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The amelioration of plasma lipids by Korean traditional confectionery in middle-aged women: A cross-over study with western cookie

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BACKGROUND/OBJECTIVES: The purpose of this study was to examine whether plasma lipid profiles are affected differently by snack kinds with equal calorific values.
SUBJECTS/METHODS: We compared a Korean traditional confectionery (*dasik*) with Western confectionery (cookie) in this regard. Controlled cross-over study consisted of two 3-week snack intake phases and for separating, a 2-week washout period (3-2-3) was carried out with 30 healthy women aged between 40-59 years old. Brown rice based Korean traditional confectionery and wheat flour based Western confectionery were used. The participants consumed either *dasik* or cookie every day for 3 weeks, providing 93 kcal a day.
RESULTS: The total cholesterol (TC) in the *dasik* group had decreased significantly after 3 weeks ($P < 0.05$). Furthermore, in the *dasik* group, reduction in TC and low-density lipoprotein-cholesterol were greater than those in the cookie group ($P < 0.05$).
CONCLUSIONS: Prioritizing functional snacks like *dasik* improves plasma lipid profiles; this may be useful information for individuals who cannot refrain from snacking.

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INTRODUCTION

The amount of time spent for snacking has increased in all age groups in recent years, and calories from snacking comprise almost a quarter of our daily energy intake [1]. Carbohydrate-based desserts, in particular, those made from refined flour, butter, eggs, and sugar are the most popular snacks among children and adults [2,3].

Dietary fat [4] and sucrose [5] contribute to elevate plasma lipid concentrations, which are a major risk factor for cardiovascular disease (CVD). *Dasik* (literally "tea food") is a Korean traditional confectionery. It is typically made by mixing steamed rice-cake flour, mung bean starch, and honey and shaping it using a special-purpose mold. No further baking or frying is required to make *dasik* [6]. Sometimes, to confer some color variety, pine pollen and roasted black sesame powder are used instead of rice-cake flour. Considering these ingredients and cooking process, *dasik* can be considered a healthier snack than Western style desserts, which are made using flour, butter, eggs, and sugar, and which are baked or fried. Health benefit of *dasik* would be more pronounced if some of the ingredients were replaced. Whole grains such as brown rice may diminish the chance of CVD [7], ischemic stroke [8], type II diabetes [9], and cancer [10]; for this reason, it is advisable to consume such staples often [11,12]. Recently, whole grain flours have become more popular in the Western diet, even in America [13]. Medicinal plants used in Oriental medicine confer health benefits by ameliorating chronic diseases. In particular, red ginseng is well known remedy in Oriental medicine, preventing serious diseases. Specifically, the effects of red ginseng in humans include anti-hypertension, anti-diabetes [14], hypolipidemic [15], and immune-stimulating activity [16]. In animal studies, ginseng has been shown to improve vascular health [14], enhance energy metabolism [17], relieve pain, and prevent cancer [18]. The active compound in red ginseng is ginsenoside, the health benefits of which are well established [18]. To reduce the energy content of food that derives from sugar and thus minimize detrimental health effects, it is urgent that manufacturers use sugar substitutes. Many possible candidates have been introduced to the market, but extensive research is still

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ongoing to find a better natural substitute for sugar.

In this cross-over study, we examined whether the choice of snack with equal calorific values can affect plasma biochemical parameters differently, in particular, plasma lipid profiles and diabetes-related indicators, if we had to take a snack. Specifically, we compared Korean confectionery, *dasik* intake with the consumption of Western confectionery, cookie in this regard; the participants were middle-aged, healthy adults.

SUBJECTS AND METHODS

Dasik preparation and control sample selection

Dasik was made using brown rice powder (CFEA Co., Cheolwon Gun, Gangwon, Korea), fructooligosaccharide (FOS; CJ Cheiljedang Co., Seoul, Korea), red ginseng extract (Korea Ginseng Co., Daejeon, Korea), and propolis (Withealth Co., Geochang Gun, Gyeongnam, Korea). This new recipe for *dasik* (brown rice-ginseng *dasik*, Br/ginseng *dasik*) was developed previously by our collaborator based on sensory evaluation. Briefly, the brown rice was roasted in the pan without oil. All ingredients (Table 1) were mixed thoroughly to make *dasik* dough. The exact amount of *dasik* dough was weighed and put into a special-purpose mold. The dough was pressed hard enough to be shaped. Six pieces of Br/ginseng *dasik* were wrapped in cooking paper and kept in the refrigerator before being served. For traditional Western confectionery, cookie (Lotus Biscoff, Lembeke, Belgium) was selected. The color and texture of cookie were closest to the Br/ginseng *dasik*. The calorie count of six pieces of Br/ginseng *dasik* or three cookies is 93 kcal. The nutritional values of Br/ginseng *dasik* and cookie served to the subject are presented in Table 2.

Table 1. Recipe for traditional Korean confectionery, *dasik*, preparation

Ingredients	g/100g
Brown rice flour	65.4
Fructoligosaccharide	28.0
Red ginseng extract[1)]	6.5
Propolis	0.05

[1)] J product manufactured by Korea Ginseng Corporation (Daejeon, Korea) which contains Rg1+Rb1+Rg3 as an bioactive compounds at 5.5 mg/g concentration was used.

Evaluation of the nutritional value of dasik and cookie

The nutritional values of *dasik* and cookie were analyzed. The calorie, carbohydrate, lipid, protein, sugar, and sodium contents were determined on the basis of (1) the recipe (in the case of *dasik*), or (2) the nutrition information (in the case of the cookie). A diet-analyzing program (CAN-pro 3.0; Korean Nutrition Society, Seoul, Korea) was used.

Subjects

Thirty volunteers, healthy women aged 40-59 years old, were recruited from the general community through poster advertising and e-mail campaigns: The aims of the study required that blood be taken four times; this was explained in the advertisement, as were the possible number of participants, duration of intervention, and exclusion criteria, which were: changes in body weight of more than 9 kg during the past 6 months; use of hypertension drugs; diabetes; and renal, liver, or CVD. In addition, subjects were not included if they were participating in a weight-control program or taking supplements that might have affected serum lipid concentrations. Patients with untreated hypertension (blood pressure > 140/90 mmHg) were also excluded.

Samples size

The required number of subjects for the study was calculated using a G*Power program [19], wherein the effect size in a two-tailed t-test was 0.5, significance level (α) was 0.05, and the required power level (1-β) was 0.95. In two groups, 54 subjects would be needed; baseline data were considered their own control. Thus, we estimated that 60 subjects would be required, assuming a 10% drop-out rate. However, because we used a cross-over study design, we recruited only 30 subjects, for a functional total of 60. Our primary outcome is plasma lipids and secondary outcome is diabetes related parameters including blood glucose, insulin, and leptin levels

Cross-over study design

This randomized, controlled, cross-over study consisted of two 3-week dessert-intake phases separated by a 2-week washout period (Fig. 1). Written consent was received from each individual, and they were randomly assigned to one of two groups (A & B), which were matched for age, weight, and

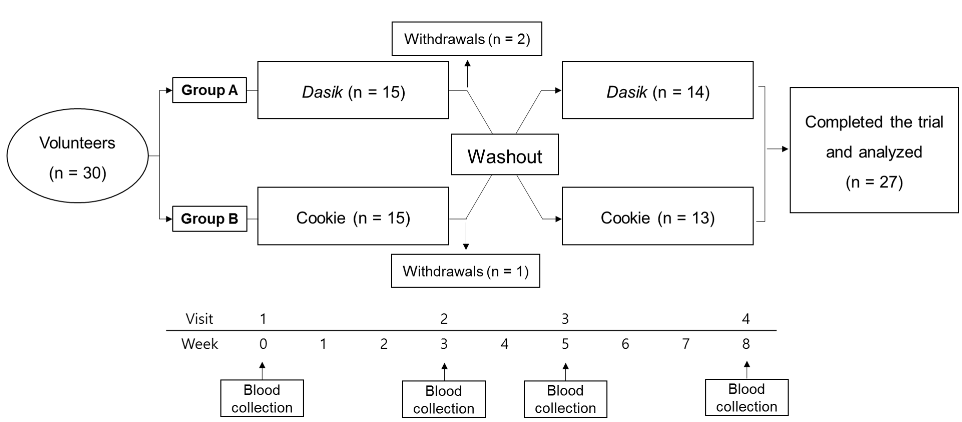

Fig. 1. Cross-over study design used in this study.

baseline BMI. During the first period of study, Group A consumed functional *dasik* (6 pieces, 93 kcal) daily as a dessert, whereas Group B had the cookies (3 pieces, 93 kcal). This accounted for approximately 5% of the individuals' total calorie intake. After 3 weeks, the subjects in both groups discontinued intake of their respective desserts and began the 2-week washout period. During the second period of study, the two groups switched desserts and continued for another 3 weeks. The *dasik* or cookies were packed for 1-day consumption, and were provided twice during each 3-week phase of study. *Dasik* or cookie intake was asked in person before providing the second batch of snack and the end of each experiment. Blood was collected twice during each phase of the study. After a 12-hour fast, blood was drawn in the morning of the visits during weeks 0, 3, 5, and 8 of the study period. Subjects in the *dasik* group were asked to keep their desserts in the refrigerator. Participants were encouraged to maintain their usual diet pattern and physical activities. And also participants were instructed not to take other snacks except those snacks provided by our team.

The cross-over study design (3-2-3) was conducted in agreement with the Helsinki Declaration of 1975, as revised in 2013 and approved by the Institutional Review Board (IRB) of YP Hospital (Yangsan, Korea), which is affiliated with Pusan National University (Busan, Korea) for ethical procedures and scientific care (Approval Number: 04-2012-038).

Primary outcome

The primary outcome was serum lipid profile, measured using Modular Analytics (PE; Roche Diagnostics, Mannheim, Germany). Serum collected at 0, 3, 5, and 8 week was analyzed for the serum triglyceride (TG), total cholesterol (TC), low-density lipoprotein (LDL)-cholesterol, and high-density lipoprotein (HDL)-cholesterol concentrations.

Diabetes-related parameters in blood

Serum glucose, alanine aminotransferase (ALT), and aspartate aminotransferase (AST) levels were measured using Modular Analytics (PE; Roche Diagnostics). Serum insulin concentration was determined using Modular Analytics (Modular E; Hitachi, Tokyo, Japan), and serum leptin concentration was determined using an r-counter (Cobra 5010. Quantum; Packard Instrument Co., Meriden, CT, USA). The homeostatic model assessment of insulin resistance (HOMA-IR), fasting glucose to insulin ratio (FGIR), and quantitative insulin sensitivity check index (QUICKI) were calculated [20].

Analysis of subjects' calorie and nutrient intake

To examine whether participants remained on their usual diet and physical activity during the experimental periods, we checked food records and physical activity at every visit to the research center. Specifically, during weeks 0, 3, 5, and 8 of the study period, the patients recorded two day food diaries, one on a weekday and the other at the weekend. Total calorie and nutrient intakes were analyzed (CAN-pro 3.0; Korean Nutrition Society, Seoul, Korea). Furthermore, the physical activity of subjects were monitored using a short version of the International Physical Activity Questionnaire (IPAQ) [21,22]. Physical activity was expressed as metabolic equivalent (MET)- minutes per week, which was calculated by multiplying the activity constant by (1) the activity duration per day (min/day) and (2) the number of times per week (days/week). The physical activity constants used to calculate the MET values of walking, moderate activity, and vigorous exercise were 3.3, 4.0, and 8.0, respectively. The patients responded to short version of the IPAQ.

Evaluating the nutritional value of dasik and cookies

The nutritional values of *dasik* and cookies were analyzed. The calorie, carbohydrate, lipid, protein, sugar, and sodium contents were determined on the basis of (1) the recipe (in the case of *dasik*), or (2) the nutrition information (in the case of the cookie). A diet-analyzing program (CAN-pro 3.0; Korean Nutrition Society, Seoul, Korea) was used.

Statistical analysis

Statistical analyses were performed using SPSS 23.0 software for Windows (SPSS Inc., Chicago, IL, USA). All data are presented as mean ± standard deviation (SD). Mean values between baseline and endpoint in each group were analyzed using the paired t-test and differences between the *dasik* and cookie groups were analyzed using the Student's t-test except diabetes-related indicators. Glucose, insulin, FGIR, HOMA-IR, QUICKI, and leptin levels were analyzed by Wilcoxon signed ranks test and Mann-Whitney U test for within and inter group differences, respectively. Values of $P < 0.05$ were considered to indicate statistical significance.

RESULTS

Comparison of nutrition values between functional dasik and cookie

In three cookies (93 kcal), the sugar content was 2.4-fold, the fat content 7.6-fold, and the sodium content 39.6-fold higher than those in six pieces of Br/ginseng *dasik* (Table 2).

Human study population

Ninety percent of participants completed the study after 8 weeks. Two subjects withdrew because they did not follow the study instructions and one withdrew because of a severe cold. Total of 27 subjects were finished the study. The baseline

Table 2. Nutritional values of dessert served to the subject daily

	Dasik	Cookie[1)]
Daily serving size	6 pieces (29.3 g)	3 pieces (18.6 g)
Energy (kcal)	93.4	93.0
Carbohydrate (sugar) (g)	21.9 (2.9)	13.7 (6.9)
Protein (g)	1.5	1.3
Fat (g)	0.5	3.8
Sodium (mg)	1.8	71.3
Fiber (g)	3.6	0.0
Ginsenoside Rg1+Rb1+Rg3 (mg)	2.3	0.0
Total flavonoid (mg)	0.2	0.0

[1)] Ingredients in cookie (Lotus Korea Co., Ltd) are wheat flour, sugar, vegetable oil & fat, candy sugar syrup, raising agent (sodium hydrogen carbonate), soy flour, salt, cinnamon.

Table 3. Changes in body weight and BMI in subjects

Variables	*Dasik*	Cookie	*P*-value[2)]
Weight (kg)			
Baseline	62.47 ± 12.32	59.93 ± 5.38	0.538
Endpoint	63.05 ± 12.23	60.53 ± 5.57	0.542
P-value[1)]	0.028	0.012	
BMI (kg/m^2)			
Baseline	23.30 ± 3.07	22.88 ± 2.53	0.720
Endpoint	23.52 ± 2.95	23.12 ± 2.57	0.731
P-value[1)]	0.030	0.012	

Data are mean ± SD (n = 27 in each group).
BMI, body mass index.
[1)] *P*-value is calculated from paired t-test between baseline and endpoint.
[2)] *P*-value is calculated from Student's t-test between *Dasik* and Cookie group.

Table 4. Changes in serum lipid profiles of the subjects after 8 weeks of dessert diet intervention

Variables	*Dasik*	Cookie	*P*-value[2)]
TG (mg/dL)			
Baseline	131.19 ± 108.71	104.31 ± 57.99	0.273
Endpoint	116.46 ± 80.48	108.88 ± 82.98	0.740
P-value[1)]	0.108	0.752	
Change	-14.73 ± 45.00	4.58 ± 73.04	0.257
TC (mg/dL)			
Baseline	216.62 ± 36.23	210.50 ± 31.95	0.522
Endpoint	203.23 ± 23.71	213.38 ± 32.28	0.180
P-value[1)]	0.027	0.485	
Change	-13.39 ± 28.78	3.42 ± 24.60	0.028
LDL-C (mg/dL)			
Baseline	131.38 ± 33.36	129.12 ± 27.65	0.791
Endpoint	123.38 ± 22.68	132.08 ± 33.09	1.000
P-value[1)]	0.137	0.491	
Change	-10.16 ± 24.62	2.96 ± 21.58	0.048
HDL-C (mg/dL)			
Baseline	59.93 ± 15.64	61.12 ± 12.97	0.766
Endpoint	57.31 ± 16.33	59.27 ± 13.77	0.642
P-value[1)]	0.099	0.089	
Change	-2.62 ± 7.77	-1.85 ± 5.31	0.679

Data are mean ± SD (n = 27 in each group).
[1)] *P*-value is calculated from paired t-test between baseline and endpoint.
[2)] *P*-value is calculated from Student's t-test between *Dasik* and Cookie group.

characteristics of the two groups were well matched in terms of the entry criteria (Table 3). The mean body weight and BMI of both groups increased significantly during the 8 weeks of the study (Table 3).

Primary outcome

The groups did not differ significantly in terms of fasting serum lipids at baseline (Table 4). Meanwhile, in the *dasik* group, the serum TC concentration after 3 weeks of dessert consumption decreased by 13.39 mg/dL ($P < 0.05$); no difference was detected in the cookie group. The decreases in serum concentrations of TC and LDL-cholesterol in the *dasik* group were higher than those in the cookie group ($P < 0.05$). Although the mean TG concentration decreased after 3 weeks of *dasik* consumption (-14.73 mg/mL), while it increased after cookie consumption (+4.58 mg/dL), these changes were not significant.

Table 5. Comparisons of fasting blood glucose, insulin, and leptin concentration of the subjects

Variables	*Dasik*	Cookie	*P*-value[2)]
Glucose (mg/dL)			
Baseline	93.97 ± 7.75	94.03 ± 10.82	0.926
Endpoint	94.38 ± 8.98	94.97 ± 12.84	0.779
P-value[1)]	0.673	0.871	
Insulin (μU/mL)			
Baseline	5.62 ± 2.56	5.45 ± 3.35	0.678
Endpoint	5.85 ± 2.97	5.88 ± 3.50	0.947
P-value[1)]	0.599	0.186	
FGIR			
Baseline	19.98 ± 11.56	22.90 ± 14.92	0.546
Endpoint	18.27 ± 8.48	23.54 ± 18.28	0.755
P-value[1)]	0.393	0.554	
HOMA-IR			
Baseline	1.42 ± 0.75	1.39 ± 1.02	0.460
Endpoint	1.62 ± 1.06	1.53 ± 1.00	0.762
P-value[1)]	0.194	0.294	
QUICKI			
Baseline	0.38 ± 0.03	0.39 ± 0.07	0.475
Endpoint	0.37 ± 0.04	0.39 ± 0.05	0.592
P-value[1)]	0.294	0.429	
Leptin (ng/mL)			
Baseline	8.86 ± 5.74	9.28 ± 7.86	0.744
Endpoint	8.72 ± 5.09	9.64 ± 6.07	0.646
P-value[1)]	0.754	0.182	

Data are mean ± SD (n = 27 in each group).
FGIR, fasting glucose to insulin ratio; HOMA-IR, homeostasis model assessment of insulin resistance; QUICKI, quantitative insulin sensitivity check index.
[1)] *P*-value is calculated from Wilcoxon single-rank test between baseline and endpoint.
[2)] *P*-value is calculated from Mann-Whitney U test between *Dasik* and Cookie group.

Serum HDL-cholesterol concentrations were unchanged in both groups.

Change in glycemic parameters

The two groups did not differ in terms of serum glucose or insulin concentration at baseline (Table 5); both were within the normal range. Moreover, when the baseline glucose and insulin concentrations were compared to the post-treatment values, there were no significant differences in either group; however, a slight increase in insulin level was observed in both groups. Similarly, in neither group were there significant changes in the FGIR, HOMA-IR, and QUICKI values, and the serum leptin concentration was not changed after 3 weeks of dessert consumption in either group.

Energy and macronutrient intakes

At baseline, the total energy and macronutrient intakes of the two groups did not differ (Table 6). Subjects remained on their usual diet throughout the study; hence, there were no significant changes in the nutrient intake of either group. Furthermore, the physical activity level did not change significantly in either group (Table 6). Serum levels of AST and ALT were within the normal ranges after 3 weeks of dessert consumption, regardless of the dessert type (data not shown).

Table 6. Changes in energy consumption, nutrient intake, and physical activity of subjects before and after 8 weeks of dessert intervention

Variables	*Dasik*	Cookie	*P*-value[2)]
Total energy (kcal/day)			
Baseline	1,613.49 ± 299.81	1,575.46 ± 512.53	0.746
Endpoint	1,622.35 ± 458.69	1,604.10 ± 589.33	0.906
P-value[1)]	0.668	0.869	
Total protein (g/day)			
Baseline	70.84 ± 15.98	60.59 ± 18.57	0.475
Endpoint	64.54 ± 25.28	65.24 ± 31.47	0.688
P-value[1)]	0.548	0.299	
Fat (g/day)			
Baseline	45.52 ± 13.56	44.20 ± 23.13	0.804
Endpoint	50.78 ± 22.76	44.12 ± 28.82	0.382
P-value[1)]	0.569	0.909	
Cholesterol (mg/day)			
Baseline	383.12 ± 154.67	313.64 ± 178.85	0.140
Endpoint	431.41 ± 340.63	369.76 ± 219.71	0.435
P-value[1)]	0.476	0.668	
Carbohydrate (g/day)			
Baseline	231.35 ± 57.51	216.33 ± 92.62	0.486
Endpoint	195.53 ± 70.05	238.57 ± 85.15	0.062
P-value[1)]	0.584	0.181	
Fiber (g/day)			
Baseline	20.72 ± 5.83	15.89 ± 7.54	0.014
Endpoint	18.32 ± 7.77	18.43 ± 7.07	0.960
P-value[1)]	0.880	0.551	
Physical activity (MET-min/wk)			
Baseline	2,060 ± 2386	2,069 ± 1377	0.989
Endpoint	2,208 ± 1747	2,215 ± 2177	0.992
P-value[1)]	0.638	0.284	

Data are mean ± SD (n = 27 in each group).
MET, metabolic equivalent.
1) *P*-value is calculated from paired t-test between baseline and endpoint.
2) *P*-value is calculated from Student's t-test between *Dasik* and Cookie group.

DISCUSSION

In this study, the serum lipid-lowering effects of *dasik*, a Korean traditional cookie, were compared with those of a Western-style cookie in a carefully controlled, cross-over study involving middle-aged, healthy subjects. The study comprised two 3-week dessert-intake phases separated by a 2-week washout period. Ninety percent of the participants completed the study. The compliances of both snacks were 100%. Participants appreciated the taste of *dasik* very much. Each 1-day portion of dessert contained 93 kcal, which constituted approximately 5% of the total daily calorie intake of the subjects, thereby body weight and BMI increased compared to their baseline. However, daily intake of Br/ginseng *dasik* for 3 weeks significantly reduced the serum concentrations of TC concentration ($P < 0.05$). Furthermore, the decreases in serum TC and LDL-cholesterol concentrations were significantly greater in the *dasik* group than in the cookie group ($P < 0.05$). In this study, no significant changes in fasting blood glucose and insulin level were observed by 3 weeks of snack intake. As a result, FGIR, HOMA-IR, and QUICKI values were not changed.

The desserts differ considerably in terms of nutrient content, although the calorie count is almost the same. The carbohydrate and fiber content in a 93-kcal Br/ginseng *dasik* (1-day portion) are 1.6-fold and 3.6-fold higher than those in a same portion of cookies, respectively. Meanwhile, the sugar, fat, and sodium contents of the cookie are 2.4-fold, 7.6-fold, and 39.6-fold, higher than those of the Br/ginseng *dasik*, respectively. This may explain why the Br/ginseng *dasik* has such a pronounced lipid-lowering effect. Surprisingly, fiber is not present, and the sodium content is extremely high, in the cookie. It is well known that dietary interventions-such as reducing saturated fat, sugar, and salt in the diet, while increasing dietary fiber-lower CVD risk by modifying levels of serum lipoproteins and improving those of cholesterol [23-25]. In this study, we did not investigate CVD risk in subjects who had consumed two different desserts. However, based on the results from the *dasik* group, where significant decreases in TC occurred, we presume that Br/ginseng *dasik* would have a health benefits against CVD. Thus, to reduce the prevalence of CVD, we strongly recommend prioritizing healthy dessert options like *dasik* over calorie-dense desserts.

Nutritional strategies that can ensure prevention rather than cure must underpin current public health policies. Untreated obesity progressively leads to serious pathological conditions such as type 2 diabetes mellitus, cardiovascular disease, osteoarthritis, cancers, and metabolic syndrome [26]. Energy-dense, nutrient-poor foods such as sugar and saturated fats, as well as a sedentary lifestyle, are the primary cause of obesity [27]. Researchers have therefore made a great effort to find healthy food items for daily use [23,28-30]. However, intervention studies with snack are few. Daily consumption of 70 g Khakhra for 90 days, a functional snack in India reduced blood glucose level in type II diabetic males, which was made with grains, seeds, soyabean, and some spices [31]. In this study, Br/ginseng *dasik*, which is made using brown rice flour, red ginseng extracts, FOS, and propolis, significantly lowered serum TC concentration in middle-aged, healthy adults.

Brown rice is richer in protein, lipids, dietary fibers, minerals, and fat-soluble vitamins than regular polished rice [11]. Indeed, unpolished grains reduce the serum concentration of lipids, in particular TC and LDL-cholesterol, and thus lower the risk of CVD [7,11]. Moreover, brown rice effectively demonstrated plasma lipid reduction and/or blood glucose level [32,33].

The saponins of Korean red ginseng, especially ginsenoside-Rg1, Rb2, and Rg3 are the active compounds responsible for this hypolipidemic activity. The known activities of these ginsenosides have been cited as inhibition of pancreatic lipase activity [34] and lipogenesis [35]. Ginsenosides, also, accelerate the turnover of serum cholesterol by elevating cholesterol degradation and excretion, as well as LDL-receptor synthesis [15,36]. In this study, the content of ginsenosides in one day serving of *dasik* was 2.3 mg, which is equivalent to that in the half cup of red ginseng tea. Propolis, which is collected by bees from the exudates of plants, has been shown to down-regulate genes associated with lipid biosynthesis and thus prevent hyperlipidemia [37].

The habitual intake of sugar in the form of snacks has been identified as a major cause of obesity in all age groups.

Therefore, finding a natural substitute for sugar is an urgent issue in the food industry. In this regard, FOS is 30%-60% as sweet as sugar, but it contains only 25%-35% of the food energy (1.0-1.5 kcal/g). In addition, FOS has demonstrated serum and hepatic lipid-lowering effects in rats [38,39], and FOS-fed rats exhibit reduced epidydimal fat mass and increased fecal excretion of neutral sterol and volatile fatty acids [39]. In this study, we wished to examine whether a traditional Korean cookie that has been consumed for over 1,000 years is healthier than a traditional Western-style cookie. In South Korea, snacking was not a problem until 4 decades ago before Western-style diets and desserts were introduced. The health problems caused by snacking became apparent in Western countries, due to the high fat, sugar, and butter contents of snacks.

Our study was limited in selecting control sample. We ensured that the calorie counts of *dasik* and the cookie were the same. For this reason, the individually wrapped cookie was selected. The cookie is available at markets in Korea; it is a traditional, Western-style cookie made from refined flour, butter, sugar, and eggs. The subjects in our study were middle-aged adults. But the lipid-lowering effects of *dasik* observed in this study may be applicable to all generations as regards snacking. Further clinical studies are required to investigate *dasik* consumption in obese children who are attracted to rich-flavored, sweet cookies.

In conclusion, we strongly recommend taking a preventative approach to reducing serum lipids by prioritizing the habitual intake of healthy desserts like Br/ginseng *dasik*.

CONFLICT OF INTEREST

The authors declare no potential conflicts of interests.

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