

Korean RDA :Are the Dietary Reference Intakes (DRI) Exportable?*

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The Dietary Reference Intakes which were developed by the Food and Nutrition Board, National Academy of Sciences of the United States, and Health Canada provide a good deal of information on nutritional requirements which apply to Korea. In addition, the processes of evidence based review of information on nutrient needs, dietary excess, and the assessment and planning of dietary intakes may be useful in Korea as well as North America. However, other aspects of the Dietary Reference Intakes may not be appropriate. This article discusses these issues.

Key words : Dietary Reference Intakes (DRI), nutrient requirements, Estimated Average Requirements (EAR), Recommended Dietary Allowances (RDA)

INTRODUCTION

The Dietary Reference Intakes (DRI) represent an investment of millions of dollars by the governments of Canada and the United States and other groups, and over a hundred thousand hours of work by volunteer nutrition scientists and staff on the various DRI committees that produced these dietary standards¹⁻⁵. The completion of a report on electrolytes scheduled for later this year marks the fruits of a decade of collaboration between scientists in Canada and the United States to develop dietary standards for English speaking North America. The sheer magnitude and time devoted to the DRI process surpasses the resources devoted to similar efforts in other countries, other regions and by the international organizations. While all of this effort does not guarantee that the resulting reference standards are more correct or valid than those of other bodies, it is certainly reasonable for scientists elsewhere to build upon this work as they create dietary reference intakes for their own countries.

Is there information in the decade-long effort of Health Canada and the National Academy of Sciences' Institute of Medicine's Food and Nutrition Board in the United States that may be exportable as deliberations begin on updating the Korean dietary standards? Korean nutrition scientists posed many excellent questions about this topic

at the joint Korean-American symposium devoted to the issue of using the DRI in Korea at the April 2003 Experimental Biology meetings in San Diego, California. This article represents one view of possible answers to their questions.

What DRI values can be exported to Korea?

The DRI "model" or paradigm is certainly exportable in most respects to Korea, whereas some individual values may not be so.

EAR : The estimated average requirement (EAR) for a nutrient is defined for each age and sex group using a specific functional criterion. This value presumably reflects representative requirements for *Homo sapiens* as a species rather than any specific race/ethnic group. The EAR used in the DRI should therefore be useful in Korea if the functional indicator chosen is deemed appropriate. For a relatively affluent country such as the Republic of Korea the use of chronic disease related functional indicators for setting EAR's might be appropriate. However, in countries where protein calorie malnutrition or micronutrient undernutrition is present, an alternative functional criterion for setting the EAR might be more appropriate (e.g. a clinical indicator of deficiency). Korean scientists may decide that different functional criteria should be chosen for ascertaining the EAR for some nutrients rather than those chosen in the DRI. In such cases, the DRI still may be useful since the DRI volumes include useful evidence-based reviews of the data available on other possible functional criteria. Thus the DRI may provide the background necessary and a

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starting point for beginning the arduous process of evaluating the evidence for other functional criteria, if that is desired.

RDA : The Recommended Dietary Allowance (RDA) is another exportable concept, but only if some of the assumptions that are built into the current recommendation are accepted. For example, the RDA is calculated from the EAR and set at an intake that would be adequate for 97-98% of the individuals in the population. And of course the RDA, is based on the same specific functional criteria. The values are specific to the functional criteria chosen in the DRI.

UL : The tolerable upper level (UL) is another concept that may be useful in crafting Korean dietary reference standards. The UL also presumably reflects the biological response of *Homo sapiens* to excessive amounts of a nutrient. It is intended to apply more or less universally. However, several caveats should be noted. First, the model is a new one, adopted from largely from the toxicological literature and one that is much less familiar to nutrition scientists than that used to establish the EAR. Second, the signs of toxicity that were chosen for the UL range from rather serious side effects and health risks to more innocuous ones (e.g. flushing), and this has led to consternation in some quarters. Third, because there is much less data available to set upper levels many values were interpolated or extrapolated for certain age/sex groups to that of others, such as children. It is not clear whether such values are valid. The UL's for zinc and vitamin A for very young infants and children may need to be reassessed, for example. Also it is not always known how the UL relate to other biomarkers such as serum levels of nutrients or metabolites or to risk in humans. More work must be done to elucidate these relationships.

What DRI values are not exportable to Korea?

AI : The adequate intake (AI) is not exportable, because it is usually set using median or average intakes of presumably healthy Americans and Canadians, whose food habits are very different from those of Koreans. The AI is an indicator of lack of knowledge. It shows that for a particular nutrient the functional outcome indicators of greatest interest need additional study before definitive conclusions about appropriate EAR's or RDA can be made. The AI is also a troublesome concept that has been confusing to define and to use. If different functional indicators appear to be appropriate for which EAR's can be derived, that approach should be considered rather than the AI approach.

Population-Based Nutrient Recommendations : Food patterns and the distribution of nutrient intakes vary greatly from country to country. Therefore a good deal of thought must go into planning the application of the

DRI to national nutrition policy for dietary assessment and planning. Population-based recommendations for nutrient intakes designed for North American populations may be inappropriate for Korea. Some data requirements for assessment and planning are discussed later in this article.

What nutrient values can the Korean RDA use from the DRI?

The DRI recommendations for values of some nutrients are more secure than they are for others because of the amount of data that was available. For some nutrients data are sparse, especially for certain age/sex/physiological state groups. Also, the evidence-based review upon which the recommendations were based only includes information published up to the time that each DRI volume was written, and some of them are now over five years old. Additional studies published since the DRI was completed should be considered in order to corroborate experts' judgments of appropriate values or to signal the need for additional review.

Micronutrients : The EAR , RDA, and UL for most of the micronutrients can probably be used, but adjustments may be needed to cope with issues such as bioavailability, nutrient-nutrient interactions, the forms of nutrients in diets, and other factors

Macronutrients : The EAR, RDA, and UL values for protein and essential fatty acids may also be useful in terms of defining requirements and recommended intakes, after making appropriate adjustments for the same factors as mentioned above.

Energy : Energy needs as expressed as Estimated Energy Requirements (EER) should also be applicable after adjustment for body size, climate, physical activity and other factors. The "reference person" is certainly different in size from the reference values used in North America.

Population-based recommendations for energy might differ, however, for subgroups that are undernourished and who might need rehabilitation to build up energy stores. Arguably these persons could be regarded as ill and thus by definition not covered by the recommendation, however this might be the case if a single set of energy recommendations were adopted for the entire Korean peninsula.

Acceptable Macronutrient Distribution Ranges (AMDR) : The acceptable ranges of intakes for energy providing nutrients that have been suggested in the DRI may need more study for application to the Korean situation. The sources of energy yielding nutrients in Korea are quite different than they are in the United States, especially for type and amount of fat, carbohydrate, and protein type and amount of fiber also vary. Also the functional indicators for setting these ranges and assum-

ptions should be examined to determine if they are appropriate for Korean concerns and uses. The distinctions made about added vs. naturally occurring sugars and fibers may be less relevant in Korea than they are in the USA and Canada.

What Basic Data are Needed for Korea to Use the DRI?

EAR, RDA, UL Values : The EAR, RDA and UL values for most nutrients can be used. Occasionally new values maybe needed. Also, new data, such as metabolic studies may be needed in some cases. The DRI provide a long list of possibilities for additional research.

Nutrient Intakes : Korean food and nutrition surveys are needed to determine what Koreans eat and what the sources of nutrients are from food and dietary supplements or other sources, such as water. Means and distributions of intakes must be available.

There is a critical need for data from Korea not only on median or mean intakes, but also on the distribution of nutrient intakes in the population and within specific subgroups of the population for applying the DRI for assessment and planning purposes^{6,7}. The amount and distribution of intakes of some nutrients are probably very different in Korean and North American populations, and therefore the data must be collected specifically for Korea.

Two reports on the uses of the DRI are valuable to review for population assessment and planning purposes. Several methods for population-based assessment and planning are presented that may be useful and generalizable to the Korean situation. For example, in assessment of the adequacy of intakes of populations, adjustments must be made in using survey data for day to day variation in intakes⁸⁻¹¹. Scientists in the Republic of Korea may wish to consider ways it can collect at least two days of dietary information for a representative sample of individuals in its nutrition survey to make it possible to apply these methods. Also, it is important to assess total dietary intakes of nutrients from all sources, not only food sources. This implies that sources of nutrients from dietary supplements and other sources must be considered as well. Also, additional reports may be helpful, such as the recent supplement to the Journal of Nutrition on applying the DRI to the analysis and planning of national survey data¹².

Many of the methods for planning nutrient intakes of population groups are also useful in the Korean context. For example, in the planning of feeding programs for groups, consumption rather than food offered is more likely to be related to nutritional status, and estimates of actual consumption should therefore be used. However the specific examples of implementation, which are all from North America, may be of limited utility in

Korea, but the underlying concepts are the same.

In all countries, the potential strategies that are chosen to assure that nutrient needs of the population are met are the same. However the wisest course to take may vary from country to country. For shortfalls of a nutrient intake, strategies include raising intakes of the entire population, or focusing on particular subgroups that are most likely to be vulnerable. For example, in the United States, fortification of the cereal products with folic acid has recently been introduced to increase the entire population's levels of this nutrient. In addition, targeted supplementation and education to women of childbearing age are being utilized. For excessive nutrient intakes, it might be appropriate to move the entire population's intakes to the left, or to focus on those subgroups which are very high consumers and to attempt to reduce their intakes from food, dietary supplements, or both. The most feasible strategies to deal with these issues probably differ in the United States, Canada, and Korea

Nutrient databases : New Korean food composition and nutrient databases maybe needed. In working with Korean data nearly a decade ago, we found that the Korean databases available lacked valid folic acid and fortificant values. The situation may be different today. US and Canadian databases lack many foods that Koreans eat frequently, and some of the foods sold in Korea may be quite different from Korean foods sold in the United States. It is also important in countries in which dietary supplement use is common that supplement databases included in dietary assessments. A database may therefore also be needed for dietary supplements that contain nutrients. The food composition database and the dietary supplement database need to interdigitate to permit estimates of total dietary intakes of nutrients. Software and databases are needed to do this in all countries.

What else need to be considered?

It would be useful in deliberations about the Korean RDA to compare evidence-based reviews and recommendations for dietary reference standards of different expert groups across the world. When an estimate of a nutrient requirement or excess is the same for similar functional criteria from all expert groups, this serves to verify the reasonableness of the DRI values, and increases confidence in and assurance of the likely veracity of the group's conclusions. When an estimate of a nutrient requirement or excess differs radically from one expert group to another, greater caution and more study will be necessary before the values can be adopted.

Neither the DRI experts nor the process are perfect. The rationale for using evidence-based reviews as the basis for recommendations is that if a different group of experts were to review the same data it would arrive

at approximately the same reference standards. However, there is no absolute assurance that in practice this actually happens. Recommendations are probably more likely to vary dramatically from one expert body to another when data are scarce or contradictory, when certain types of evidence are given more or less credence, when experts differ in their expertise or views, when opinions diverge widely on the meaning and interpretation of the data, and when differences exist in the choice of functional criteria.

Also, no matter how carefully they are reviewed reports of such magnitude on highly technical topics, including the DRI, inevitably contain some oversights, omissions and mistakes that only become obvious when many scientists scrutinize and use them. The DRI process does not permit a public "vetting" or review and discussion of tentative recommendations by the nutrition science community prior to their finalization, and as a result some mistakes or ill-advised phrases probably do slip through. Since the committees are dissolved when their reports are released, there is no opportunity for them to come together to deal with such matters.

Nevertheless, while it is true that over the past few years, some specific DRI recommendations have been questioned, in general the nutrition science community has readily accepted the reasoning and resulting recommendations. The most common criticisms for the EAR are of the functional criteria selected (e.g. fiber), and extrapolations or interpolations of adult values to other age/sex groups (e.g. levels of dietary fiber and functional outcomes chosen for infants and young children). The UL is a new concept that many nutrition scientists find difficult to understand; the model itself (a toxicological one) and functional criteria for excess have also been questioned in some instances (e.g. calcium, zinc, and folate in some age groups).

CONCLUSION

In summary, the DRI methods are exportable but some of the DRI values are not. The concepts embodied in the DRI are probably more universal than the specific values. Korean nutrition scientists may wish to consider adopting some of the functional criteria for evaluating nutrients, perhaps some values (e.g. the EAR and UL, and perhaps the RDA for micronutrients, protein, essential fatty acids, adjusted energy intake, and possibly some other values for energy providing nutrients. Some of the DRI methods for dietary assessment and planning may be helpful as well. The concept of the AI, and popula-

tion-based nutrient recommendations may have less utility because the Korean food supply and levels as well as distributions of nutrient intakes within the Korean population are likely to be so different from those in North America.

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