Dietary Reference Intakes for Japanese 2010: Basic Concepts for Application

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Summary

The Dietary Reference Intakes for Japanese (DRIs-J) 2010 is not merely as scientific report describing the intake of energy and nutrients necessary for prevention of deficiency/insufficiency and excess but also a source of practical guidelines in planning for dietary improvement in general and in food services by dietitians and other health professionals. This review briefly describes the basic concepts in the application of the DRIs-J 2010. It consists of two sections considering the purposes of use in the Dietary Reference Intakes (DRIs) in Japan: (1) the basic concepts in their application and related issues and (2) the methods of their application. The latter is further divided into 3 sections each describing a goal in the application of the DRIs: (1) improvement of diet for an individual, (2) improvement of diet for a group, and (3) management of food services. A major challenge in the application of the DRIs is that compared to research into determination of the intake of energy and nutrients for development of the DRIs, research into application of the DRIs has been extremely scarce in Japan. Due to lack of evidence, current application of the DRIs is conceptual rather than scientific and practical. Highly scientific research into application of the DRIs is thus urgently needed.

Key Words
dietary reference intakes, application, Japan

Introduction

This review briefly describes the basic concepts in the application of the Dietary Reference Intakes for Japanese (DRIs-J) 2010. Although the use of standardized concepts for DRIs has been proposed in the United States and Europe, universal concepts have not yet been established (1–3). As body size, major health problems, and nutritional intake all differ between Japanese and Western populations, country-specific conceptualization of the DRIs is needed.

Basic Concepts in DRI Application and Related Issues

1. Target individuals and groups

The targets of the DRIs are healthy individuals and groups mainly composed of healthy individuals, as well as individuals not receiving dietary education or undergoing dietary therapy or restriction and individuals with low levels of risk factors, such as high blood pressure, dyslipidemia, or hyperglycemia. In cases in which dietary education, therapy, or restriction is recommended to an individual or a group for treatment or prevention of a disease, disease-specific guidelines should be referred to and the DRIs-J 2010 should be used as a supplemental reference. Several studies have reported differences between the estimated average requirements (EARs) and the nutritional requirements of healthy individuals and certain groups, including the elderly (i.e., those needing nursing care) and the disabled (4–6). However, as evidence regarding these differences has not yet sufficiently accumulated, it is still unclear whether the values developed for healthy subjects are applicable to these groups.

2. Sources of intake

With some exceptions, the primary sources of energy and nutrients are foods eaten as meals, including fortified foods, and dietary supplements taken for health improvement and not for treatment of disease.

3. Duration of intake

The DRIs are standards for “habitual” intake expressed as “intake per day.” Thus, they apply to long-term rather than short-term (e.g., single-day) intake. This is due to the fact that health problems addressed by the DRIs are caused by habitual inadequate intake. The period needed to develop health problems due to inadequate intake depends on the nutrient(s) involved and the type of health problems. For example, serum vitamin B1 level decreases greatly 2 wk after eliminating vitamin B1 from the diet, and various symptoms caused by its deficiency emerge within 4 wk (7). This illustrates the necessity of dietary management of vitamin B1 within a period shorter than 1 mo. On the other hand, excessive intake of sodium (salt) is correlated with hypertension due to aging (8), indicating the importance of the dietary management of sodium over several decades.

Due to the characteristics of nutrient intake, in particular its day-to-day variability, it is difficult to define the habitual intake of a particular nutrient. According to previous observations (9–12), the period required for
assessing or managing habitual intake is approximately 1 mo, with some exceptions for nutrients with great day-to-day variability in intake.

4. **Priority of goals and nutrients in nutritional management** (Table 1)

Reliability and priority in application are not same among energy and nutrients. Maintaining adequate energy balance between intake and expenditure is fundamental in nutritional management. Nutrients are categorized into 2 types depending on the purpose of intake: avoidance of both insufficient and excessive intake (while considering natural growth in infants and children) and primary prevention of lifestyle-related diseases. As the former should be given priority, EARs, recommended daily allowances (RDAs), adequate intakes (AIs), and tolerable upper intake levels (ULs) should be determined prior to determining tentative dietary goals for preventing lifestyle-related diseases (DGs). DGs should only be considered when maintenance of health status is assured. Priority is also low for nutritional management of nutrients without confirmed deficiency in humans and for nutrients for which intake cannot be measured or estimated. However, the order of priority is not fixed and may need to be changed, depending on the characteristics of the individuals or groups that are being assessed and the goals of the DRIs.

5. **Points for application based on each of the DRIs**

5-1. **Estimated energy requirement.** In nutritional management, the estimated energy requirement (EER) of an individual must be considered to determine the energy per serving. The EER is determined by measurement of energy expenditure using the doubly labeled water method. Physical activity level (PAL) is estimated using the following formula, which is based on measurement of energy expenditure and basal metabolic rate (BMR):

\[
\text{EER} = \frac{\text{BMR}}{\text{PAL}}
\]

However, as the EER is immeasurable from an application point of view, it is estimated from BMR and PAL with consideration of sex and age class using the following formula:

\[
\text{EER} = \frac{\text{BMR}}{\text{PAL}}
\]

Nevertheless, the BMR is not always easy to measure, and the estimation error of PAL tends to be large. It is therefore not always practical to estimate energy requirements using the BMR and PAL.

Several formulae have been proposed to estimate the BMR based on individual characteristics, including sex, age, height, and weight, such as the Harris-Benedict equation (13); an equation developed by the Food and Agricultural Organization (FAO), the World Health Organization (WHO), and the United Nations University (UNU) (14); and the NIH equation for the Japanese population (15). However, equations developed for Western populations have been found to overestimate the EER for the Japanese population (16, 17). Thus, when using these equations for estimating an individual’s energy requirement, their reliability and applicability must be fully considered, in addition to the estimation error of PAL.

The true energy requirement has been found to have a standard deviation of 200 kcal/d among male adults and 160 kcal/d among female adults (18). Because of this wide variation in true energy requirement at an individual level and several other factors, determination of energy balance (i.e., balance between energy intake and expenditure) should be based on evaluation of body weight and body mass index (BMI), both of which are relatively easy to measure accurately, instead of comparison of EER with energy intake as evaluated by

<table>
<thead>
<tr>
<th>Energy/nutrient</th>
<th>Nutrients (examples)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Energy</td>
<td>—</td>
<td>Including alcohol</td>
</tr>
<tr>
<td>2. Protein</td>
<td>Protein</td>
<td>—</td>
</tr>
<tr>
<td>3. Fat</td>
<td>Fat</td>
<td>% energy (%E)</td>
</tr>
<tr>
<td>4. Nutrients listed in food composition table (nutrients for which both EAR and RDA or AI has been established)</td>
<td>Vitamin A, vitamin B1, vitamin B2, vitamin C, calcium, iron</td>
<td>Nutrients for which critical deficiency has been observed and for which prevention of deficiency is important. Requires consideration of relatively short-term intake.</td>
</tr>
<tr>
<td>5. Nutrients listed in food composition table (nutrients for which a DG has been established)</td>
<td>Saturated fatty acids, dietary fiber, sodium, potassium</td>
<td>Nutrients important in primary prevention of lifestyle-related diseases. Requires consideration of relatively long-term intake.</td>
</tr>
<tr>
<td>6. Nutrients not listed in food composition table</td>
<td>—</td>
<td>Usually low priority except for particular groups or groups with particular food habits.</td>
</tr>
</tbody>
</table>

1 Table appears in *Standard Tables of Food Composition in Japan*, 5th Revised and Enlarged Edition. DRIs-J, Dietary Reference Intakes for Japanese; EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; DG, tentative dietary goal for preventing lifestyle-related diseases.
differential assessment.

5-2. **EAR and RDA.** Since use of the EAR poses a 50% probability of insufficient intake, dietary intervention is needed when the intake of several or many members in a group is below the EAR. The RDA is the intake level that poses a nearly 0% of deficiency in an individual or the individuals in a group. Therefore, if the intake of individuals or a group approaches or is above the RDA, it can be assumed that they face nearly no risk of deficiency. However, users of the DRIs-J 2010 should understand the purpose and definition of each DRI and the characteristics of each nutrient because the application method differs according to the purpose.

5-3. **AI.** The AI is determined when the EAR is not available. Although there is very low risk of deficiency when the intake of a nutrient is above the AI, it is not possible to identify the existence of deficiency or its risk when intake is below the AI.

5-4. **UL.** The UL indicates a threshold intake above which a risk of health problems exists. Since UL values are theoretically and empirically difficult to establish, most are based on a few reports of accidental overdose, indicating the insufficiency of scientific evidence for determining ULs. Therefore, individuals should use ULs as values to avoid approaching rather than to avoid exceeding, and not use them in primary prevention of lifestyle-related diseases.

5-5. **DG.** A DG is established for primary prevention of lifestyle-related diseases. As diet is one of many causes of lifestyle-related diseases, it is not correct to strictly maintain DG simply for their primary prevention. For example, excessive intake of sodium (salt) is just one of several factors increasing the risk of hypertension (19). Compared to health problems due to insufficient or excessive intake, lifestyle-related diseases are considered outcomes of lifestyle factors, including dietary habits, sustained over very long periods. In view of this consideration, long-term (lifetime) management is more important than strict short-term management.

6. **Dietary assessment**

6-1. **Relationship to application.** Evaluation of energy and nutrient intake is performed for comparison of an intake value with its corresponding DRI value. However, due to the various problems discussed below, especially measurement errors in dietary assessment, users of the DRIs-J 2010 must pay careful attention to the means of standardization and endeavor to maintain accuracy in both assessment and interpretation of the values.

6-2. **Under- and over-reporting.** Of the several methods used for dietary assessment, most are based on self-reporting by subjects, inevitably leading to reporting errors. Of under- and over-reporting, the most significant reporting errors, under-reporting occurs more frequently. Under-reporting of energy in particular requires careful attention. In research, the level of measurement error differs, depending on the assessment method used and subject characteristics. Among Japanese adults, males under-report their energy intake by 11% on average and females by 15% (20).

Under-reporting may have a highly negative effect on the interpretation of a dietary assessment. For example, the excessive energy intake of a man who gains 5 kg in a year is 96 kcal/d (i.e., \(7,000 \times 5/365\)), assuming that 1 kg of body weight is equal to approximately 7,000 kcal (21, 22). The measurement error due to under-reporting by 13% would be 260 kcal/d for a man whose total energy intake is 2,000 kcal/d, a value much larger than the 96 kcal/d. This example shows that under-reporting makes it almost impossible to compare a value obtained by dietary assessment with the EER. Furthermore, under- and over-reporting are strongly affected by the degree of obesity (23). Comparing intake estimated from analysis of 24-h urinary excretion of nitrogen (a biomarker of protein intake), potassium, and sodium and the corresponding self-reported intake of Japanese subjects, one study found a clear relationship between the degree of reporting error and the degree of obesity in terms of BMI (24).

6-3. **Day-to-day variation.** It is widely known that day-to-day variations exist in energy and nutritional intakes (8). Nevertheless, determination of intake dis-

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Table 2. Differences between nutrient definitions in DRIs-J 2010 and Standard Tables of Food Composition in Japan, 5th Revised and Enlarged Edition.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>DRIs-J 2010</th>
<th>Food composition table¹</th>
<th>Notes when intake or serving size is estimated from food composition table² for use in DRIs-J 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin E</td>
<td>Only α-tocopherol is reported.</td>
<td>α-, β-, γ-, and δ-tocopherol are reported individually.</td>
<td>Only α-tocopherol should be used.</td>
</tr>
<tr>
<td>Niacin</td>
<td>Niacin equivalents (=niacin [mg] + 1/60 tryptophan [mg]) is used.</td>
<td>Nicotinic acid equivalent is used (niacin synthesized in the body from tryptophan is not included).</td>
<td>Niacin (mg) + 1/60 tryptophan (mg) should be used. Since tryptophan concentration in food is roughly 1/100 that of protein, its value approaches the value of niacin (mg) + 1/6,000 protein (mg), and can be rewritten as niacin (mg) + 1/6 protein (g).</td>
</tr>
</tbody>
</table>

¹ Reference 27).

² Since use of the EAR poses a 50% probability of insufficient intake, dietary intervention is needed when the intake of several or many members in a group is below the EAR. The RDA is the intake level that poses a nearly 0% of deficiency in an individual or the individuals in a group. Therefore, if the intake of individuals or a group approaches or is above the RDA, it can be assumed that they face nearly no risk of deficiency. However, users of the DRIs-J 2010 should understand the purpose and definition of each DRI and the characteristics of each nutrient because the application method differs according to the purpose.

³ The AI is determined when the EAR is not available. Although there is very low risk of deficiency when the intake of a nutrient is above the AI, it is not possible to identify the existence of deficiency or its risk when intake is below the AI.

⁴ The UL indicates a threshold intake above which a risk of health problems exists. Since UL values are theoretically and empirically difficult to establish, most are based on a few reports of accidental overdose, indicating the insufficiency of scientific evidence for determining ULs. Therefore, individuals should use ULs as values to avoid approaching rather than to avoid exceeding, and not use them in primary prevention of lifestyle-related diseases.

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tributions without consideration of day-to-day variations is required, as the DRIs do not consider variations despite the fact that the degree of day-to-day variation in energy and nutrient intake differs among individuals and groups (9–12). A further challenge is that due to difficulties in study methodology, actual day-to-day variation in the Japanese remains poorly investigated.

Day-to-day variation also poses difficulty in assessing the intake distribution of a group. Because of day-to-day variation, a distribution curve obtained from assessment of a nutrient over a limited number of days is narrower than that obtained from assessment of habitual intake. Therefore, the observed percentage of individuals with deficient/insufficient or excessive intake depends on the number of days examined in a dietary assessment (25). Moreover, seasonal variation as a component of day-to-day variation must be considered. The intake of several nutrients, including vitamin C, has been found to have clear seasonal variation in Japanese populations (7, 11, 24–26).

**Food composition table.** A food composition table is used to calculate nutrient intakes in a dietary assessment and those of the menu of a food service. However, the definitions of the nutrients slightly differ between the DRIs and the food composition table (27) (Table 2).

**Table 3. Basic concepts in applying DRIs-J 2010 for dietary improvement of individuals.**

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Indices</th>
<th>Dietary assessment</th>
<th>Planning for and application of dietary improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessment of energy balance</td>
<td>Change in BMI and/or body weight</td>
<td>Balance is negative when BMI is below 18.5 and positive when BMI is over 25.0.</td>
<td>Planning should aim to maintain BMI within normal range.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Evaluation of change by measurement of body weight change.</td>
<td>Note: Measurement should be performed at least twice within a certain period and plans reviewed and revised based on the results.</td>
</tr>
<tr>
<td>Assessment of insufficient nutrient intake</td>
<td>EAR, AI</td>
<td>Determination of percentage of individuals with intake below EAR.</td>
<td>Planning should aim to minimize the number of individuals with intake below EAR.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When using AI, compare AI and measured intake to ensure that intake is not below AI.</td>
<td>When intake is approximate to or above RDA or AI, planning should aim to maintain intake. Note: Measurement of intake below AI does not indicate the probability of inadequacy.</td>
</tr>
<tr>
<td>Assessment of excessive nutrient intake</td>
<td>UL</td>
<td>Estimation of possibility of excessive intake by comparing measured intake and UL.</td>
<td>When intake is above UL, planning should aim to reduce intake below UL. Note: Intake above UL should be avoided. When excessive intake is reported, plans should be reviewed, revised, and implemented promptly.</td>
</tr>
<tr>
<td>Assessment of risk of primary prevention of lifestyle-related disease</td>
<td>DG</td>
<td>Comparison of measured intake and DG. However, assessment should be done with comprehensive consideration of existence and degree of other nutrition-related and non-nutrition-related factors of target lifestyle-related disease.</td>
<td>Planning should aim to maintain intake within a range of DG. Note: Assessment of target nutrient should be conducted with comprehensive consideration of (1) the existence and degree of other nutrition-related and non-nutrition-related factors contributing to the target lifestyle-related disease and (2) the sustainability of a plan over the long term, as lifestyle-related diseases develop over the course of the lifespan.</td>
</tr>
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DRIs-J, Dietary Reference Intakes for Japanese; BMI, body mass index; EAR, estimated average requirement; RDA, recommended dietary allowance; AI, adequate intake; UL, tolerable upper intake level; DG, tentative dietary goal for preventing lifestyle-related diseases.
used as markers (29, 30). However, their careful interpretation is required because clinical symptoms and the results of clinical examinations are affected by other factors besides the levels of a target nutrient.

**Methods of Application**

The DRIs are used for many purposes but mainly for dietary improvement and management of food services. Theories of application of dietary improvement, which consists of assessment of dietary intake, preparation based on assessment, and practice, differ between individuals and groups, and should therefore be described separately. The term management of food service refers to dietary planning for a particular group and an on-going meal service. The DRIs, which are the fundamental data sources used to establish dietary guidelines and recommendations, do not necessarily need to be achieved immediately for any purpose.

1. **Dietary improvement of individuals**
   
   1-1. **Basic concepts.** Table 3 shows the basic concept in application of the DRIs to the dietary improvement of individuals. This concept is based on the concepts proposed in the DRIs of the United States and Canada (1, 2, 31) and the application patterns of the DRIs in Japan.

   **Assessment of energy balance**
   
   The DRIs are used for many purposes but mainly for dietary improvement and management of food services. Theories of application of dietary improvement, which consists of assessment of dietary intake, preparation based on assessment, and practice, differ between individuals and groups, and should therefore be described separately. The term management of food service refers to dietary planning for a particular group and an on-going meal service. The DRIs, which are the fundamental data sources used to establish dietary guidelines and recommendations, do not necessarily need to be achieved immediately for any purpose.

   **Assessment of insufficient nutrient intake**
   
   When using AI, compare AI and measured intake to ensure that intake is not below AI using distribution of measured intake.

   When using AI, planning should aim to increase mean group intake to approximate AI.

   Note: It is difficult to compare percentage of individuals with intake below EAR and the percentage with intake below AI because the percentages have different meanings.

   **Assessment of excessive nutrient intake**
   
   When intake is above the EAR but below the RDA, increasing intake up to the RDA is recommended. However, decisions regarding the intake of a particular nutrient should be made with consideration of the intake of other nutrients. When intake is below the EAR, increasing intake is strongly recommended. Assessment

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**Table 4. Basic concepts in applying DRIs-J 2010 for dietary improvement of groups.**

<table>
<thead>
<tr>
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<td>Evaluation of change by measurement of body weight change.</td>
<td>Planning should aim to maintain BMI within normal range.</td>
</tr>
<tr>
<td>Assessment of insufficient nutrient intake</td>
<td>EAR, AI</td>
<td>Determination of percentage of individuals with intake below EAR.</td>
<td>Planning should aim to minimize number of individuals with intake below EAR.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>When using AI, compare AI and measured intake to ensure that intake is not below AI using distribution of measured intake.</td>
<td>When using AI, planning should aim to increase mean group intake to approximate AI.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: Measurement should be performed at least twice within a certain period and plans reviewed and revised based on results.</td>
<td></td>
</tr>
<tr>
<td>Assessment of excessive nutrient intake</td>
<td>UL</td>
<td>Calculation of percentage of individuals at risk of excessive intake using distribution of measured intake and UL.</td>
<td>Planning should aim to reduce intake of all individuals below UL.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: Intake above UL should be avoided. When excessive intake is reported, plans should be reviewed, revised, and implemented promptly.</td>
<td></td>
</tr>
<tr>
<td>Assessment of risk of primary prevention of lifestyle-related disease</td>
<td>DG</td>
<td>Calculation of percentage of individuals with intake outside range of DG using measured intake and DG.</td>
<td>Planning should aim to increase number of individuals with intake within or approximates the range of DG.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Note: Assessment of target nutrient should be conducted with comprehensive consideration of (1) the existence and degree of other nutrition-related and non-nutrition-related factors contributing to the target lifestyle-related disease and (2) the sustainability of a plan over the long term, as lifestyle-related diseases develop over the course of the lifespan.</td>
<td></td>
</tr>
</tbody>
</table>
of intake using the AI should consider that intake equal to or above the AI poses nearly 0% risk of inadequacy. Even if intake is below AI, risk of inadequacy cannot, by its nature, be quantitatively judged. As the UL is used for preventing excessive intake, an intake above the UL is evaluated as excessive. DGs are used for primary prevention of lifestyle-related diseases. However, as lifestyle-related diseases have many causes, dietary improvement by adherence to DGs should not be overly emphasized.

1-3. Development and use of dietary improvement plans (Table 3). Planning for dietary improvement consists of evaluation of nutrient intake by dietary assessment and implementation of dietary changes based on the results. However, because conducting these procedures is often difficult, several compromises may be taken into consideration according to the situation. For assessment of insufficient or excessive intake of energy, BMI or body weight change should be used, planning should be focused on maintaining a normal range of BMI, and measurement should be performed at least twice within several months (at least twice a year) and reviewed using changes in body weight as indices. For assessment of nutrient intake, the RDA should be used. If intake is close to or above the RDA, planning should aim to maintain this intake, and if intake is below the RDA, it should aim to approach the RDA. The AI should be used for assessment of nutrients for which the AI has been established. If intake is close to or above the AI, it should be maintained, and if below the AI, it should be increased to approach the AI. As intake above the UL should strictly be avoided, a plan for the reduction of the intake of any nutrient whose intake is above the UL should be promptly developed and implemented. If intake is out of a range of a DG, the goal of planning should be to come within the range.

While conducting such planning, comprehensive consideration of other nutrition- and non-nutrition-related factors associated with lifestyle-related diseases, as well as the sustainably of a particular plan over many years, as prevention of lifestyle-related diseases is a lifelong endeavor, is recommended.

2. Dietary improvement of groups

2-1. Basic concepts. The basic concepts in applying the DRIs for dietary improvement of a group are shown in Table 4. These concepts are based on DRIs of the United States and Canada (1, 2, 33) and the application patterns of the DRIs in Japan. The following 3 procedures are important in these concepts: assessment of dietary intake, development of a plan for dietary improvement based on the results of the assessment, and implementation of the plan for dietary improvement.

2-2. Dietary assessment (Table 4). For assessment of insufficient or excessive intake of energy, the BMI should be used. Energy is calculated from the distribution of the percentage of individuals within and outside the range of normal BMI, defined by the Japan Society for the Study of Obesity as BMI between 18.5 and 25.0 (32). For determination of nutrient intake, the distribution of nutrient intake as obtained from dietary assessment is used. Such assessment should be performed with full understanding of measurement errors, especially those due to under- and over-reporting and day-to-day variation.

For nutrients for which the EAR has been established, the percentage of individuals for whom intake is below the EAR should be calculated. Theoretically, the probability method should be used to obtain the correct percentage. However, as it is rarely applicable because it can be used only under strict conditions (1), the cut-point method is usually used instead (13). In cases in which the distribution curve of requirement is very different from the normal distribution, the value calculated using the cut-point method differs from the true value, as does the value for iron (1). Moreover, when mean intake and its distribution differ from the EAR, the value obtained using the cut-point method may differ from the true percentage. When, in using the AI, the percentage of individuals whose intake is below the AI is calculated, it does not theoretically match the true percentage of those with inadequate intake. However, because no other indices exist, the AI must be used for practical reasons. In using the UL, the percentage of those at risk of excessive intake should be calculated from the intake distribution and the UL. In using a DG, the percentage of those whose intake is out of range of the DG should be calculated from the intake distribution and the DG.

2-3. Development and use of plans for dietary improvement (Table 4). For assessment of insufficient or excessive intake of energy, the BMI or change in body weight is used as an index. Planning should focus on increasing the percentage of individuals with a BMI within the normal range. Measurement should be performed at least twice within a period of several months (at least twice a year), and change in body weight should be used for making and revising plans.

For assessment of sufficiency of nutrient intake, the EAR or AI is used. When the EAR is used, planning should aim to decrease the percentage of individuals with an intake below the EAR. When the AI is used, planning should aim to increase the mean intake of the group to approach the AI. For prevention of excessive nutrient intake, the UL is used. Planning should aim to reduce individual intake below the UL, as intake above the UL should strictly be avoided. For evaluation of nutrients related to lifestyle-related diseases, the DG is used. Planning should aim to increase the percentage of individuals whose intake is within or close to the DG while considering other nutrition- and non-nutrition-related factors related to lifestyle-related diseases and the sustainability of a particular plan over a long period.

3. Management of food services

3-1. Basic concept. The term management of food service refers here to planning for the provision of a continuous food supply with appropriate quality control based on evaluation of intake of a specific group of individuals. Maintenance and improvement of health, healthy growth of children, and primary prevention of lifestyle-related diseases are the key goals of management of food service. Therefore, it is necessary to plan for the serving of foods based on the DRIs.
3-2. Characteristics of target groups. Management of food services for a target group requires determination of the distribution of sex, age, body height and weight, and PAL and the percentage of individuals with a BMI outside the normal range of 18.5 to 25.0 (34). Using reference data, such as those contained in student health records, rather than conducting an independent assessment is recommended. When such reference data are not available, those obtained from similar groups can be used. It is desirable to repeat assessment of individual characteristics periodically for revision of the food service plan.

3-3. Dietary assessment. Not only are the meals provided by food services but all meals subject to assessment. It is preferable to use data regarding total intake to determine the extent of nutrient contribution by food services. If such data are difficult to obtain, data obtained by assessment of a single meal or a sample of individuals may be used. To prevent insufficient intake of nutrients, the percentage of individuals with an intake below the EAR is estimated from the measured intake distribution. When the AI is used, the percentage of individuals with intake below the AI is estimated. To prevent excessive intake, the percentage of individuals with an intake above the UL is estimated from the measured intake distribution. For primary prevention of lifestyle-related diseases, the percentage of individuals with an intake outside of a range of a DG is calculated from measured intake distribution.

3-4. Dietary planning. Dietary planning should be conducted using the DRIs, be based on individual characteristics and intakes, and consider whether every meal or a single daily meal is served. Determination of energy provided per serving should be based on sex, age group, and PAL distribution and on standard indices, such as the BMI. Changes in the BMI and body weight should also be used when useful.

Not all individuals in a group must meet the EAR or AI, which may increase the percentage of individuals with excessive intake. Menus should be planned to avoid the risk of approaching the UL. For primary prevention of lifestyle-related diseases, menus should be planned such that nearly no individual’s intake falls outside of a range of a DG where possible. It is also important to consider the existence and degree of other nutrition- and non-nutrition-related factors in lifestyle-related diseases; the sustainability of a menu plan over a long period, as prevention of lifestyle-related diseases is a life-long endeavor; and the fact that a DRI is not a standard of nutrient provision but rather of nutrient intake, which requires flexibility in its use.

3-5. Supplementary note regarding dietary planning. As required energy and nutrient intakes differ among groups when individuals are classified into more than one group according to sex, age group, and PAL, preparation of a specific menu for each group is desirable. If doing so is difficult, the method described here may be used as a practical alternative. The EER is calculated based on sex, age group, and PAL. When there is more than one EER for a number of groups, they are grouped together such that one EER may be used as a representative value for these groups, such as when the difference in energy requirement among several groups is within a range of 200 kcal/d. When doing so, the energy intake of each individual should preferably be within ±10% of the EER.

In order of increasing priority, dietary planning of should be conducted as follows: planning for (1) energy; (2) protein, with attention to prevention of deficiency; (3) fat; (4) vitamins A, B1, B2, and C; calcium; and iron; (5) saturated fatty acid, dietary fiber, sodium (salt), and potassium; and (6) other nutrients considered important for a particular group.

Closing Comments

The DRIs-J 2010 is not merely a scientific report describing the intake of energy and nutrients necessary for prevention of deficiency/insufficiency and excess but also a source of practical guidelines in planning for dietary improvement in general and in food services by dietitians and other health professionals. Reliable and comprehensive data regarding energy and nutrient intakes obtained by evaluation of representative samples of the Japanese population have been indispensable in both determining DRI values and establishing methods for their application. Nevertheless, compared to research into determination of the intake of energy and nutrients in the DRIs, research into application of the DRIs has been extremely scarce in Japan, limiting the availability of data and raising questions concerning its quality (35). Due to lack of evidence, current application of the DRIs is conceptual rather than scientific and practical. Highly scientific research into application of the DRIs is thus urgently needed.

REFERENCES


