Original Article

The effect of socio-demographic variables and dairy use on the intake of essential macro- and micronutrients in 0.5-12-year-old Indonesian children

Yekti Widodo MSc[1,2], Sandjaja Sandjaja DrPH[1,3], Edith Sumedi MSc[1,4], Ilse Khouw PhD[5], Paul Deurenberg PhD[6]

[1]*SEANUTS Indonesian Team, PERSAGI, Kebayoran Baru, Jakarta, Indonesia*
[2]*Center of Public Health Intervention Technology, NIHRD, MoH, Indonesia*
[3]*Center of Applied Health Technology and Clinical Epidemiology, NIHRD, MoH, Indonesia*
[4]*Division of Nutrition, Polytechnic of Health Jakarta II, MoH, Indonesia*
[5]*FrieslandCampina, Amersfoort, the Netherlands*
[6]*Nutrition Consultant, Langkawi, Malaysia*

Background and Objectives: To study the associations between nutrient intake, dairy intake and socio-economic variables. **Methods and Study Design:** Food consumption data using 24 h recall were collected in 3600 children, aged 0.5 to 12 years old in addition to frequency of dairy use and anthropometric and socio-demographic variables. **Results:** Overall height for age Z-score (HAZ) and body mass index for age Z-score (BAZ) values (mean±SE) were -1.40±0.03 and -0.48±0.03 respectively, associated with a high prevalence of stunting and thinness in the population. The overall percentage of children not using any dairy products was 71%, and this percentage increased steadily with age. The overall energy intake from dairy was 99±3 kcal/capita/day and the overall energy intake from dairy in dairy users was 291±7 kcal/day. Dairy use did not differ between boys and girls, but was higher in urban areas, higher if the education of the mother was higher and higher if the mother had a permanent job and if the wealth status of the family was in the upper levels. Nutrient intake after the age of 3 years was inadequate for energy and all nutrients except for protein. The achievement of Recommended Dietary Allowances (RDA) for all nutrients was higher in dairy users compared to non-dairy users, also after correcting for the confounding effect of the higher energy intake (from dairy) and socio-demographic variables. The contribution increased with increasing frequency of dairy use. **Conclusion:** Adequate dairy intake can substantially add to the achievement of RDA in Indonesian children.

Key Words: Indonesia, children, nutrient intake, nutritional status, dairy use

INTRODUCTION

Anno 2014, Indonesia still faces many nutritional problems among infants and children[1-4] and many programs are in place to target an improvement of the nutritional status of the children.[5,6] In 2011, the prevalence of stunting was reported as 35.6%, the prevalence of underweight in children younger than 5 years was 17.9% and the prevalence of thinness in school age children was 12.2%.[4] Also an earlier publication of Indonesian SEANUTS (South East Asian Nutrition Surveys) data showed comparable high figures of 25.1% to 39.2% for stunting, 19.2% to 28.9% for underweight and 5.8% to 6.0% for wasting in urban and rural areas respectively.[2] The prevalence of under nutrition in Indonesia was found to be higher than the prevalence in the three other Asian countries participating in SEANUTS.[7-9]

Unfortunately also the prevalence of childhood overweight and obesity is increasing based on data of two recent nationwide studies,[3,4] although it is still low compared to values reported for developed countries and figures from some other Asian countries.[7,9] As expected most overweight and obese children are found in urban areas.[2]

The prevalence of anaemia, iron deficiency and vitamin D deficiency in Indonesia was high and reported to be 17.6% and 18.8%, 4.6% and 8.8% and 43.0% and 44.2% for urban and rural areas respectively.[2] Surprisingly, SEANUTS Indonesia reported a prevalence of vitamin A deficiency below the public health concern levels,[2] much lower than earlier reported[10] and lower than in surrounding Asian countries.[7-9]

The high prevalence of stunting together with the apparent deficiencies of micro nutrients points to a chronic

Corresponding Author: Dr Sandjaja Sandjaja, Persatuan Ahli Gizi Indonesia, Jalan Hang Jebat III/F3, Kebayoran Baru, Jakarta, Indonesia.
Tel: +62-81318585151; Fax: +62 251 8326348
Email: san_gizi@yahoo.com; paul.deurenberg@gmail.com
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nutritional problem. Apart from lack of intake, also socio-demographic factors and food habits might contribute to this observation. As reported earlier,[11] both under- and over nutrition might affect development and cognitive performance early in life and it is well known that malnutrition in early life increases the risk for chronic diseases in later life.[12]

Dairy products have naturally a high content of many essential nutrients, especially protein, calcium and vitamin B-2.[13,14] Therefore, dairy is often advised as a food item that should be part of each child's diet.[14] Today, many dairy products are fortified with minerals and vitamins, in order to increase nutritional density and allowing an even more substantial contribution to achieving Recommended Dietary Allowances (RDA) for these essential nutrients.[15] For this reason data on food consumption and dairy consumption frequency from SEANUTS were analysed in relation with socio-demographic variables that might affect nutritional intakes.

METHODS

This study is part of SEANUTS (South-East Asia Nutritional Surveys), a cross-sectional nutritional survey conducted between 2010 and 2011 in four countries: Indonesia, Malaysia, Vietnam and Thailand. The study was conducted according to the guidelines laid down in the Declaration of Helsinki and in Indonesia all procedures were approved by the Committee of Health Research Ethics, the National Institute of Health Research and Development, the Ministry of Health, Republic of Indonesia, number LB.03.02/KE/6430/2010 and the Ministry of home Affairs, number 440.02/1751.D.I. The study is also registered in the Netherlands Trial Registry as NTR2462. Written informed consent was obtained from all the parents or carers of the children and verbal assent was obtained from each child before data collection.

Details of the study design and used methods have been published earlier.[2,16] In short: a multi-stage cluster sampling, stratified for geographical area, sex and age was carried out in 7211 Indonesian children, aged 0.5 to 12 years old. In a random selection of 3600 children food consumption data were also collected in addition to socio-demographic variables and anthropometric variables. Weight factors based on population census information[17] were used in the statistical analyses to obtain country representative outcomes.

Weight was measured using calibrated digital scales accurate to 0.1 kg. Height was measured using wall-mounted stadiometers accurate to 0.1 cm. Body mass index (BMI, kg/m^2) was calculated as weight divided by height squared. Body mass index for age Z-scores (BAZ) and height for age Z-scores (HAZ) were calculated based on WHO references.[18,19]

Structured questionnaires were used to obtain information on socio-economic parameters. The education level of the mother was categorized in four groups as: no formal education, primary education, secondary education and tertiary education. The occupation of the mother was categorized in three groups as house wife, permanent job or temporarily job. From income, housing and living conditions, and belongings and property a 'wealth' status was calculated and was categorised into 5 groups (quantiles), very low, low, modal, above modal and high.[20,21]

Food consumption was assessed by a single 24 h recall using standardized questionnaires with assessment of portion size using household measures. Dietary intake was calculated using the Nutrisoft program developed by the Food and Nutrition Research Centre, using Indonesian food composition tables.[22,23] In children who were still breastfed, the amount and frequency of breastfeeding was assessed and nutrient intake was calculated using age specific breast milk composition data[24] and age specific breast milk volume data.[25] In addition to the 24 h recall, average dairy frequency was also asked and categorised as: never or seldom, once a day, twice a day or more than twice a day. As a higher dairy frequency does not necessary coincide with higher amounts, dairy consumption was also categorized in three groups based on energy intake from dairy as obtained from the 24 h recall (1) no energy from dairy; (2) less than 291 kcal/day from dairy (average sample value and equivalent to about 300 mL full cream milk) and (3) more than 291 kcal/day (300 mL/day). All questionnaires and measurements were standardized and taken by trained enumerators. RDAs used in this paper are Indonesian RDAs.[26]

Data were analysed using SPSS (IBM cooperation 2011, Armonk NY), version 20.0.0. All presented results are based on weighted data[17] obtained with the SPSS 'complex sample' procedure. Differences between groups were tested using analysis of (co)variance techniques (GLM) after correction for possible confounders. Differences in categorical variables across groups were tested using Chi-square statistics. Values are expressed as mean and SE and level of significance is set at $p<0.05$.

RESULTS

Table 1 shows the characteristics of the children in 5 age groups. As expected, weight and height increased with age and the average BMI values showed the typical rebound after the age of 3 to 5.9 years. HAZ was significantly lower after the first year of life, coinciding with a higher prevalence of stunting in children older than 1 year (results not shown). With only a slightly higher value in the age range of 1 to 3 years, BAZ values were similar over the whole age range. Remarkable was the high percentage of non-dairy users in the population (71%) and the higher number of non-users in the older age groups. As a consequence, hardly any children used substantial amounts of dairy after the age of 6 years. Most used dairy product in the lowest age group was milk powder. Liquid milk and condensed milk consumption was relatively stable over the age groups. Cheese, yoghurt, and drink yoghurt, including cultured milk were hardly used.

Dairy use was found not to be different between boys and girls, but rural children were less likely to use dairy products twice or more per day (Table 2). Children of mothers with higher education used dairy products more often and children with stay-at-home-mothers were more likely to be non-dairy users. The consumption of dairy was higher in the higher wealth levels. Across the age groups there were no significant differences in wealth distribution, but the educational level of the mother tended towards better education for the younger children. In older children fewer mothers were housewife and more

Table 1. Characteristics of the population and frequency of dairy use by age[†]

	Age group (years)										All	
	0.5 to 0.9 n=434		1.0 to 2.9 n=1125		3.0 to 5.9 n=832		6.0 to 8.9 n=713		> 9 years n=496		n=3600	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Age (years)	0.70	0.00	2.00	0.00	4.60	0.00	7.50	0.00	10.4	0.00	6.30	0.10
Weight (kg)	8.00	0.10	10.5	0.10	14.9	0.10	20.6	0.20	28.1	0.40	18.9	0.20
Height (cm)	69.8	0.30	81.2	0.30	100	0.40	116	0.30	131	0.50	109	0.40
BMI (kg/m^2)	16.2	0.10	15.8	0.10	14.8	0.10	15.1	0.10	16.1	0.20	15.4	0.10
HAZ	-0.47[†]	0.10	-1.50[‡]	0.05	-1.49[‡]	0.07	-1.41[‡]	0.05	-1.40[‡]	0.06	-1.40	0.03
BAZ	-0.58[†]	0.08	-0.12[‡]	0.05	-0.45[†]	0.06	-0.53[†]	0.06	-0.63[†]	0.08	-0.48	0.03
Dairy use (%)[*]												
Never	67		57		62		77		82		71	
Once per day	6		11		17		15		15		15	
Twice per day	4		8		11		5		3		6	
More than twice per day	24		24		10		3		1		8	

BMI: body mass index; HAZ: height for age Z-score; BAZ: body mass index for age Z-score.
[†]Values are corrected for possible sex and urban rural differences across the age groups.
[*]Dairy use across age groups is significant different (Chi-squared); [†], [‡]: different superscripts in rows indicate significant differences between the columns.

Table 2. Socio-demographic variables (% of total population) across groups of dairy users

	Dairy use			
	Never	Once per day	Twice per day	>Twice per day
Girl/boy	72/70	15/14	7/6	7/9
Urban/rural*	63/79	18/11	8/4	11/6
Education mother*				
None	86	12	0	1
Primary	81	12	3	5
Secondary	69	16	8	7
Tertiary	55	18	11	16
Occupation mother*				
House wife	72	14	6	8
Permanent job	53	14	16	17
Temporary job	75	14	4	7
Wealth level*				
Very low	88	7	3	2
Low	77	15	3	6
Modal	68	15	8	8
Above modal	60	18	10	12
High	57	20	8	15

*Significant different ($p<0.01$) across groups (Chi-square).

mothers had a permanent or temporarily job.

The children consumed on average 13 different foods (with a maximum of 38). Eight hundred forty one (841) children were still breastfed with the oldest child being 2 year old. Supplements were taken by in total 11.2 percent of the children, with more supplement users among the younger and urban children from well educated mothers and higher wealth groups. Occupation of the mother and sex of the child did not differ between the takers and non-takers of supplements.

In Table 3, the absolute and relative intakes (compared to RDA) of energy, protein, minerals and vitamins are listed. Children older than one year did not reach their RDA for energy and children over the age of 9 also not for protein. The RDAs for most minerals and vitamins were not met, especially not in children older than 1 year, with the exception of the intakes of vitamin B-2 and vitamin D till the age of 3 years. Remarkable is the very high intake of vitamin D in the youngest age group.

Table 4 lists the percent achievement of the RDA for essential nutrients for dairy and non-dairy users. Dairy users have a higher percentage of RDA achievement for all nutrients. In the highest dairy user group it was more than twice the RDA for calcium, iron, vitamin B-2 and vitamin D.

Table 5 and 6 list the percent RDA achievement in the dairy groups after correction for confounders. The tables show that after correction for confounders the differences between the dairy frequency groups were smaller for most nutrients, but remained significant, especially in the highest dairy group. The confounding effect of age was negative, which is not surprising as dairy consumption was lower at older age. There were hardly differences between boys and girls, but rural children had lower achievements, except for energy and the vitamins B-1, C, A, and D. Energy intake had a large positive effect for all nutrients. With each 1000 kcal energy intake, the RDA achievement rose, varying from 31 percent points (vitamin D) to 87 percent points for protein. Generally, a higher education of the mother resulted in a better RDA achievement with a remarkable big effect for vitamin D. Mother's occupation did not affect the RDA achievement much. Generally, a better wealth status resulted in better nutritional intakes, although the effects were not always significant.

As the frequency of dairy use is not necessary related to the amount, the analyses were repeated with three diary groups reflecting the amounts of dairy used. Table 7 shows that for protein, calcium, iron, vitamin B-2, C, and D a dairy intake of about 300 mL/day is sufficient to guarantee an intake above RDA values if the remaining diet and socio-demographic variables would remain unchanged. For other nutrients, higher amounts of dairy would be required.

DISCUSSION

This randomly selected SEANUTS subpopulation, in which food consumption was assessed, can be regarded as representative for the Indonesian population of children aged 0.5 to 12 year. The age and sex distribution of this subsample was not different compared to the total sample and the means of weight, height and BMI (Table 1) were not different compared to data previously published for the total study population.[2] The strength of the current study is the large population representative number of children and the standardized approach in the field work. A limitation is the inevitable lack of information and incomplete data in the local food composition tables. This might have affected the total intakes (absolute as well as expressed as % RDA) as well as the contribution of dairy to the intakes. The missing data in the local food composition tables might lead to an underestimation of the achieved RDA from total diet and perhaps to an overestimation of the effects of dairy, as dairy products are generally well tabulated in food composition tables.

For Indonesian children at birth, HAZ values were only slightly (but significantly) lower than the international reference (WHO), but the children increasingly lagged

Table 3. Absolute and relative to Recommended Dietary Allowances (RDA) intakes of nutrients[†]

	Age group (years)										All	
	0.5 to 0.9		1.0 to 2.9		3.0 to 5.9		6.0 to 8.9		> 9			
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Energy (kcal)	767	19	910	20	1053	20	1174	23	1206	26		
From dairy (kcal)	132	19	153	12	93	8	39	4	25	4		
Protein (g)	19	1	30	1	38	1	42	1	43	1		
Fat (g)	31	1	32	1	35	1	39	1	38	1		
Calcium (mg)	461	26	477	20	421	14	390	11	393	12		
Iron (mg)	4.0	0.3	6.0	0.2	6.0	0.2	6.4	0.2	6.6	0.2		
Zinc (mg)	3.1	0.1	3.7	0.1	4.0	0.1	4.4	0.1	4.4	0.1		
Vitamin B-1 (mg)	0.3	0.0	0.4	0.0	0.5	0.0	0.5	0.0	0.5	0.0		
Vitamin B-2 (mg)	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0	0.5	0.0		
Vitamin B-3 (mg)	2.9	0.1	3.6	0.1	3.9	0.1	4.3	0.1	4.5	0.1		
Vitamin C (mg)	45	2	27	1	17	1	14	1	14	1		
Vitamin A (μg)	443	13	329	9	290	9	312	10	294	11		
Vitamin D (μg)	14.1	0.4	6.7	0.3	3.5	0.2	2.9	0.2	3.2	0.2		
As percent Recommended Dietary Allowances (RDA)												
Energy	118[†]	3	91[‡]	2	79[§]	2	69[¶]	1	62[††]	1	75	1
From dairy	20[†]	3	15[†]	1	7[‡]	1	2[§]	0	1[§]	0	6	0
Protein	118[†]	5	121[†]	3	112[†]	3	98[‡]	2	90[‡]	2	104	1
Calcium	115[†]	6	95[‡]	4	84[‡]	3	69[§]	2	49[¶]	2	74	1
Iron	57[†]	4	75[‡]	3	70[‡]	2	67[‡]	2	51[§]	2	65	1
Zinc	41[†]	2	45[†]	1	44[†]	1	41[†]	1	36[‡]	1	41	1
Vitamin B-1	83[†]	3	80[†]	2	81[†]	2	66[‡]	2	55[§]	1	70	1
Vitamin B-2	140[†]	6	105[‡]	4	93[‡]	3	65[§]	2	54[¶]	2	78	1
Vitamin B-3	103[†]	5	60[‡]	2	54[‡]	2	46[§]	1	40[§]	1	51	1
Vitamin C	112[†]	4	67[‡]	3	39[§]	2	32[¶]	2	30[¶]	2	42	1
Vitamin A	111[†]	3	82[‡]	2	67[§]	2	65[§]	2	53[¶]	2	67	1
Vitamin D	283[†]	7	134[‡]	5	70[§]	4	59[§]	4	65[§]	4	84	2

[†]Statistics for % RDA only as absolute values are expected to increase with age.
[†], [‡], [§], [¶], [††]: different superscripts in rows indicate significant differences between the columns.

Table 4. Energy intake and percent achievement of Recommended Dietary Allowances (RDA) for nutrients in the different diary groups[†]

	No dairy		Once per day				Twice per day				> Twice per day			
	From total diet		From total diet		From dairy		From total diet		From dairy		From total diet		From dairy	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Energy (kcal)														
As percent Recommended Dietary Allowances (RDA)	1029[†]	13	1241[‡]	40	122[††]	3	1283[‡]	45	185[‡‡]	8	1265[‡]	29	486[§§]	21
Energy	68[†]	1	8[‡]	2	8[††]	0	92[§]	2	14[‡‡]	1	116[¶]	3	47[§§]	2
Protein	92[†]	1	112[‡]	3	11[††]	0	135[§]	5	19[‡‡]	1	166[¶]	5	73[§§]	4
Calcium	56[†]	1	82[‡]	3	26[††]	1	104[§]	4	42[‡‡]	3	190[¶]	7	139[§§]	7
Iron	55[†]	1	69[‡]	3	9[††]	1	81[§]	3	17[‡‡]	2	128[¶]	5	80[§§]	5
Zinc	36[†]	1	45[‡]	1	6[††]	0	54[§]	2	10[‡‡]	1	68[¶]	2	35[§§]	2
Vitamin B-1	62[†]	1	76[‡]	3	7[††]	0	89[§]	3	13[‡‡]	1	113[¶]	4	50[§§]	3
Vitamin B-2	60[†]	1	96[‡]	3	22[††]	1	111[§]	4	38[‡‡]	3	184[¶]	6	111[§§]	5
Vitamin B-3	45[†]	1	53[‡]	2	5[††]	0	62[§]	3	9[‡‡]	1	95[¶]	4	49[§§]	3
Vitamin C	31[†]	1	51[‡]	4	14[††]	2	54[‡]	5	25[‡‡]	4	110[¶]	6	74[§§]	5
Vitamin A	63[†]	1	75[‡]	4	5[††]	0	75[‡]	4	9[‡‡]	1	89[‡]	3	27[§§]	2
Vitamin D	72[†]	2	80[‡]	5	14[††]	1	89[‡]	7	24[‡‡]	3	189[¶]	10	118[§§]	8

[†]Values are not corrected for the possible effects of confounders.
[†, ‡, §, ¶]: different superscripts in rows indicate significant differences between the columns 'total diet'.
[††, ‡‡, §§]: different superscripts in rows indicate significant differences between the columns 'from dairy'.

Table 5. Percent Recommended Dietary Allowances (RDA) contribution for energy, protein, calcium, iron and zinc in relation to frequency of dairy use, age, sex and socio-demographic variables

Nutrient	Energy		Protein		Calcium		Iron		Zinc	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Use of dairy[†]										
Never[‡]	74	0	101	1	63	1	60	1	40	0
Once per day	73	1	101	2	74	2	61	2	39	1
Twice per day	73	1	110[*]	3	86[*]	3	65	4	44[*]	1
More than twice	86[*]	2	129[*]	3	162[*]	6	108[*]	4	54[*]	1
Age (years)	-6[*]	0	-7[*]	0	-6[*]	0	-3[*]	0	-2[*]	0
Boys versus girls	0	1	-1	1	0	2	1	1	-1	1
Rural versus urban	-1	1	-4[*]	1	-3[*]	1	-3[*]	1	-3[*]	1
Energy/1000 kcal	-	-	87[*]	3	63[*]	3	61[*]	2	37[*]	1
Education mother										
No education	1	2	7	5	0	5	5	4	5[*]	2
Primary	0	1	-3	2	-6[*]	2	-4[*]	2	1	1
Secondary	1	1	-3	2	-5[*]	2	-4[*]	2	0	1
Tertiary[‡]	-	-	-	-	-	-	-	-	-	-
Occupation mother										
Permanent job	2	1	6	3	3	4	3	3	1	1
Temporary job	-1	1	1	1	4[*]	2	1	1	1	1
Housewife[‡]	-	-	-	-	-	-	-	-	-	-
Socio-economic status (SES) quintile										
Very low	-1	1	-9[*]	3	3	3	4[*]	2	-5[*]	1
Low	0	1	-9[*]	3	1	3	0	2	-6[*]	1
Modal	0	1	-5	3	0	3	2	2	-3[*]	1
Above modal	0	1	-5	3	0	3	2	2	-3[*]	1
High[‡]	-	-	-	-	-	-	-	-	-	-

[†]Values are corrected for age, sex, urban/rural, educational level of the mother, occupation of the mother and income level (GLM).
[‡]This group was set as reference. [*]$p<0.05$ compared to reference group.

Table 6. Percent Recommended Dietary Allowances (RDA) contribution vitamins in relation to frequency of dairy use, age, sex and socio-demographic variables

Nutrient	Vitamin B-1		Vitamin B-2		Vitamin B-3		Vitamin C		Vitamin A		Vitamin D	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
Use of dairy[†]												
Never[‡]	68	1	67	1	50	1	35	1	68	1	79	2
Once per day	69	1	88[*]	2	48	2	47[*]	3	70	3	77	5
Twice per day	72	2	88[*]	4	49	3	41[*]	5	59[*]	4	67	8
More than twice per	86[*]	2	148[*]	5	73[*]	3	88[*]	6	64	3	145[*]	9
Age (years)	-5[*]	0	-7[*]	0	-5[*]	0	-5[*]	0	-6[*]	0	-10[*]	1
Boys versus girls	1	1	0	2	0	1	-1	2	-3	2	0	4
Rural versus urban	0	1	-5[*]	2	-2[*]	1	2	2	0	2	0	5
Energy/1000 kcal	63[*]	2	58[*]	3	39[*]	2	31[*]	4	47[*]	3	31[*]	5
Education mother												
No education	1	3	-3	4	2	4	-4	5	9	5	-34[*]	13
Primary	-2	2	-1	2	-3	2	-4	4	-2	3	-31[*]	7
Secondary	-2[*]	1	-2	2	-6[*]	2	-3	4	2	3	-32[*]	6
Tertiary[‡]	-	-	-	-	-	-	-	-	-	-	-	-
Occupation mother												
Permanent job	4[*]	2	8[*]	4	1	3	0	5	3	3	2	10
Temporary job	0	1	-1	2	0	1	2	2	-2	2	-4	5
Housewife[‡]	-	-	-	-	-	-	-	-	-	-	-	-
Socio-economic status (SES) quintile												
Very low	2	2	-13[*]	3	-3	2	-9	5	-2	4	-3	8
Low	0	2	-7[*]	3	-4	3	-8	5	-2	4	7	8
Modal	1	2	-2	3	-1	2	-6	4	0	4	7	7
Above modal	1	2	-3	3	-4	2	-2	4	-3	4	-8	7
High[‡]	-	-	-	-	-	-	-	-	-	-	-	-

[†]Values are corrected for age, sex, urban/rural, educational level of the mother, occupation of the mother and income level (GLM).
[‡]This group was set as reference. [*]$p<0.05$ compared to reference group.

Table 7. Percent Recommended Dietary Allowances (RDA) contribution for energy and nutrients in relation to amount of dairy used[†]

Dairy intake (kcal/day)[‡]	Energy		Protein		Calcium		Iron		Zinc		Vitamin B-1		Vitamin B-2		Vitamin B-3		Vitamin C		Vitamin A		Vitamin D	
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE
0	74	0	101	1	63	1	60	1	40	0	68	1	67	1	50	1	35	1	68	1	79	2
<291	74	1	103	2	80*	1	63	1	41	1	70	1	90*	2	49	1	45*	2	66	2	76	4
>291	90*	2	138*	4	186*	6	123*	4	60*	1	92*	3	165*	5	82*	3	107*	6	67	3	167*	10

[†]Values are corrected for age, sex, urban/rural, energy intake, education and occupation of the mother and wealth quintile (GLM, see Table 5 and 6).
[‡]291 kcal/day (mean intake in the dairy users) is equivalent to about 300 mL milk per day.
*Significant different ($p<0.05$) compared to non dairy users.

behind in linear growth in the higher age groups (Table 1). Low HAZ values were observed in all four SEANUTS countries[2,7-9] and it might be questioned whether the WHO references[18,19] are suitable as standard in the Asian population.[27,28] Also the weight corrected for height development (BAZ) was below the international WHO reference,[18,19] but was, apart from a small peak in the age group 1 to 3 years, constant over age.

Overall, dairy consumption was low in Indonesian children, with more than 70% of the children reporting to be a non-dairy user. Obviously, there were more dairy users in the younger age group, but the rapid decrease in consumption of dairy products with age is striking (Table 1). No specific information on the consumption of dairy products by 0.5-12 year olds in Indonesia has been published before. However, the National Socio-economic Survey (Susenas) of the Central Board of Statistics, Indonesia, found that the consumption of dairy products was only 2.04 kg/capita/year (5.6 g/capita/day). As in this study, dairy products most frequently consumed in 2013 were powdered milk (whole and skimmed milk), sweetened condensed milk, infant formula, and UHT/fresh milk.[29] In an earlier study in Indonesia, it was found that factors associated with the amount of dairy consumption include rural/urban area, education and occupation of household head, socio-economic class and age.[30] Also related were the need of dairy products for household members (infants), brand loyalty, dairy product quality, advertisement and promotion, and socio-cultural factors.[31]

There can be various reasons for the low dairy consumption in Indonesia, ranging from dairy not being part of a traditional diet, unawareness of the benefits of dairy (education) and affordability. Education surely played a role in determining dairy consumption, as dairy consumption was much more frequent in the children of higher educated mothers (Table 2). Occupation of the mother also played a role, with mainly children of mothers with a permanent job being more frequent dairy consumers. Partly, this could be an economic effect too, which was also seen in the income graduation. Children in the lowest wealth group were more likely to be non-dairy users and children in the highest wealth group the most frequent dairy users (Table 2).

With the exception of the youngest age group, RDAs were not met for most nutrients and were sometimes even far below a sufficient level, as s for vitamin C in the 3 to 6 year olds (Table 3). The exception of the youngest age group might be partly due to a higher intake of essential nutrients due to breastfeeding, or mixed feeding. Actually, only intakes of protein and to a lesser extent energy were satisfactory for all age groups. This might be due to a focus by governmental programs on adequate energy and protein intakes.[4] With the low achievement of RDA levels, it is not surprising that studies show a high prevalence of anaemia, iron deficiency and vitamin D deficiency in Indonesia.[2]

The contribution of dairy to energy intake gradually falls with age, from a substantial 20 percent points RDA to just one percent point RDA at the age of 9 years and older (Table 3). One can speculate that the gradual decrease in intake of dairy products with age might contribute to the decreasing achieved RDA levels at older age.

Dairy use contributes to the achievement of RDAs and this effect is more pronounced when the frequency of dairy use is higher (Table 4). In children using dairy at least twice a day, all RDAs were met, with the exception of zinc and vitamin A. The contribution of dairy to this achievement was large and the improvement was entirely due to the use of dairy.

However, it is likely that dairy intake (see Table 2) and quality of the diet can be affected by age, gender, area of residence and socio-demographic variables, including education and occupation of the mother and income. In addition, it will also be easier to meet RDA values when energy intake is higher. For that reason the effects of these confounding factors on the achievement of RDAs for various nutrients were determined. Although a positive effect of dairy intake on the achievement of RDA remained obvious, the effects were smaller after correction for the higher energy intake of dairy users (dairy users had an average 200 kcal/day higher energy intake, Table 4) and after correction for socio-demographic variables (mainly urban/rural, wealth and education) (Table 5 and 6). Thus, the positive effect of dairy intake on achievement of RDAs was at least partly attributable to the increased energy intake of dairy users.

The current data on frequency of dairy use did not allow to calculate the amount of dairy used, but an estimate of overall dairy use can be obtained based on the 24 h recall data and calculated energy from dairy. Dairy intakes over 291 kcal/day (average value of energy from dairy, equivalent to about 300 mL milk) in combination with the Indonesian diet allowed the RDAs for protein, calcium, iron, vitamin B-2, C and D to be met, independent of total energy intake and socio-demographic variables (Table 7).

Today, many dairy products are fortified, also in Indonesia, enabling a positive effect of dairy use on intakes of nutrients that are normally not present in dairy products.[13,14] An example is the fortification of milk with iron and vitamin D. The fortification of dairy products with iron and vitamin D resulted in adequate intakes of these nutrients in dairy users compared to non dairy users. Given the high prevalence of anaemia, iron deficiency anaemia and vitamin D deficiency in Indonesia,[2] this is important to notice.

In summary, the study showed that the adequacy of nutrient intakes of Indonesian children is far below the recommended RDAs, with generally lower achieved RDAs in rural children. Knowledge (education of the mother) and higher wealth are main contributing factors to a better nutrient intake. Dairy intake had a positive effect on the achievement of the RDAs for many nutrients, an effect that was partly due to its high nutrient density[13,14] and its energy contribution. With an estimated daily intake of about 300 mL milk in the existing Indonesian diet, RDA's could be achieved for protein, calcium, iron, vitamin B-2, C and D.

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AUTHOR DISCLOSURES

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Original Article

The effect of socio-demographic variables and dairy use on the intake of essential macro- and micronutrients in 0.5-12-year-old Indonesian children

Yekti Widodo MSc[1,2], Sandjaja Sandjaja DrPH[1,3], Edith Sumedi MSc[1,4], Ilse Khouw PhD[5], Paul Deurenberg PhD[6]

[1]*SEANUTS Indonesian Team, PERSAGI, Kebayoran Baru, Jakarta, Indonesia*
[2]*Center of Public Health Intervention Technology, NIHRD, MoH, Indonesia*
[3]*Center of Applied Health Technology and Clinical Epidemiology, NIHRD, MoH, Indonesia*
[4]*Division of Nutrition, Polytechnic of Health Jakarta II, MoH, Indonesia*
[5]*FrieslandCampina, Amersfoort, the Netherlands*
[6]*Nutrition Consultant, Langkawi, Malaysia*

社会人口学因素和乳制品摄入对 0.5-12 岁印度尼西亚儿童必须宏量和微量营养素摄入的影响

背景与目的：研究营养素摄入、奶制品摄入和社会经济因素之间的关系。**方法与研究设计**：采用 24 小时膳食回顾法收集 3600 名年龄为 0.5-12 岁儿童的膳食摄入量，并收集其乳制品的使用频率、人体测量指标和社会人口学指标。**结果**：总的年龄别身高 Z 分数和年龄别体质指数 Z 分数（均数±标准误）分别为-1.40±0.03 和-0.48±0.03，其与人群中发育迟缓和消瘦的高发生率相关。不使用任何乳制品的儿童占总人数的 71%，并且这一比例随着年龄的增长而稳步增长。乳制品来源的总能量摄入平均为 99±3 千卡/人/天，乳制品使用者来自总乳制品的能量为 291±7 千卡/人/天。乳制品的使用没有性别差异，但城市地区高于农村地区。另外，如果母亲受教育程度越高、母亲有一份稳定的工作、或者家庭的收入状况处于偏上水平的儿童，其奶制品的使用频率也较高。3 岁之后，除了蛋白质，能量和所有营养素的摄入是不足的。校正乳制品来源的更高能量摄入和社会人口因素之后，与非乳制品使用者相比，乳制品使用者所有营养素达到推荐膳食摄入量的比例更高，随着乳制品使用频率的增加贡献也增加。**结论**：摄入充足的乳制品将大大促进印度尼西亚儿童达到推荐膳食摄入量。

关键词：印度尼西亚、儿童、营养摄入量、营养状况、奶制品使用