Serum Lipid Levels in Relation to Consumption of Yogurt: The 2012 Korea National Health and Nutrition Examination Survey

Bong-Kyung Seo, Nam-Eun Kim, Kyong-Min Park, Kye-Yeung Park, Hoon-Ki Park, Hwan-Sik Hwang*

Department of Family Medicine, Hanyang University College of Medicine, Seoul, Korea

Background: The purpose of this study was to evaluate serum lipid levels in Korean adults after consumption of different types of yogurt.

Methods: Study subjects were 3,038 individuals (≥19 years of age) who participated in the 2012 Korean National Health and Nutrition Examination Survey. Yogurt intake was assessed with a food frequency questionnaire by using the 24-hour recall method. We conducted complex samples general linear analysis with adjustment for covariates.

Results: The serum triglyceride levels in the group consuming viscous yogurt were lower than those in the group consuming non-viscous yogurt.

Conclusion: Consumption of viscous yogurt is associated with low serum triglyceride levels in Korean adults.

Keywords: Yogurt; Cholesterol; Triglycerides
INTRODUCTION

Hypertriglyceridemia as a risk factor for cardiovascular disease is becoming important in the context of the growing epidemic of metabolic syndrome and obesity, and high triglyceride levels are known to play an important role as a marker associated with atherogenic lipoproteins. Evidence suggests that triglyceride levels more than 150 mg/dL are an independent risk factor for cardiovascular disease as a component of metabolic syndrome. In Korea, mortality from cardiovascular disease and cerebrovascular disease has ranked second and third, respectively, among causes of death. Ischemic heart disease or cerebrovascular disease is caused by plaque disruption and atherosclerosis, which are closely related to increased fasting plasma triglycerides, high levels of low-density lipoprotein (LDL) cholesterol, and low levels of high-density lipoprotein (HDL) cholesterol. Therefore, the importance of managing dyslipidemia is highlighted by many guidelines. The National Cholesterol Education Program-Adult Treatment Panel III guidelines recommend lifestyle changes including dietary modification, exercise, and weight reduction for management of dyslipidemia.

Among these recommendations, dietary modification is a powerful nonpharmacological strategy for the treatment of dyslipidemia. For example, dietary fiber has been shown to favorably alter blood cholesterol levels, while omega-3 fatty acids lower blood triglyceride levels. There have been some studies that have examined the effect of dairy intake on dyslipidemia, obesity, and metabolic syndrome. In studies on the association between dairy intake and obesity, dairy intake was found to have a protective effect against obesity. In a Korean study, regular consumption of milk resulted in lower rates of metabolic syndrome, obesity, abdominal obesity, hypertriglyceridemia, hypertension, and impaired fasting glucose compared with a control group. Yogurt is a food produced by the fermentation of milk, and there has been increased interest recently in the effect of probiotics in yogurt to improve cholesterol metabolism, with several studies currently in progress internationally.

The aim of the present study was to examine the correlation between consumption of different types of yogurt and serum lipid levels in Korean adults. As per our knowledge, there has been no evaluation of serum lipid levels in relation to consumption of different types of yogurt. Numerous previous studies have revealed that dairy products and probiotics have a positive effect on serum lipid levels. However, none of these studies has addressed the difference between liquid and viscous yogurt. Moreover, we believed that the amount and type of lactic acid bacteria could have an effect on serum lipid levels. We also assumed that, depending on the consistency of each type of yogurt, the amount and type of lactic acid bacteria might differ.

METHODS

1. Study Subjects

The study used data from the 2012 Korean National Health and Nutrition Examination Survey (KNHANES). A total of 6,293 participants aged 19 years or over were selected; among these, 3,255 were excluded because of insufficient information regarding education, income, body mass index, waist circumference, alcohol intake, smoking, physical activity, daily energy intake, or serum lipid levels. Participants were also excluded if they did not respond to the food questionnaire, did not observe the 8-hour fasting period, were undergoing treatment for dyslipidemia, or were pregnant. Ultimately, a total of 3,038 participants were included as study subjects.

2. Yogurt Consumption

In the 3,038 study participants included, yogurt consumption was assessed with a questionnaire on food frequency by using the 24-hour recall method. As few participants consumed yogurt more than two times per week, we classified participants into two groups: those with yogurt consumption ≥once per week and those with yogurt consumption <once per week. In the statistical analyses, frequency of yogurt intake was calculated as the average frequency.

3. Other Variables

Data regarding age, sex, education, income, smoking, alcohol consumption, and physical activity were obtained using a self-report questionnaire. Level of education was categorized into four groups: elementary school graduate or below, middle school graduate, high school graduate, and college graduate or higher; level of income was categorized as low, middle-low, middle-high, or high; and smoking status was classified as current or non-current smoker. Current alcohol consumption was classified as <1 time per month or ≥1 time per month; frequency of physical activity was classified as <3 days per week or ≥3 days per week.

Body mass index was calculated using the formula body weight (kg)/ height (m²). Waist circumference was measured to one decimal point at the end of a normal expiration by using a tape measure at a level midway between the lowest rib and the iliac crest, without pressing into the skin.

Blood samples were obtained from all participants. As LDL cholesterol was undisclosed for individuals whose triglyceride levels were below 200 mg/dL in the original data, LDL cholesterol was calculated using the Friedewald formula. Log-transformation of triglyceride values was performed to account for the extreme right skewness of the data.

4. Statistical Analysis

Statistical analyses were conducted using the complex samples procedure because the KNHANES data set was selected using a representative, stratified, and clustered sampling method, not a random sampling method. The t-test was used for continuous variables, such as age, body mass index, waist circumference, daily energy intake, and serum lipid levels, while the chi-square test was used for categorical variables, such as sex, level of education, income, smoking, alcohol consumption, and physical activity. Two groups of participants were
created according to consumption of yogurt (Table 1): the yogurt-consum- ing group and non-consuming group were defined on the basis of yogurt consumption ≥1 time per week and <1 time per week, respectively. Two groups of participants were additionally created in relation to consumption of different types of yogurt (liquid or viscous), with all 3,038 participants accounted for in the two groups (Table 2); these were further divided into subgroups according to frequency of consumption (<1 time per week or ≥1 time per week). General linear analy- sis of complex samples was used to evaluate serum lipid levels de- pending on consumption of yogurt irrespective of its type, and type of yogurt consumed after adjustment for confounding factors such as age, sex, level of education, income, smoking, alcohol consumption, physical activity, and daily energy intake. Data were analyzed using IBM SPSS Windows ver. 20.0 (IBM Corp., Armonk, NY, USA). P-values <0.05 were considered significant.

RESULTS

1. General Characteristics of the Study Participants

The general characteristics of the group consuming any kind of yogurt more than once a week and the group consuming any kind of yogurt less than once a week are shown in Table 1. The general characteristics of the participants according to type of yogurt consumed are shown in Table 2. Among the 3,038 participants, 1,199 participants consumed any kind of yogurt more than once a week. The following characteristics were observed for these participants: younger age, higher educa- tional status, higher income, less alcohol intake, less physical activity, a greater proportion of women, and lower triglyceride levels than the participants who consumed any kind of yogurt less than once a week (P<0.05) (Table 1). Among the 3,038 participants, 934 individuals consumed liquid yogurt at least once a week and 608 consumed viscous yogurt at least once a week (Table 2). Regardless of the type of yogurt consumed, the subgroups with yogurt intake ≥1 time per week had a younger average age, higher level of education, and higher income.

Table 1. Baseline characteristics of the 3,038 study participants according to consumption of yogurt

| Characteristic             | Yogurt intake ≥1 time/wk (n=1,199) | Yogurt intake <1 time/wk (n=1,839) | P-value |
|----------------------------|------------------------------------|------------------------------------|---------|
| Age (y)                    | 42.8±12.3                          | 44.2±12.4                          | 0.002*  |
| Sex                        |                                    |                                    | 0.002†  |
| Male                       | 419 (34.9)                         | 745 (40.5)                         |         |
| Female                     | 780 (65.1)                         | 1,094 (59.5)                       |         |
| Education                  |                                    |                                    | <0.001† |
| Primary school             | 96 (8.0)                           | 284 (15.4)                         |         |
| Middle school              | 104 (8.7)                          | 161 (8.8)                          |         |
| High school                | 505 (42.1)                         | 713 (38.8)                         |         |
| College                    | 494 (41.2)                         | 681 (37.0)                         |         |
| Income                     |                                    |                                    | <0.001† |
| Low                        | 241 (20.1)                         | 471 (25.6)                         |         |
| Middle-low                 | 286 (23.9)                         | 490 (26.6)                         |         |
| Middle-high                | 332 (27.7)                         | 429 (23.3)                         |         |
| High                       | 340 (28.4)                         | 449 (24.4)                         |         |
| Body mass index (kg/m²)    | 23.4±3.5                           | 23.6±3.4                           | 0.12*   |
| Waist circumference (cm)   |                                    |                                    |         |
| Male                       | 83.9±9.1                           | 84.2±8.4                           | 0.53*   |
| Female                     | 76.3±9.0                           | 77.1±9.4                           | 0.52*   |
| Alcohol intake (time/mo)   |                                    |                                    | 0.04†   |
| <1                         | 623 (52.0)                         | 1,025 (55.7)                       |         |
| ≥1                         | 576 (48.0)                         | 814 (44.3)                         |         |
| Smoking                    |                                    |                                    | 0.09†   |
| Never & former             | 986 (82.2)                         | 1,466 (73.7)                       |         |
| Current                    | 213 (17.8)                         | 373 (20.3)                         |         |
| Physical activity (d/wk)   |                                    |                                    | 0.03†   |
| <3                         | 999 (83.3)                         | 1,586 (86.2)                       |         |
| ≥3                         | 200 (16.7)                         | 253 (13.8)                         |         |
| Energy intake (kcal/d)     | 2,038±388.4                        | 2,017±852.6                        | 0.08*   |
| Total cholesterol (mg/dL)  | 189.9±36.2                         | 190.0±34.4                         | 0.89*   |
| High-density lipoprotein cholesterol (mg/dL) | 52.9±12.3 | 52.6±12.7 | 0.43* |
| Low-density lipoprotein cholesterol (mg/dL) | 114.9±31.5 | 114.3±30.3 | 0.60* |
| Triglyceride (mg/dL)       | 119.0±104.1                        | 127.4±94.7                         | 0.02*   |

Values are presented as mean±standard error or number (%). *Analyzed using Student t-test. †Analyzed using the chi-square test.
than the subgroups consuming yogurt <1 time per week (P<0.05 for both) (Table 2).

With regard to consumption of viscous yogurt, in the subgroup with higher weekly intake, women outnumbered men, body mass index was lower, waist circumference was smaller in women, alcohol consumption was lower, smoking was less frequent, physical activity was greater, daily energy intake was lower, and serum triglyceride and HDL cholesterol levels were lower than those in the subgroup with intake <1 time per week (P<0.05).

2. Serum Lipid Levels in Relation to Consumption of Different Types of Yogurt: General Linear Analysis of Complex Samples

General linear analysis of complex samples was used to evaluate serum lipid levels according to consumption of yogurt (Table 3) and consumption of different types of yogurt (Table 4), after adjustment for confounding factors such as age, sex, level of education, income, smoking, alcohol consumption, physical activity, and daily energy intake.

---

Table 2. Baseline characteristics of the 3,038 study participants according to consumption of liquid and viscous yogurt

| Characteristic                  | Liquid yogurt intake ≥1 time/wk (n=934) | Liquid yogurt intake <1 time/wk (n=2,104) | P-value | Viscous yogurt intake ≥1 time/wk (n=608) | Viscous yogurt intake <1 time/wk (n=2,430) | P-value |
|--------------------------------|-----------------------------------------|-------------------------------------------|---------|------------------------------------------|-------------------------------------------|---------|
| Age (y)                        | 42.6±12.4                               | 44.0±12.3                                 | 0.004*  | 41.6±12.2                               | 44.0±12.4                                 | <0.001* |
| Sex                            |                                         |                                           |         |                                          |                                           |         |
| Male                           | 356 (38.1)                              | 809 (38.5)                                | 0.86†   | 155 (25.5)                              | 1,010 (41.6)                             | <0.001† |
| Female                         | 578 (61.9)                              | 1,295 (61.5)                              |         | 453 (74.5)                              | 1,420 (58.4)                             |         |
| Education                      |                                         |                                           |         |                                          |                                           |         |
| Primary school                 | 77 (8.2)                                | 303 (14.4)                                | <0.001† | 35 (5.8)                                | 345 (14.2)                               |         |
| Middle school                  | 83 (8.9)                                | 181 (6.6)                                 |         | 49 (8.1)                                | 215 (8.8)                                |         |
| High school                    | 403 (43.1)                              | 817 (38.8)                                |         | 260 (42.8)                              | 960 (39.5)                               |         |
| College                        | 371 (39.7)                              | 803 (38.2)                                |         | 264 (43.4)                              | 910 (37.4)                               |         |
| Income                         |                                         |                                           |         |                                          |                                           | <0.001† |
| Low                            | 192 (20.6)                              | 521 (24.8)                                |         | 112 (18.4)                              | 601 (24.7)                               |         |
| Middle-low                     | 234 (25.1)                              | 542 (25.8)                                |         | 136 (22.4)                              | 640 (26.3)                               |         |
| Middle-high                    | 256 (27.4)                              | 505 (24.0)                                |         | 168 (27.6)                              | 593 (24.4)                               |         |
| High                           | 252 (27.0)                              | 536 (25.5)                                |         | 192 (31.6)                              | 596 (24.5)                               |         |
| Body mass index (kg/m²)        | 23.5±3.4                                | 23.5±3.4                                  | 0.85*   | 23.1±3.4                                | 23.6±3.4                                 | 0.001*  |
| Waist circumference (cm)       |                                         |                                           |         |                                          |                                           |         |
| Male                           | 84.2±8.9                                | 84.1±8.5                                  | 0.80*   | 83.0±8.9                                | 84.3±8.6                                 | 0.08*   |
| Female                         | 76.4±8.9                                | 76.9±9.4                                  | 0.28*   | 75.6±8.7                                | 77.1±9.4                                 | 0.002*  |
| Alcohol intake (time/mo)       |                                         |                                           |         |                                          |                                           |         |
| <1                             | 430 (46.0)                              | 959 (45.6)                                |         | 324 (53.3)                              | 1,065 (43.8)                             |         |
| ≥1                             | 504 (54.0)                              | 1,145 (54.4)                              |         | 284 (46.7)                              | 1,365 (56.2)                             |         |
| Smoking                        |                                         |                                           |         |                                          |                                           | <0.001† |
| Never & former                 | 751 (80.4)                              | 1,702 (80.3)                              |         | 534 (87.8)                              | 1,919 (79.0)                             |         |
| Current                        | 183 (19.6)                              | 402 (19.1)                                |         | 74 (12.2)                               | 511 (21.0)                               |         |
| Physical activity (d/wk)       |                                         |                                           |         |                                          |                                           | 0.015†  |
| <3                             | 759 (81.3)                              | 1,751 (83.2)                              |         | 482 (79.3)                              | 2,028 (83.5)                             |         |
| ≥3                             | 175 (18.7)                              | 353 (16.8)                                |         | 126 (20.7)                              | 402 (16.5)                               |         |
| Energy intake (kcal/d)         | 2,073.3±883.4                           | 2,013.0±854.6                             | 0.07*   | 1,946.4±776.8                           | 2,052.8±883.1                           | 0.007*  |
| Total cholesterol (mg/dL)      | 190.0±36.6                              | 190.0±34.5                                | 0.96*   | 188.2±35.7                              | 190.5±35.0                               | 0.16*   |
| High-density lipoprotein choles | 52.5±12.4                               | 52.8±12.7                                | 0.55*   | 54.1±12.3                               | 52.3±12.6                                | 0.002*  |
| Low-density lipoprotein choles | 114.8±31.7                              | 114.4±30.3                                | 0.76*   | 113.9±31.0                              | 114.7±30.7                               | 0.57*   |
| Triglyceride (mg/dL)           | 122.8±111.7                             | 124.8±92.1                               | 0.60*   | 106.5±69.8                              | 128.6±104.1                              | <0.001* |

Values are presented as mean±standard error or number (%).
*Adjusted for age, sex, education, income, alcohol intake, smoking, physical activity, and total energy intake.

Table 3. Serum lipid levels of the study participants consuming yogurt ≥1 time per week compared with <1 time per week

| Variable                      | Yogurt intake ≥1 time/wk | 95% confidence interval | P-value |
|-------------------------------|--------------------------|-------------------------|---------|
| Unadjusted                    |                          |                         |         |
| Total cholesterol (mg/dL)     | -0.28±1.47               | -3.18 to 2.62           | 0.85    |
| HDL cholesterol (mg/dL)       | 0.17±0.57                | -0.92 to 1.29           | 0.76    |
| LDL cholesterol (mg/dL)       | 0.27±1.33                | -2.36 to 2.89           | 0.84    |
| Triglyceride (mg/dL)          | -0.015±0.006             | -0.026 to 0.003         | 0.29    |
| Adjusted                      |                          |                         |         |
| Total cholesterol (mg/dL)     | 1.18±1.59                | -1.97 to 4.32           | 0.46    |
| HDL cholesterol (mg/dL)       | -0.34±0.57               | -1.48 to 0.79           | 0.56    |
| LDL cholesterol (mg/dL)       | 1.31±1.41                | -1.48 to 4.10           | 0.36    |
| Triglyceride (mg/dL)          | -0.006±0.006             | -0.017 to 0.006         | 0.327   |

HDL, high-density lipoprotein; LDL, low-density lipoprotein.
*Adjusted for age, sex, education, income, alcohol intake, smoking, physical activity, and total energy intake.
†From complex samples general linear analysis comparing the difference between the two groups.
‡Log-transformed.
take. Triglyceride levels among participants consuming viscous yogurt ≥1 time per week were lower than the levels among those consuming viscous yogurt <1 time per week (P<0.05) (Table 4). Neither levels of total cholesterol nor levels of HDL and LDL cholesterol were correlated with yogurt consumption.

DISCUSSION

The results of the present study showed that serum triglyceride levels were significantly lower in participants who consumed viscous yogurt ≥1 time per week than in those consuming viscous yogurt <1 time per week. No significant triglyceride-lowering effect was observed in participants who consumed liquid yogurt ≥1 time per week compared to those consuming liquid yogurt <1 time per week. There was also no significant triglyceride-lowering effect in participants who consumed any kind of yogurt ≥1 time per week compared to those consuming any kind of yogurt <1 time per week.

Hypertriglyceridemia is a prevalent risk factor for cardiovascular disease and is increasingly important in the context of the current epidemics of obesity and insulin resistance. High triglyceride levels are markers for several types of atherogenic lipoproteins. High triglyceride levels are associated with yogurt consumption. Yogurt, a dairy product with fatty acids, are also known to have an effect on these substances to improve cholesterol metabolism. For example, levels of total cholesterol, LDL cholesterol, and triglycerides decreased by 2.7%, 3.2%, and 5.2%, respectively, in 32 adult men who consumed a capsule containing 2×10⁹ Enterococcus faecium M74 once a day for 4 weeks, and total cholesterol and LDL cholesterol decreased by 12.1% and 19.7%, respectively, in 20 adults who consumed 100 mL of low-fat yogurt containing Bifidobacterium longum three times a day for 4 weeks. Different levels or types of probiotics and MSNF in either viscous yogurt or liquid yogurt may distinguish the degree of lowering of blood triglyceride levels. The MSNF contain the lactose, caseins, whey proteins, and minerals (ash content) of the product from which they were derived. It is thought that higher calcium intake facilitates lipolysis and lipid oxidation through its effects on intracellular calcium concentrations. Several intervention studies have reported that calcium intake has a beneficial effect on lipid profiles. A study has reported that calcium ingested through yogurt diminished postprandial lipid response followed by a decrease in the postprandial increase in chylomicron triglyceride. Milk-derived bioactive peptides exert several other important health-promoting activities, besides their anti-hypertensive effect, including involvement in the regulation of insulinemia, modulation of the lipid profile, and stimulation of the satiety response, all of which may play roles in the prevention and treatment of metabolic syndrome and its complications.

In terms of probiotics, recent studies have focused on the use of these substances to improve cholesterol metabolism. For example, levels of total cholesterol, LDL cholesterol, and triglycerides decreased by 2.7%, 3.2%, and 5.2%, respectively, in 32 adult men who consumed 100 mL of low-fat yogurt containing Bifidobacterium longum three times a day for 4 weeks, and total cholesterol and LDL cholesterol decreased by 12.1% and 19.7%, respectively, in 20 adults who consumed a capsule containing 2×10⁹ Enterococcus faecium M74 once a day for 56 weeks. However, the mechanism by which serum triglyceride levels reduce is not fully understood. In one study, administra¬
tion of probiotics to rats led to transcriptional changes in peroxisome proliferator-activated receptor-α, carnitine palmitoyltransferase II, sterol regulatory element-binding protein-1, fatty acid synthase, and stearoyl-CoA desaturase-1; it was assumed that these changes were responsible for the reduction in serum triglyceride levels.26)

Probiotics settle in the gut and increase the production of short chain fatty acids (SCFAs) following the fermentation of indigestible carbohydrates from food, and finally SCFAs produced in the gut enter the liver.27) SCFAs might inhibit the synthesis of fatty acids in the liver, thereby decreasing the triacylglycerol secretion rate and serum triglyceride levels.28) Viscous yogurt has higher content of MSNF and probiotics within it than liquid yogurt, which can contribute to lowering blood triglyceride levels.

Our study has several limitations to be considered. First, we classified the groups according to the number of times each participant consumed yogurt, but we could not determine the quantities of yogurt consumed. Second, this study was not a prospective cohort study; therefore, it is difficult to establish a direct effect of yogurt consumption on serum lipid levels. Third, as this study was based on 24-hour dietary recall, the type and amount of food intake might have been inaccurate. Although lifestyle variables, such as alcohol intake, smoking, total energy intake, and physical activity, have been adjusted in this study, these variables might have not been sufficiently adjusted if the differences among these variables were too great. Lastly, the study did not show any precise difference between consumption of liquid yogurt and viscous yogurt.

Despite these limitations, and in conclusion, our study has shown for the first time that consumption of viscous yogurt is associated with low serum triglyceride levels. Further studies should focus on determining which probiotics or which specific ingredient affects serum cholesterol levels, and how they act.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Miller M, Stone NJ, Ballantyne C, Bittner V, Criqui MH, Ginsberg HN, et al. Triglycerides and cardiovascular disease: a scientific statement from the American Heart Association. Circulation 2011;123:2292-333.
2. Hokanson JE, Austin MA. Plasma triglyceride level is a risk factor for cardiovascular disease independent of high-density lipoprotein cholesterol level: a meta-analysis of population-based prospective studies. J Cardiovasc Risk 1996;3:213-9.
3. National Statistical Office. Annual report on the cause of death statistics (based on vital registration). Daejeon: Statistics Korea; 2008.
4. Chapman MJ, Ginsberg HN, Amarenco P, Andreotti F, Boren J, Catapano AL, et al. Triglyceride-rich lipoproteins and high-density lipoprotein cholesterol in patients at high risk of cardiovascular disease: evidence and guidance for management. Eur Heart J 2011;32:1345-61.
5. National Cholesterol Education Program, Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults. Third report of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (adult treatment panel III). Bethesda (MD): National Institutes of Health, National Heart, Lung, and Blood Institute, National Cholesterol Education Program; 2001.
6. Astrup A. Yogurt and dairy product consumption to prevent cardiometabolic diseases: epidemiologic and experimental studies. Am J Clin Nutr 2014;99(5 Suppl):1238S-1242S.
7. Lin SL, Tarrant M, Hui LL, Kwok MK, Lam TH, Leung GM, et al. The role of dairy products and milk in adolescent obesity: evidence from Hong Kong’s “Children of 1997” birth cohort. PLoS One 2012;7: e52575.
8. Louie JC, Flood VM, Hector DJ, Rangan AM, Gill TP. Dairy consumption and overweight and obesity: a systematic review of prospective cohort studies. Obes Rev 2011;12:e582-92.
9. Lee CJ, Joung H. Milk intake is associated with metabolic syndrome: using data from the Korea National Health and Nutrition Examination Survey 2007-2010. Korean J Community Nutr 2012;17:795-804.
10. Atiea-Jafari A, Larijani B, Alavi Majd H, Tahbaz F. Cholesterol-lowering effect of probiotic yogurt in comparison with ordinary yogurt in mildly to moderately hypercholesterolemic subjects. Ann Nutr Metab 2009;54:22-7.
11. Talayero BG, Sacks FM. The role of triglycerides in atherosclerosis. Curr Cardiol Rep 2011;13:544-52.
12. Nordestgaard BG, Benn M, Schnohr P, Tybjaerg-Hansen A. Nonfasting triglycerides and risk of myocardial infarction, ischemic heart disease, and death in men and women. JAMA 2007;298:299-308.
13. Kim MA. Triglyceride and cardiovascular disease. J Lipid Atheroscler 2013;2:1-8.
14. Kratz M, Baars T, Guyenet S. The relationship between high-fat dairy consumption and obesity, cardiovascular, and metabolic disease. Eur J Nutr 2013;52:1-24.
15. Spence LA, Cifelli CJ, Miller GD. The role of dairy products in healthy weight and body composition in children and adolescents. Curr Nutr Food Sci 2011;7:40-9.
16. Marette A, Picard-Deland E. Yogurt consumption and impact on health: focus on children and cardiometabolic risk. Am J Clin Nutr 2014;99(5 Suppl):1243S-1247S.
17. Wang H, Livingston KA, Fox CS, Meigs JB, Jacques PF. Yogurt consumption is associated with better diet quality and metabolic profile in American men and women. Nutr Res 2013;33:18-26.
18. Ministry of Food and Drug Safety. Standards of livestock products. Cheongju: Ministry of Food and Drug Safety; 2016.
19. Chandan RC. Manufacturing yogurt and fermented milks. Ames (IA): Blackwell Publishing; 2006.
20. Reid IR. Effects of calcium supplementation on circulating lipids: potential pharmacoeconomic implications. Drugs Aging 2004;21:7-17.
21. Vaskonen T. Dietary minerals and modification of cardiovascular risk factors. J Nutr Biochem 2003;14:492-506.
22. Lorenzen JK, Nielsen S, Holst JJ, Tetens I, Rehfell JD; Astrup A. Effect of dairy calcium or supplementary calcium intake on postprandial fat metabolism, appetite, and subsequent energy intake. Am J Clin Nutr 2007;85:678-87.
23. Ricci-Cabello I, Herrera MO, Artacho R. Possible role of milk-derived bioactive peptides in the treatment and prevention of metabolic syn-
drome. Nutr Rev 2012;70:241-55.
24. Xiao JZ, Kondo S, Takahashi N, Miyaji K, Oshida K, Hiramatsu A, et al. Effects of milk products fermented by Bifidobacterium longum on blood lipids in rats and healthy adult male volunteers. J Dairy Sci 2003;86:2452-61.
25. Hlivak P, Odraska J, Ferencik M, Ebringer I, Jahnova E, Mikes Z. One-year application of probiotic strain Enterococcus faecium M-74 decreases serum cholesterol levels. Bratisl Lek Listy 2005;106:67-72.
26. Ahn HY, Kim M, Chae JS, Ahn YT, Sim IH, Choi ID, et al. Supplementation with two probiotic strains, Lactobacillus curvatus HY7601 and Lactobacillus plantarum KY1032, reduces fasting triglycerides and enhances apolipoprotein A-V levels in non-diabetic subjects with hypertriglyceridemia. Atherosclerosis 2015;241:649-56.
27. Sadrzadeh-Yeganeh H, Elmadfa I, Djazary A, Jalali M, Heshmat R, Chamary M. The effects of probiotic and conventional yoghurt on lipid profile in women. Br J Nutr 2010;103:1778-83.
28. Trautwein EA, Rieckhoff D, Erbersdobler HF. Dietary inulin lowers plasma cholesterol and triacylglycerol and alters biliary bile acid profile in hamsters. J Nutr 1998;128:1937-43.