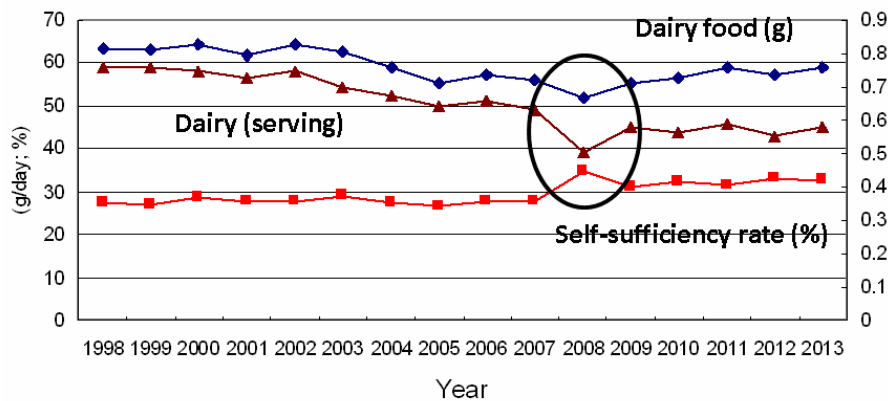


Figure 3. Dairy food self-sufficiency and servings, Taiwan 1998-2013.

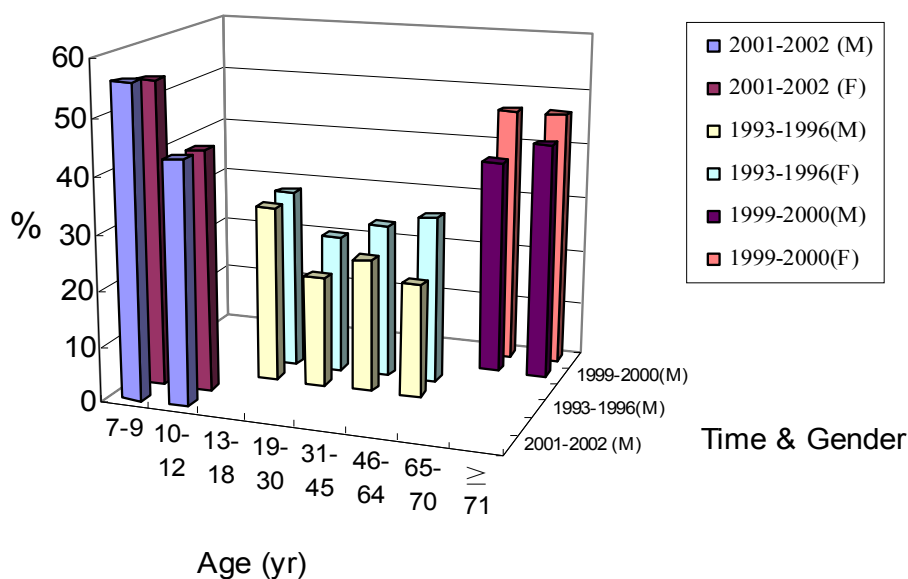


Figure 4. Age-gender-specific dairy consumption prevalences, 3 NAHSITs.

day are acceptable to about half of oriental Asians who are lactase non-persistent as judged from Taiwanese studies. Those who consume dairy at these frequencies gain a mortality and morbidity advantage.

AUTHOR DISCLOSURES

No conflict of interest.

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亞洲人的乳製品與健康：臺灣經驗

乳製品與健康的關聯，絕大多數取決於其富含的營養素（蛋白質、鈣和核黃素），而這些建議多半衍生自乳糖酶續存之高加索人群。這些建議外推至多數為乳糖酶非續存的亞洲人，就生物，文化和環境層面可能不恰當。一些研究，尤其是在東北亞的臺灣，提供了他們最佳奶品建議量的指引。在臺灣，NAHSIT（臺灣營養與健康變遷調查），串連到全民健保和死亡登記資料庫，提供了大部分證據。從食物平衡表及重複調查的趨勢分析，反映出文化和社會經濟障礙，產生讓民眾增加乳製品消費的阻力，而無法達成每日一份奶品的建議攝取量。對於亞洲常見的疾病及死亡原因，只要少量而不是太多的乳製品是首選。這適用於全死因和心血管疾病死亡率，特別是中風；疾病方面包括過重（測量 BMI 和腹圍）、糖尿病、骨折及其後遺症的風險。在臺灣，奶類與總癌症死亡率無關，在歐洲人則可能是保護的。從歷史上看，儘管南亞和亞洲部分族群和地區早就食用發酵哺乳動物的奶，但大部分亞洲人的乳製品攝取起源於第二次世界大戰後進口的奶粉或鮮奶。透過鼓勵攝取優格，及茶與咖啡的普及，增加了奶品的攝取量。亞洲膳食指南和臨床營養方案，需要鼓勵適度且無症狀的乳製品攝入量。

關鍵詞：乳製品、健康、中風、乳糖酶持久性、臺灣