Dietary Reference Intakes for Koreans with special consideration to older adults

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ABSTRACT

BACKGROUND/OBJECTIVES: The Dietary Reference Intakes for Koreans (KDRIs) were revised in 2020. Due to the rapidly aging Korean population, special consideration was given to reclassify the KDRI age group categories of older adults. This article examines the evidence for modifying the current KDRI age group ranges of older adults (65–74 and ≥ 75 yrs).

SUBJECTS/METHODS: We first reviewed the domestic and international data on the elderly, following which we received expert opinions on age classification from the KDRI Advisory Committee. Finally, the 6th and 7th (2013–2017) Korea National Health and Nutrition Examination Survey (KNHANES) data were used to analyze the nutritional intake statuses by considering the age of older adults.

RESULTS: According to the review results of domestic and international data and the inputs received from the expert advisory committee, the minimum age considered for the elderly was maintained at 65 yrs. However, the KNHANES data was analyzed to review whether there was a need to subdivide the later periods. Examining the differences in nutrient intakes by age group through the interaction effect term of the piecewise linear regression model revealed the interaction effect was maximum in the groups divided by 65 yrs (50–64 and 65–80), as compared to the groups divided by 70 yrs (50–69 and 70–80) and 75 yrs (50–74 and 75–80). The mean adequacy ratio was calculated per 1 yr of age, and a 3-yr (age) moving average analysis was performed to examine the change in the trends of overall nutrient intake. However, it was challenging to secure a scientific basis for subdivision into age groups in older adults from the results obtained.

CONCLUSIONS: This study could not find any scientific evidence for modifying the KDRI age groups for older adults.

Keywords: Dietary Reference Intake; elderly; age groups; nutritional intake

INTRODUCTION

The Dietary Reference Intakes for Koreans (KDRIs) are population estimates for daily nutrient requirements and dietary recommendations set by the Korean Ministry of Health and Welfare (MOHW) to maintain the health of the general population by eliminating nutritional deficiencies and reducing the risk of chronic diseases. First established by
Age group categories for KDRIs of older adults

Based on the data obtained from the Ministry of the Interior and Safety of South Korea (MOIS) and Statistics Korea (KOSTAT), including the 2015 KDRIs which used age classification data, we investigated the current status of age classification in domestic statistical data (Table 1). The age group of older adults in the 2015 KDRIs is subdivided into the age groups 65–74 and ≥ 75 yrs [3]. Korea’s official population statistics of resident registration categorized males and females separately (by gender) and by 10-yr age intervals (0–9, 10–19, … 70–79, 80–89, 90–99, and ≥ 100 yrs) [6]. The Korean Statistical Information Service (KOSIS) of KOSTAT divided males and females separately and by age: below 65 yrs were grouped by 5-yr intervals, and ≥ 65 yrs were divided into 3 groups (≥ 65, ≥ 85, and ≥ 100 yrs) [8]. The KOSTAT ‘Statistics of Aged People’ divided males and females separately and classified the ages into 65–69, 70–79, and ≥ 80 yrs [9]. The KOSTAT ‘Projected Population by Major Age Group’ classification included the working-age population (15–24, 25–49, and 50–64 yrs) and the aged population (65–74, 75–84, and ≥ 85 yrs), with 3 subgroups each [10]. The Korean Ministry of Education divided the school-age population into preschool (3–5 yrs), elementary school (6–11 yrs), middle school (12–14 yrs), high school (15–17 yrs), and
higher education (18–21 yrs), but did not distinguish between genders [11]. In addition, the ‘Korean National Survey on Elderly’ conducted by the Korea Institute for Health and Social Affairs classified age ≥ 65 yrs into 5-yr intervals (65–69, 70–74, 75–79, 80–84, and ≥ 85 yrs) [12]. In the field of geriatric medicine, such as the Korean Academy of Clinical Geriatrics and the Korean Gerontological Nursing Society, age is divided into 5- or 10-yr intervals and includes the subgroups 80, 85, and ≥ 100 yrs. The Korea Centers for Disease Control and Prevention (KCDC) divides the seniors into 60–69 and ≥ 70 yrs by 10-yr intervals in the ‘Korea Community Health Survey’ [13], whereas the Korea National Health and Nutrition Examination Survey (KNHANES) divides the older adults into 60–69 and > 70 or > 65 yrs [14].

AGE GROUP FOR OLDER ADULTS IN OTHER COUNTRIES

When comparing the age range for Dietary Reference Intakes (DRIs) with other countries, the older adult age group of the United Kingdoms (UK), China, and South Korea was the most subdivided (Table 2). The 2015 DRIs in Japan [15], the 2011 DRIs in the United States and Canada [16], and the 2017 Nutrient Reference Values in Australia and New Zealand [17] do not classify age ranges over 70 yrs, while the 2011 Dietary Reference Values in the UK [18] and the 2015 DRIs in South Korea [3] are presented for ages up to > 75 yrs. The 2013 DRI of China [19] divides older adults into the groups 65–79 and ≥ 80 yrs. In addition, the United Nations classifies the age ranges of older adults as ≥ 60 or ≥ 65 yrs. WHO’s ‘World Report on Ageing and Health’ presents age ranges up to 85 or 100 yrs by dividing the age into

Table 1. Comparison of age segments in the national statistics of Korea

| Variables     | Ministry of Health and Welfare | Ministry of the Interior and Safety | Statistics Korea | Ministry of Education |
|---------------|--------------------------------|------------------------------------|------------------|-----------------------|
|               | 2015 KDRI | Population statistic(1) | Population and housing census(2) | Population structure by age(3) | Statistics of aged people(4) | Projected population by major age group(5) | School-age population(6) |
| Classification of M/F from childhood | M/F | M/F | No gender classification | M/F | No gender classification |
| Infancy       | 0–5 mon 6–11 mon | 0–9 yrs 0–4 yrs | 0–14 yrs |
| Toddler       | 1–2 yrs 3–5 yrs | 5–9 yrs | | | |
| Childhood     | 6–8 yrs 9–11 yrs | 10–19 yrs 15–18 yrs | 10–14 yrs 15–64 yrs | | | |
| Adolescence   | 12–14 yrs 15–18 yrs | 10–19 yrs 15–18 yrs | 10–14 yrs 15–64 yrs | Working-age population 15–24 yrs Middle school 12–14 yrs | | |
| Adulthood     | 19–29 yrs | 20–29 yrs | | Working-age population 25–49 yrs Higher education 18–21 yrs | | |
|               | 30–49 yrs 50–64 yrs | 30–39 yrs 40–49 yrs | 60–64 yrs | Working-age population 50–64 yrs | | |
| Middle age/Older adults | 65–74 yrs ≥ 75 yrs | ≥ 65 yrs 70–79 yrs | 65–69 yrs 70–79 yrs | ≥ 65 yrs 70–79 yrs | ≥ 65 yrs 70–79 yrs | ≥ 65 yrs 70–79 yrs |
|               | 80–89 yrs 90–99 yrs ≥ 100 yrs | ≥ 85 yrs 80 yrs | 70–89 yrs 80 yrs | ≥ 80 yrs 80 yrs | ≥ 80 yrs 80 yrs | ≥ 100 yrs 100 yrs |

KDRI, Dietary Reference Intake for Koreans.
(1)'Population statistics of resident registration’ by the Ministry of the Interior and Safety (2017) [6].
(2)'Population by age and gender’ of 'Population and Housing Census' from the Korean Statistical Information Service by Statistics Korea (2015) [7].
(3)'Population structure in age’ in e-national indicators by Statistics Korea (2016) [8].
(4)'Statistics of aged people’ by Statistics Korea (2016) [9].
(5)‘Projected population by major age group’ in Korean Statistical Information Service by Statistics Korea (2017) [10].
(6)'School-age population’ in the Ministry of Education’s 'Brief Statistics on Korean Education’ (2016) [11].
The WHO 2000–2025 standard population is divided by age range into 5-yr periods and 9 subgroups for older adults (60–64, 65–69, 70–74, ..., 90–94, 95–99, and ≥ 100 yrs) [4]. The 2011 DRIs of the United States and Canada [16] do not classify age groups over 70 yrs, but suggest that for adults aged over 70 yrs, the DRIs should reflect the variations in the calculation of EAR and AI because of the large variation in physical activity and individual differences in functional capacity. In addition, the WHO’s ‘World Report on Aging and Health’ [4] reports that with progressing age, there is a decrease in the physical capacity, which is reported to vary greatly from person to person due to the individual environment interaction. Several foreign countries have presented the necessity to examine the classification of the age group of older adults, but since no grounds for changing the age range have been provided, the age range for older adults remains unchanged.

**ADVISORY COMMITTEE**

The KDRI Advisory Committee provided the following suggestions on the review of age ranges.

- Given the changing patterns of aging and physiological alterations resulting in longer lifespan up to the age of 70 yrs, the need to change to 70 yrs needs to be considered. This needs to be properly examined due to age-specific aspects of geriatric disease and malnutrition. Hence, it is necessary to review data of age groups 70 and 75 yrs. Moreover, afflicted adults over 80 yrs have a slow recovery when hospitalized, but this is not significant in terms of prevention and early diagnosis.
- Since personnel managing the patient’s diet (dietitian, clinical dietitian, etc.) often refer to KDRI s, realistic age classification is necessary. Given the expanding scale of meals for seniors, modifying to age 70 yrs may not be practically appropriate.
- Considering the size of the baby boomer generation, it would be realistic to maintain the current 2020 KDRI s age group criterion.
- If altering the KDRI s changes the criteria for the modifying the age range of older adults to 70 yrs, it is necessary to consider how this criterion is to be applied to the age group

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**Table 2. Comparison of age groups for DRIs of Korea with other countries**

| Korea (2015 KDRI) [3] | United States and Canada (2011 DRI) [15] | Australia and New Zealand (2017 NRV) [16] | United Kingdom (2011 DRV) [17] | China (2013 DRI) [18] | Japan (2015 DRI) [14] |
|------------------------|------------------------------------------|------------------------------------------|--------------------------------|-----------------------|-----------------------|
| 0–5 mon                | 0–6 mon                                  | 0–6 mon                                  | 0–3 mon                         | 0 yrs                 | 0–5 mon               |
| 6–11 mon               | 7–12 mon                                 | 7–12 mon                                 | 4–6 mon                         | 0.5 yrs               | 6–11 mon              |
| 1–2 yrs                | 1–3 yrs                                  | 1–3 yrs                                  | 1–3 yrs                         | 1 yrs                 | 1–2 yrs               |
| 3–5 yrs                | 4–8 yrs                                  | 4–8 yrs                                  | 4–6 yrs                         | 4 yrs                 | 3–5 yrs               |
| Male/Female            | Male/Female                              | Male/Female                              | Male/Female 0                   | 7–10 yrs              | 7 yrs                 |
| 6–8 yrs                | 9–13 yrs                                 | 9–13 yrs                                 | 9–13 yrs                        | 9 yrs                 | 6–7 yrs               |
| 9–11 yrs               | 14–18 yrs                                | 14–18 yrs                                | 11–14 yrs                       | 11 yrs                | 10–11 yrs             |
| 12–14 yrs              | 19–30 yrs                                | 19–30 yrs                                | 15–18 yrs                       | 14 yrs                | 12–14 yrs             |
| 15–18 yrs              | 31–50 yrs                                | 31–50 yrs                                | 19–24 yrs                       | 15 yrs                | 15–17 yrs             |
| 19–29 yrs              | 51–70 yrs                                | 51–70 yrs                                | 25–34 yrs                       | 18 yrs                | 18–29 yrs             |
| 30–49 yrs              | > 70 yrs                                 | > 70 yrs                                 | 35–44 yrs                       | 30 yrs                | 30–49 yrs             |
| 50–64 yrs              | 45–54 yrs                                | 50 yrs                                   | 50 yrs                          | 50–69 yrs             |
| 65–74 yrs              | 55–64 yrs                                | 65 yrs                                   | > 70 yrs                        | > 70 yrs              |
| ≥ 75 yrs               | 65–74 yrs                                | 80 yrs                                   | ≥ 70 yrs                        |> 70 yrs               |

KDRI, Dietary Reference Intake for Koreans; DRI, Dietary Reference Intake; NRV, Nutrient Reference Value; DRV, Dietary Reference Value.

1) In case of energy, males and females are classified from infancy.

2) In case of macronutrients, vitamins, and minerals, males and females are classified from 11 yrs age.

5- or 10-yr intervals [4].
Age group categories for KDRIs of older adults

50 to 69 yrs. In older adults, it is necessary to examine the age ranges that define this population. If changed to 70 yrs, additional information needs to be collected after reviewing any problems associated by increasing the previous range of 50–69 yrs age.

• There has been no analysis focused on age differences in chronic disease and undernutrition in the 70s and 80s age group. The results differ when analyzed as 65–74 and ≥ 75 yrs (of age). It is, therefore, necessary to review the analysis by dividing the age groups into 70 yrs and 75 yrs.

• Overall, there is insufficient data to change the older adult criterion (65 yrs) set in the current KDRIs. It is necessary to review the analysis results for age groups 65–74 and 75–79 yrs. Due to the large difference in results expected when the analysis is divided into groups based on 65 yrs of age, it may be difficult to set 50–74 yrs as the age range for older adults.

Based on the above estimations, the starting point should be maintained at 65 yrs of age, i.e., the same as the current age range for older adults. Further scientific evidence is required to determine the points of division that distinguish between malnutrition and chronic disease management. In addition, it is necessary to analyze and reexamine the health status according to the age range by applying various age groups.

NUTRITIONAL INTAKE STATUS OF OLDER ADULTS

Data from the 6th and 7th KNHANES (2013–2017), a cross-sectional, nationally representative survey carried out by the KCDC, were examined to clarify characteristics of the nutritional intake status of older adults. The KNHANES uses a stratified, multistage sampling method and comprises 3 surveys: a health interview, a health examination, and a nutrition survey. Detailed information of KNHANES is available on the website (https://knhanes.kdca.go.kr). The study population encompassed males and females aged ≥ 50 yrs who responded to the 2013–2017 KNHANES (n = 16,410). The following exclusion criteria were applied: subjects without the 24-h dietary recall data (n = 4,347), pregnant or lactating women (n = 11), subjects with a self-reported doctor-diagnosed disease such as hypertension, dyslipidemia, stroke, myocardial infarction or angina pectoris, arthritis, and various cancers (n = 10,431), subjects who consumed differently than the usual intake (n = 1,056), and subjects who consumed differently than the usual intake (n = 1,056), and subjects with daily calorie intake levels less than 500 kcal/day or more than 5,000 kcal/day (n = 33). A total of 3,213 participants (1,685 males and 1,528 females) were included in the final analysis. The 2013-2014 KNHANES protocol was approved by the Institutional Review Board of the KCDC (2013-07CON-03-4C and 2013-12EXP-03-5C), whereas the 2015-2017 KNHANES were exempted from research ethics review based on the Bioethics and Safety Act. Written informed consent was obtained from all participants.

The nutrient adequacy ratio (NAR) was calculated for each of the 9 nutrients (protein, vitamin A, thiamine, riboflavin, niacin, vitamin C, calcium, phosphorus, and iron) using the following formula: NAR = Subject’s Daily Intake of a Nutrient/RNI of that nutrient according to the subject’s gender and age. For a given nutrient, the NAR is the ratio of the subject’s intake to the RNI but is limited not to exceed 1. The nutrient consumed is less than the RNI when the NAR is < 1; the nutrient consumed is greater than or equal to the RNI when the NAR is 1 [20]. To evaluate the overall dietary adequacy, the mean adequacy ratio (MAR), which is the mean value of 9 NARs, was calculated using the following formula: MAR = 1/NAR (each truncated at 1)/Number of Nutrients. In this study, nutrient intake was assessed based on the 2015 KDRIs [3].

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All statistical analyses were performed using the SAS software (version 9.4; SAS Institute, Inc., Cary, NC, USA). Due to the complex sampling design of the KNHANES study, our analysis considered the relevant primary sampling units, stratification, and sample weights. Nutrient intake status (MAR) in older adults is expressed as weighted means and SEMs using the procedures of SURVEYMEANS. A 3-yr moving average was applied to smooth the mean ages against the nutrient intake trends using the PROC EXPAND procedure. A piecewise linear regression model (using the PROC GLIMMIX procedure) [21,22] was used to observe significant changes in the linear regression slope of nutrient intakes across 2 age groups (under or over a specific age). All dietary nutrient intake variables (carbohydrate, protein, fat, vitamin A, thiamine, riboflavin, niacin, vitamin C, calcium, phosphorus, iron, sodium, and potassium) were energy-adjusted using the residuals method, before applying a piecewise linear regression model.

We first examined the association between energy-adjusted nutrient intake and age group across each gender using the piecewise linear regression model. In this model, the scatter plot is divided into 2 parts (at each point of age 65, 70, and 75 yrs), and 2 separate and connected lines fitted, one for each piece function connected at the knot point. The piecewise linear regression model where 2 pieces are connected at $\chi = 65$, $\chi = 70$, $\chi = 75$ can be formulated as follows:

$$y = \beta_0 + \beta_1 \chi + \beta_2 (\chi - 65) \chi_2 + \epsilon$$

This formula is for the age 65 years as the knot point and can be simplified as follows:

$$y = \beta_0 + \beta_1 \chi + \beta_2 \chi_2^* + \epsilon$$

where $\chi$ is age, and $\beta_1$ is the slope of age. The interaction effect term ($\beta_2$) shows the difference in intake by age group, while $\chi_2$ is a dummy variable (0 if $\chi < 65$, and 1 if $\chi \geq 65$). $\chi_2^*$ denotes $\beta_2 (\chi - 65) \chi_2$, the interaction effect term.

Results of the piecewise linear regression for each of the 13 nutrients (carbohydrate, protein, fat, vitamin A, thiamine, riboflavin, niacin, vitamin C, calcium, phosphorus, iron, sodium, and potassium) revealed maximum interaction effect in the groups aged under and over 65 yrs (50–64 and 65–80; 10 and 12 nutrients were significant in males and females, respectively), as compared to the groups aged under and over 70 yrs (50–69 and 70–80; 7 and 10 nutrients were significant in males and females, respectively), and under and over 75 yrs (50–74 and 75–80; 7 nutrients were significant in both males and females).

None of the nutrients showed an interaction effect on the groups aged under and over 65 yrs (50–64 and 65–80), whereas groups aged under and over 70 yrs (50–69 and 70–80), or under and over 75 yrs (50–74 and 75–80) showed an interaction effect on nutrient intake (Table 3).

Next, we calculated the MAR and observed the change (reduction) in overall nutrient intake (measured by MAR) trends (whether smooth or not) in older age groups across each gender, using the 3-yr (age) moving average method. Our results revealed an overall decrease in MAR in males, regardless of the age junction (at the age 65, 70, and 75 yrs); in females, the MAR tended to remain constant until 65 yrs of age after which there was a tendency to decrease (Fig. 1). In addition, in the comparison of MAR by 1-yr interval of age, the age at which MAR started to fall below 0.75 (the standard value indicating nutrient intake adequacy [23]) was determined to be 69 yrs for males and 65 yrs for females (Table 4).
Summarizing the above results, we could not find any scientific evidence for changing the age group of older adults because the number of subjects aged over 70 yrs was too small (424 males and 390 females) and showed inconsistent patterns. Even if the age group is subdivided, it is considerably difficult to secure the necessary scientific evidence when setting the KDRIs for the segmented age group. The limitations of this analysis are as follows. First, the number of subjects is too small. Second, it is currently difficult to comprehensively evaluate age-related changes in the physical and morphological functions of older adults, and to understand the scientific basis for estimating nutritional requirements in older adults. Third, there is insufficient evidence to determine truly healthy older people. In the future, it is necessary to reorganize the concept of how “health,” as defined by the KDRIs, is applied to older adults. In particular, although the KDRIs are standards for a healthy population, further research is required to interpret the meaning of “health” in older adults as the absence of disease, which is not realistic due to the characteristics of this population. Nevertheless, this study is meaningful in that it attempts to reconsider the classification of older adults by

Table 3. The association between energy-adjusted nutrient intake and age group across each gender using piecewise linear regression model; age group (under and over a specific age)

| Variables          | 65 yrs | 70 yrs | 75 yrs |
|--------------------|--------|--------|--------|
|                    | Male   | Female | Male   | Female | Male   | Female |
|                    | F Value| Pr > F | F Value| Pr > F | F Value| Pr > F |
| Carbohydrate* age group | 3.03   | 0.0484 | 22.01  | < 0.0001| 15.68  | < 0.0001| 21.15  | < 0.0001| 29.63  | < 0.0001|
| Protein* age group  | 5.62   | 0.0037 | 5.88   | 0.0028 | 1.66   | 0.1910 | 8.02   | 0.0003 | 4.02   | 0.0181 | 12.68  | < 0.0001|
| Fat* age group      | 7.33   | 0.0007 | 7.32   | 0.0007 | 13.19  | < 0.0001| 26.51  | < 0.0001| 20.70  | < 0.0001| 48.29  | < 0.0001|
| Vitamin A* age group| 1.59   | 0.2045 | 1.35   | 0.2603 | 0.10   | 0.9017 | 1.13   | 0.3228 | 0.23   | 0.7964 | 1.42   | 0.2421 |
| Thiamine* age group | 3.95   | 0.0195 | 11.19  | < 0.0001| 2.14   | 0.1176 | 5.14   | 0.0060 | 0.25   | 0.7750 | 2.31   | 0.0998 |
| Riboflavin* age group| 3.57  | 0.0031 | 4.46   | 0.0117 | 3.71   | 0.0247 | 8.45   | 0.0002 | 6.46   | 0.0016 | 19.09  | < 0.0001|
| Niacin* age group   | 5.80   | 0.0031 | 13.07  | < 0.0001| 2.00   | 0.1354 | 11.98  | < 0.0001| 5.21   | 0.0056 | 17.56  | < 0.0001|
| Vitamin C* age group| 6.01   | 0.0025 | 7.28   | 0.0007 | 3.27   | 0.0382 | 1.67   | 0.1881 | 1.31   | 0.2711 | 2.67   | 0.0697 |
| Calcium* age group  | 2.86   | 0.0573 | 7.57   | 0.0005 | 0.59   | 0.5538 | 4.73   | 0.0090 | 2.92   | 0.0540 | 14.96  | < 0.0001|
| Phosphorus* age group| 10.90 | < 0.0001| 13.50  | < 0.0001| 3.71   | 0.0246 | 6.78   | 0.0012 | 3.23   | 0.0398 | 14.46  | < 0.0001|
| Iron* age group     | 8.72   | 0.0002 | 4.32   | 0.0135 | 9.62   | < 0.0001| 3.79   | 0.0227 | 7.49   | 0.0006 | 0.26   | 0.7705 |
| Sodium* age group   | 2.18   | 0.1132 | 3.80   | 0.0225 | 0.71   | 0.4915 | 0.79   | 0.4530 | 0.80   | 0.4497 | 0.69   | 0.4996 |
| Potassium* age group| 19.52  | < 0.0001| 25.86  | < 0.0001| 9.64   | < 0.0001| 7.46   | 0.0006 | 1.85   | 0.1574 | 2.37   | 0.0941 |

*Denotes the interaction effect term between nutrient and age group.

Fig. 1. Trends of MAR in older adults in South Korea. The smoothed curves were obtained by the 3-yr moving average. X-axis, age (yrs); Y-axis, MAR. (A) Males; (B) Females.
MAR, mean adequacy ratio.

Summarizing the above results, we could not find any scientific evidence for changing the age group of older adults because the number of subjects aged over 70 yrs was too small (424 males and 390 females) and showed inconsistent patterns. Even if the age group is subdivided, it is considerably difficult to secure the necessary scientific evidence when setting the KDRIs for the segmented age group. The limitations of this analysis are as follows. First, the number of subjects is too small. Second, it is currently difficult to comprehensively evaluate age-related changes in the physical and morphological functions of older adults, and to understand the scientific basis for estimating nutritional requirements in older adults. Third, there is insufficient evidence to determine truly healthy older people. In the future, it is necessary to reorganize the concept of how “health,” as defined by the KDRIs, is applied to older adults. In particular, although the KDRIs are standards for a healthy population, further research is required to interpret the meaning of “health” in older adults as the absence of disease, which is not realistic due to the characteristics of this population. Nevertheless, this study is meaningful in that it attempts to reconsider the classification of older adults by
## Table 4. The NAR and MAR in Older Adults in South Korea

| Variables | Number | NAR | MAR |
|-----------|--------|-----|-----|
| Protein   | 0.95 ± 0.02 | 0.91 ± 0.04 | 0.22 ± 0.02 |
| Vitamin A | 0.50 ± 0.03 | 0.84 ± 0.04 | 0.67 ± 0.03 |
| Thiamine  | 0.98 ± 0.01 | 0.84 ± 0.03 | 0.60 ± 0.04 |
| Riboflavin| 0.98 ± 0.02 | 0.82 ± 0.03 | 0.68 ± 0.04 |
| Niacin    | 0.86 ± 0.02 | 0.87 ± 0.02 | 0.72 ± 0.03 |
| Vitamin C | 0.88 ± 0.02 | 0.86 ± 0.02 | 0.64 ± 0.04 |
| Calcium   | 0.80 ± 0.02 | 0.80 ± 0.02 | 0.65 ± 0.04 |
| Phosphorus| 0.59 ± 0.04 | 0.83 ± 0.03 | 0.70 ± 0.03 |
| Iron      | 0.90 ± 0.03 | 0.75 ± 0.03 | 0.61 ± 0.04 |
| Female (yrs) | 0.89 ± 0.02 | 0.86 ± 0.02 | 0.64 ± 0.04 |
| Protein   | 0.95 ± 0.02 | 0.84 ± 0.04 | 0.60 ± 0.04 |
| Vitamin A | 0.50 ± 0.03 | 0.84 ± 0.04 | 0.67 ± 0.03 |
| Thiamine  | 0.98 ± 0.01 | 0.84 ± 0.03 | 0.60 ± 0.04 |
| Riboflavin| 0.98 ± 0.02 | 0.82 ± 0.03 | 0.68 ± 0.04 |
| Niacin    | 0.86 ± 0.02 | 0.87 ± 0.02 | 0.72 ± 0.03 |
| Vitamin C | 0.88 ± 0.02 | 0.86 ± 0.02 | 0.65 ± 0.04 |
| Calcium   | 0.80 ± 0.02 | 0.80 ± 0.02 | 0.65 ± 0.04 |
| Phosphorus| 0.59 ± 0.04 | 0.83 ± 0.03 | 0.70 ± 0.03 |
| Iron      | 0.90 ± 0.03 | 0.75 ± 0.03 | 0.61 ± 0.04 |

The NAR and MAR in older adults in South Korea.
examining domestic and international data on the elderly and by examining the consumption patterns by age through various statistical analyses.

CONCLUDING REMARKS AND SUGGESTIONS FOR FURTHER RESEARCH

Based on these results, we conclude that there is no scientific basis for changing the age group for older adults in the KDRIs. In the future, there is a need to refine the concept of “healthy” for older adults, as defined by DRIs. Furthermore, it is necessary to know the exact nutrient requirements and intake level of this population for a more accurate analysis of the age group classification of older adults. It is also important to continuously monitor new updates and how it is being updated in other countries with regard to setting the age group for older adults.

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Table 4. (Continued) The NAR and MAR in older adults in South Korea

| Variables | Number | Protein | Vitamin A | Thiamine | Riboflavin | Niacin | Vitamin C | Calcium | Phosphorus | Iron |
|-----------|--------|---------|-----------|----------|------------|--------|-----------|---------|------------|------|
| 75        | 29     | 0.81 ± 0.04 | 0.26 ± 0.05 | 0.89 ± 0.03 | 0.48 ± 0.05 | 0.63 ± 0.05 | 0.42 ± 0.07 | 0.31 ± 0.03 | 0.80 ± 0.04 | 0.90 ± 0.04 | 0.61 ± 0.03 |
| 76        | 19     | 0.81 ± 0.06 | 0.37 ± 0.07 | 0.93 ± 0.03 | 0.67 ± 0.07 | 0.64 ± 0.05 | 0.45 ± 0.06 | 0.33 ± 0.05 | 0.84 ± 0.06 | 0.97 ± 0.02 | 0.67 ± 0.04 |
| 77        | 20     | 0.87 ± 0.05 | 0.30 ± 0.07 | 0.89 ± 0.04 | 0.53 ± 0.04 | 0.63 ± 0.06 | 0.46 ± 0.08 | 0.39 ± 0.04 | 0.86 ± 0.05 | 0.97 ± 0.02 | 0.66 ± 0.03 |
| 78        | 20     | 0.82 ± 0.05 | 0.38 ± 0.07 | 0.89 ± 0.04 | 0.64 ± 0.07 | 0.59 ± 0.06 | 0.56 ± 0.10 | 0.38 ± 0.05 | 0.84 ± 0.05 | 0.97 ± 0.02 | 0.67 ± 0.05 |
| 79        | 20     | 0.72 ± 0.07 | 0.21 ± 0.06 | 0.83 ± 0.05 | 0.44 ± 0.07 | 0.55 ± 0.07 | 0.41 ± 0.09 | 0.30 ± 0.05 | 0.73 ± 0.07 | 0.88 ± 0.05 | 0.56 ± 0.06 |
| 80        | 163    | 0.74 ± 0.02 | 0.32 ± 0.02 | 0.85 ± 0.02 | 0.52 ± 0.02 | 0.54 ± 0.02 | 0.39 ± 0.03 | 0.34 ± 0.01 | 0.77 ± 0.02 | 0.94 ± 0.01 | 0.60 ± 0.01 |

Values are presented as mean ± SE.
NAR, nutrient adequacy ratio; MAR, mean adequacy ratio.

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