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Short Communication: Recommended Dietary Allowance for School-Aged Children in Cambodia

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Abstract: Nutrient standards have not been developed for school-aged children in Cambodia, which has led to a lack of basic nutritional education and feeding programs in schools. This article highlights the recommended dietary allowance (RDA) for school-aged children in Cambodia, which was developed by the Ministry of Health in 2016 with the participation of representatives from relevant government agencies, international organizations, and non-governmental organizations. Because of the limited amount of data and scientific knowledge specified for Cambodia, this new RDA (CAM-RDA) was based on Southeast Asian RDAs (SEA-RDA) and used extrapolation methods shown in various guidelines such as those of the World Health Organization/Food and Agriculture Organization/United Nations, Japan, or the USA/Canada. First, the Foundation for International Development/Relief (FIDR) conducted a nutritional survey using a 24-h dietary method combined with anthropometric measurements among 2,020 children aged 6–17 years throughout Cambodia between November 2014 and July 2015 (CAM-data). The body weight and height values recorded were much lower than the reference values used in SEA-RDA. Therefore, an estimated ideal weight was determined as the reference value for CAM-RDA; that is, the intermediate value between of the reference value from SEA-RDA and the median value from the CAM-data was set to the reference weight values to calculate the requirements for energy and 19 nutrients in the CAM-RDA. Because an increase in body weight of Cambodian children is expected in the future due to nutrition transition, the reference values should be reviewed. We hope that the CAM-RDA will help in guiding the national nutritional policies in Cambodia.

Keywords: Cambodia, School-Aged Children, Recommended Dietary Allowance, Development, Reference Weight

1. Introduction

National dietary recommendations or guidelines have been formulated worldwide for education and feeding programs. However, some countries, such as the Kingdom of Cambodia, located on the Indo-China peninsula in Southeast Asia, have no established standards for nutrient intake. According to the Cambodia Inter-Censal Population Survey [1], school-aged children (6–17 years) account for approximately 24.6% of the total population. Productivity of the young population is one of the key factors for sustaining the future development of Cambodia, which means that promoting their health is imperative and strategies for maintaining their nutritional status are indispensable. Recommended dietary allowances (RDAs) can be used to assess the nutritional status of the population.

To date, no RDA have been developed specifically for the Kingdom of Cambodia, and the country has relied on the Southeast Asian RDAs (SEA-RDA) [2] or others. There are, however, differences between the reference weight values of the SEA-RDA and that of the Cambodian children. Reference weight (i.e., average or standard weight) is used to formulate RDAs and greatly impacts the calculated value. Thus, new RDAs for school-aged Cambodian children that are

formulated using reference weight values based on current data are needed. Under these circumstances, the Department of Preventive Medicine, Cambodian Ministry of Health (MoH) has recognized the necessity of creating a set of food-based dietary guidelines for Cambodian school-aged children. Despite the department's efforts to seek technical and financial support, this initiative was not launched until the Foundation for International Development/Relief (FIDR) provided support. Subsequently, the FIDR conducted a nationwide survey to assess the nutritional status and dietary intakes of Cambodian school-aged children. This led to the formulation of a set of RDAs and food-based dietary guidelines for this population. During the formulation process, the FIDR reported to the Development Team, which comprised members from relevant departments of the Royal Government of Cambodia, as well as from international and non-governmental organizations. Finally, the RDA and food-based dietary guidelines were endorsed by the MoH, and the guidelines were officially launched in November 2017. This article aimed to introduce the newly developed RDA for school-aged children in Cambodia (CAM-RDA) [3].

2. Development Process of CAM-RDA

2.1. Data Source (CAM-Data)

Data for formulating the CAM-RDA were collected from a survey conducted by the FIDR between November 2014 and July 2015 in collaboration with the Department of Preventive Medicine, Cambodian MoH. Ethical approval for the survey was obtained on August 25, 2014 from the National Ethics Committee for Health Research of the Cambodian MoH. The study sample comprised a total of 2,020 children aged 6–17 years (959 boys; 1,061 girls) selected randomly from 136 schools (elementary, junior high, and senior high schools) in 23 provinces and Phnom Penh. Of these, 32/40 (boys/girls) were aged 6 years, 200/222 were aged 7–9 years, 251/281 were aged 10–12 years, 310/360 were aged 13–15 years, and 166/158 were aged 16–17 years [3].

2.2. Age Groups

Five age groups were set with reference to the SEA-RDA, i.e., (4)–6, 7–9, 10–12, 13–15, and 16–17(18) years. The data of 4, 5 and 18 years old were excluded in this survey.

2.3. Reference Weight

The reference weight values have a strong influence on the RDA, therefore, reference weight values were determined carefully while also considering the reference weight values used in other countries. First, we found that the reference weight values were different among the six Eastern Asian countries (Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam) as well as the WHO and the USA [4]. Second, the SEA-RDAs adopted the WHO-recommended reference value for children; however, it was stated that the reference weight values should be based on ideal weight values determined using reliable and more recent local data [2]. Third, although Cambodia is located in Southeast Asia, CAM-data was found to differ from the reference data in the SEA-RDA [2].

Therefore, an ideal weight was estimated and used as the reference value for CAM-RDA; that is, the intermediate value between of the reference value from the SEA-RDA [2] and the median value from CAM-data were set to the reference values to calculate the requirements for energy and 19 nutrients in the CAM-RDA [3].

2.4. Selected Nutrients and Calculated Values

Requirements for energy and 19 nutrients were selected to formulate the CAM-RDA, based on the SEA-RDA and considering the international trends in nutritional strategy.

The estimated energy requirement (EER) was calculated for the energy values. Both the estimated average requirement (EAR) and the RDA were calculated for protein, calcium, iron and copper. The RDAs were calculated for zinc, iodine, selenium, vitamins A, D, C, B_1, B_2, niacin and folate. Tentative dietary goal for the prevention of life-style related diseases (DG) were determined for fat, dietary fiber, sodium, and potassium intakes. Adequate intake was defined to phosphorus.

2.5. Calculation Methods

Dietary intakes of energy and nutrients were calculated using the FIDR Nutrition Calculation Database 2013 which was developed based on the ASEAN Food Composition Tables [5] and SMILING food composition tables for Cambodia [6]; the median values of each group by age and sex (hereafter CAM-Data) were obtained. Next, the estimated energy requirements (EER) and RDA were calculated by an extrapolation method using the values from the SEA-RDA [2], reports from the World Health Organization (WHO)/Food and Agriculture Organization (FAO)/United Nations (UN) [7-11], and Dietary Reference Intakes (DRIs) in Japan (DRIs-J) [12], and in the USA/Canada [13]. The extrapolation methods are shown in Table 1, and calculation methods for each nutrition are as follow:

(1) Energy

Basal metabolic rates from the FAO/WHO/UN [7] were used, and the EER was calculated by multiplying the basal metabolic rate by the physical activity coefficient adopted from the DRIs-J [12].

(2) Protein

The EAR of protein was calculated using the factor addition method, which includes body protein mass, protein deposition, conversion for its utilization for growth, maintenance requirement, and efficiency of conversion from dietary protein. The RDA was calculated by multiplying the EAR by the coefficient of variation.

(3) Calcium

Using the calculation method and data for calcium intake from the DRIs-J [12], the EAR of calcium was calculated considering bone mineral accretion, urinary excretion, losses through the skin, and apparent calcium absorption. RDA was calculated by multiplying the EAR by the coefficient of variation.

Table 1. *Extrapolation methods for CAM-RDA.*

Target nutrients	Parameters/methods	Logic/Formula
Energy	FAO/WHO/UN method	Basal metabolic rate × Physical activity level + Energy deposition*
Protein, Calcium, Iron	Factorial method	Considering factors by nutrients.
Zinc, Iodine, Selenium, Vitamin A, D, C, Folate, Copper	Body surface area	$X^{\dagger} \times (\text{Reference weight}_{CAM}{}^{\ddagger} / \text{Reference weight}_{SEA}{}^{\S})^{0.75}$
Vitamin B_1, B_2, Niacin	Energy requirement	$X^{\dagger} \times EER_{CAM}{}^{\|} / EER_{SEA}{}^{\P}$
Fat, Dietary fiber, Sodium (Salt), Potassium, Phosphorus	DRIs-J, WHO and USA/Canada	Based on CAM-data and calculated using the methods established.

* Energy deposition =Weight gain (kg/year) obtained from CAM-data × 1000/365 × Energy density of body tissue
† SEA-RDA value or DRIs-J value
‡ Reference weight of CAM-RDA
§ Reference weight of SEA-RDA
|| EER_{CAM} = EER of CAM-RDA
¶ EER_{SEA} = EER of SEA-RDA

(4) Iron

The EAR of iron was calculated considering basal iron losses, iron deposition in hemoglobin, increment of tissue iron, increment of iron storage, and iron absorption rate. Separate values were calculated for girls aged 10 years or older considering iron losses from menstruation. RDA was calculated by multiplying the EAR by the coefficient of variation.

(5) Vitamins B_1, B_2, and Niacin

The RDAs for Thiamine (Vitamin B_1), Riboflavin (Vitamin B_2), and Niacin were calculated based on the EER of CAM-RDA.

(6) Zinc, Iodine, Selenium, Vitamins A, D, C and Folate

The RDAs of vitamins A, D, and C, Folate, Zinc, and Iodine, and Selenium were extrapolated from the SEA-RDA values [2].

(7) Copper

The EAR of copper was extrapolated from the DRIs-J values [12]. The RDA was calculated by multiplying the EAR by the coefficient of variation.

(8) Fat

DRIs-J values were adopted for fat intake [12], which recommended 20–30% of the total energy intake in every age group.

(9) Dietary fiber

The DG for dietary fiber was calculated by using CAM-data combined with the values of the DRIs-J [12]

(10) Sodium

The average value between the WHO recommended level <2000 mg/day sodium (5 g/day salt) adjusted for the EER and the value of CAM-data was calculated for the DG of Sodium and salt [9].

(11) Potassium

The recommended intake of at least 3,510mg/day by WHO was adjusted downward for children based on the energy requirements of children relative to those of adults [10]. The EER of the SEA-RDA [2] was used for the value of adults because of the lack of data on energy intake of Cambodian adults.

(12) Phosphorus

The average value between DRIs in the USA/Canada [13] and the value of CAM-data was calculated for phosphorus.

2.6. The Developed CAM-RDA

The newly CAM-RDA is developed as Table 2 shown with the values of energy and 19 nutrients by age groups and genders.

3. Future of CAM-RDA

As reference weight and height values are important in the formulation of DRIs and RDAs, many countries revise these reference values according to current values of weight and height in the population. In Japan, during the evaluation of DRIs in 1959, it was stated that the estimated ideal. weight and height measurements needed to be revised according to the current data; this was because these measurements in the younger population had exceeded the reference value due to rapid increase in weight and height [14]. The first revision for DRIs was done in 1969 [15] by the estimated ideal weight and height to be 1 year later by the years' growing, considering the School Health Statistics and a national nutrition survey. From the second revision, the DRIs had adopted the estimated ideal weight and height to be 5 years later as the reference values and revised until the fifth revision in 1994 [16]. With economic growth, the weight and height of Japanese children has increased greatly and nutritional status has improved since the DRIs were established. Furthermore, "the current mean value", based on the national survey, has been used as the reference value since the sixth revision of the DRIs in 1999 [17].

In the newly developed CAM-RDA, the current mean value of CAM-data was not adopted as the reference value because it was necessary to improve the current nutritional status of school-aged children. It is expected to increase the weight and height of Cambodian children in the future when economic growth is expected. It is, therefore, the estimated ideal weight used as the reference value for CAM-RDA would be changed according to the actually observed values by the current survey. CAM-RDA should be revised according to the changes in weight and height measurements in the target population in the future. Furthermore, the information of the CAM-RDA has been translated into food-based dietary guidelines (FBDG) [3], which comprises simple messages on healthy eating, would promote nutritional recommendations and be used as tools for nutrition education in schools as well as for interventions among the public [3].

Table 2. *CAM-RDA [3].*

Gender	Age Group* (years)	Reference Body Weight	Energy			Protein		Calcium	Iron
			Light†	Middle†	High†	Estimated Average Requirement	Recommended Dietary Allowance		
		kg	kcal			g		mg	mg
Boys	(4)–6	19	1,300	1,500	1,700	25	30	550	6.5
	7–9	24	1,500	1,700	1,900	30	40	600	7.5
	10–12	30	1,800	2,100	2,300	40	50	750	7.0
	13–15	42	2,200	2,500	2,700	45	60	850	12.0
	16–17 (18)	53	2,500	2,800	3,100	45	60	750	9.0
Girls	(4)–6	18	1,300	1,500	1,600	25	30	500	6.0
	7–9	24	1,500	1,700	1,900	30	40	650	8.0
	10–12	31	1,700	2,000	2,200	40	50	850	9.0/13.5‡
	13–15	43	2,000	2,200	2,500	40	50	750	9.5/13.5‡
	16–17 (18)	48	2,100	2,300	2,600	40	50	650	6.0/10.0‡

Gender	Age Group* (years)	Zinc	Iodine	Selenium	Vitamin A	Vitamin D	Vitamin C	Thiamin	Riboflavin
		mg	µg	mg	µg	µg	mg	mg	mg
Boys	(4)–6	5.5	90	20	450	5	30	0.6	0.6
	7–9	5.5	110	20	450	5	30	0.8	0.8
	10–12	6.0	110	30	550	5	60	1.2	1.3
	13–15	8.0	140	30	550	5	60	1.1	1.2
	16–17 (18)	8.5	140	30	600	5	60	1.1	1.2
Girls	(4)–6	5.5	80	20	400	5	30	0.6	0.6
	7–9	5.5	110	20	450	5	30	0.8	0.8
	10–12	5.5	110	25	550	5	60	1.1	1.0
	13–15	7.0	140	25	550	5	60	1.1	1.0
	16–17 (18)	7.0	150	25	600	5	60	1.1	1.0

Gender	Age Group* (years)	Niacin	Folate	Fat§ (median)	Dietary Fiber	Sodium (salt)	Potassium	Phosphorus	Copper
		mg	µg	%	g	mg (g)	mg	mg	mg
Boys	(4)–6	8	200	20–30 (25)	8	1,600 (4)	1,300	500	0.5
	7–9	11	300	20–30 (25)	10	1,600 (4)	1,400	600	0.5
	10–12	15	400	20–30 (25)	12	1,600 (4)	1,700	850	0.6
	13–15	15	400	20–30 (25)	15	2,000 (5)	2,000	950	0.8
	16–17 (18)	15	400	20–30 (25)	18	2,000 (5)	2,300	950	1.0
Girls	(4)–6	8	200	20–30 (25)	8	1,600 (4)	1,400	450	0.5
	7–9	11	300	20–30 (25)	10	1,600 (4)	1,700	550	0.5
	10–12	15	400	20–30 (25)	12	1,600 (4)	2,000	850	0.6
	13–15	15	400	20–30 (25)	15	2,000 (5)	2,200	900	0.7
	16–17 (18)	15	400	20–30 (25)	16	2,000 (5)	2,300	900	0.7

* 4,5 and 18 years old were excluded from the data collection.
† Mets (metabolic equivalent) by age group (low/middle/high): 4–6 (1.35/1.55/1.75), 7–9 (1.38/1.58/1.78), 10–12 (1.47/1.67/1.87), 13–15 (1.52/1.72/1.92), and 16–17 (1.55/1.75/1.95)
‡ Menstruation
§ Fat percentage from total energy
[3] Source: Quoted from Development of Recommended Dietary Allowance and Food-Based Dietary Guidelines for School-aged Children in Cambodia. 2017

4. Conclusion

The first RDA for school-aged children in Cambodia (CAM-RDA) was endorsed by the Ministry of Health, Royal Government of Cambodia in November 2017. The CAM-RDA should be used to guide national nutrition policies such as nutritional assessment, nutritional education, and feeding programs for school-aged children in Cambodia in the future.

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Conflict of Interest

The authors have no conflicts of interest.

References

[1] National Institute of Statistics, Ministry of Planning, Cambodia Inter-Censal Population Survey 2013. Phonm Penh, 2013. Available at http://www.stat.go.jp/info/meetings/cambodia/pdf/ci_fn02.pdf (Accessed June 1, 2018).

[2] E-Siong Tee, Rodolfo F. Florentino, Recommended dietary allowances: Harmonization in Southeast Asia. International Life Sciences Institute, Singapore, 2005. Available at http://ilsisea-region.org/wp-content/uploads/sites/21/2016/06/ILSI-SEAR-Monograph-ASEAN-RDAs.pdf. (Accessed June 1, 2018).

[3] Foundation for International Development/Relief (FIDR), Development of Recommended Dietary Allowance and Food Based Dietary Guidelines for school-aged children in Cambodia 2017. Available at http://www.fao.org/3/I9704EN/i9704en.pdf (Accessed June 8, 2018).

[4] E-Siong Tee, 1998. Current Status of Recommended Dietary Allowances in Southeast Asia: A Regional Overview. Nutrition Reviews 56, 10-18. doi.org/10.1111/j.1753-4887.1998.tb01709.x.

[5] Puwastien P, Burlingame B, Raroengwichit M, Sungpuag P, ASEAN Food Composition Tables 2000. Institute of Nutrition, Mahidol University, Thailand, 2000.

[6] INFOODS, SMILING food composition table for Cambodia. 2013. Available at http://www.fao.org/infoods/infoods/tables-and-databases/asia/en/. (Accessed June 1, 2018).

[7] WHO, Energy and protein requirements: Report of a Joint FAO/WHO/UNU Expert Consultation. WHO Technical Report Series 724. Geneva, 1985.

[8] FAO, Human energy requirements. Report of a Joint FAO/WHO/UNU Expert Consultation. 17-24. Rome, 2001.

[9] WHO, Guideline: Sodium intake for adults and children. Geneva, 2012.

[10] WHO, Guideline: Potassium intake for adults and children. Geneva, 2012.

[11] WHO, Diet, nutrition and the prevention of chronic diseases. Report of a Joint FAO/WHO Expert Consultation. WHO Technical Report Series 916. Geneva, 2003.

[12] Ministry of Health, Labor and Welfare (Scientific Committee of Dietary Reference Intakes for Japanese), Dietary reference intakes for Japanese (2015 revision). Tokyo, 2014. (in Japanese).

[13] Food and Nutrition Board, Institute of Medicine. Dietary reference intakes for calcium, phosphorus, magnesium, vitamin D, and fluoride. National Academy Press, Washington, DC, 1997. Available at https://www.ncbi.nlm.nih.gov/books/NBK109825/pdf/Bookshelf_NBK109825.pdf (Accessed May 30, 2018).

[14] Ministry of Health and Welfare (Section of Nutrition, Council for Public Health), Recommended dietary allowance for Japanese. Tokyo, 1959. (in Japanese).

[15] Ministry of Health and Welfare (Section of Nutrition, Council for Public Health), Recommended dietary allowance for Japanese (1969 revision). Tokyo, 1969. (in Japanese).

[16] Ministry of Health and Welfare (Section of Health Promotion, Council for public Health), Recommended dietary allowance for Japanese (5th revision). Tokyo, 1994. (in Japanese).

[17] Ministry of Health and Welfare (Section of Health Promotion, Council for public Health), Recommended dietary allowance for Japanese (6th revision). Tokyo, 1999. (in Japanese).