Glycative Stress Research

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Original article

Lipid profile of masters athletes in ice-skating, a model of anti-aging research

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Abstract

***Objective*:** Masters athletes in ice-skating are considered to serve as a model of anti-aging research. Previously, we investigated a study population of such athletes using the Anti-Aging QOL Common Questionnaire (AAQOL), and proposed a method of analysis by category. In this study, blood data from masters athletes in ice-skating were analyzed with a focus on lipid profiles.
***Methods*:** Lipid profiles, a parameter closely associated with glycation stress, were examined in 76 male masters athletes in ice-skating (aged 40-73 years with a mean age of 54.2 ± 9.5 years).
***Results*:** With regard to body mass index (BMI), triglyceride (TG), high-density lipoprotein-cholesterol (HDL), low-density lipoprotein-cholesterol (LDL), LDL/HDL, and atherogenic index (AI), the values were often within their respective normal ranges for 84.2%-98.6% of the subjects. A significant correlation was found in the combinations of parameters BMI and TG ($r = 0.31$), BMI and AI ($r = 0.22$), TG and HDL ($r = 0.52$), TG and AI ($r = 0.57$), and TG and HDL/LDL ($r = 0.29$).
***Conclusion*:** The results of the present study are believed to be highly significant as it was conducted using an exclusive limited population of subjects as a model of anti-aging medicines with nearly uniform lifestyles; the results of such a population have not been reported to date. This study provides meaningful basic data for future research. The results of the present study revealed characteristic findings, including low TG, hyper-HDL-emia, and BMI-lipid correlations, along with evidence for low levels of glycation stress, suggesting that the exercise habits of these subjects maintained over many years might have a favorable effect. It should be noted, however, that the present study involves a limitation from the analytical viewpoint of lipid profile only; it will be necessary to investigate correlations with lifestyles, cardiopulmonary function, exercise function, and other factors, as well as lipid profiles.

***KEY WORDS*:** lipid profile, masters athletes, ice-skating, aerobic exercise, resistance

Introduction

Master athletes are defined as athletes typically older than 35 years of age and systematically training for, and competing in organized forms [1]. They usually continue sports for long years with less vascular diseases, dementia or social problems, compared to usual healthy middle-aged people [2-6]. From these reports, it is more likely that masters athletes would be the healthy long-lived model or achiever [2-4].

We have investigated the anti-aging research for healthy subjects and patients with various diseases, using the standard Anti-Aging QOL common Questionnaire (AAQOL) [7,8]. AAQOL has been useful tool for investigating daily QOL, including 30 physical, 22 psychological symptoms, and several life style-related inquiries. We proposed the new categorization analysis method and revealed the significant differences between masters athletes and usual healthy middle-aged people [7,8].

In addition, we have studied the detail aspect of master athletes in ice-skating and revealed their characteristic points. They usually participate the annual ice-skating competition, and continue regular life style and applicable habit of meal, alcohol and smoking, having almost same exercise habit during four seasons with 4.3-4.5 days per week [8,9]. Consequently, masters athletes would be suitable for study subjects in the field of anti-aging medicine with the purpose of pursuing health and long life.

Recently, anti-aging research has been progressed globally, and glycation stress and advanced glycation end products (AGEs) have been focused as risk factors of the aging.

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Not only the glucose metabolism but also the lipid (LDL cholesterol and triglyceride) would influence glycation stress. Moreover, the exercise has been known to be effective in reducing glycation stress [10).

In the previous reports, athletes have tendency to show decreased triglyceride (TG) and elevated HDL levels [11,12). Thus, we can raise a hypothesis that persistent exercise in masters athletes could improve glucose and lipid metabolism, resulting in decreased glycation stress. Correlations among these several factors must be investigated in this field of research.

In this study, we investigated glucose and lipid metabolism for masters athletes in ice-skating, who have an almost uniform lifestyle with constant exercise habit.

Methods

Subjects

The subjects of this study consisted of 76 male masters athletes in ice skating who had been ice skaters for at least 5 years. The mean age is 54.2 ± 9.5 years, and median age is 52.5 years, ranging 40-73 years old (***Table 1***).

Survey methods and parameters

A questionnaire form was sent to 94 candidate subjects who attended annual masters skating game, of whom 76 responded (responding ratio: 81%). Each subject was asked to list his height, body weight, and blood test data focusing on lipid, including total cholesterol (Total-C), triglyceride (TG), high-density lipoprotein-cholesterol (HDL), and low-density lipoprotein-cholesterol (LDL). In addition to these parameters, correlations with body mass index (BMI) as well as the arteriosclerosis indicators LDL/HDL ratio and atherogenic index (AI) were statistically analyzed using the equation AI = (Total-C − HDL) ÷ (HDL).

Statistical analyses

Data were shown as the mean ± standard deviation. For statistical analyses, correlation coefficients (Pearson) were calculated using the JMP (Version 8) statistical analysis software (JMP Japan Division of SAS Institute Japan Ltd., Minato-ku, Tokyo, Japan) and the Microsoft Excel analytical tool. Intergroup comparisons were made using the Wilcoxon rank sum test or the Bonferroni multiple comparison (Lambert method). A significance level of less than 5% obtained using the two-tailed test was considered to indicate a significant difference.

Ethical Considerations

The present study was conducted in compliance with the ethical principles of the Declaration of Helsinki and Japan's Act on the Protection of Personal Information, and with reference to the Ministerial Ordinance on Good Clinical Practice (GCP) for Drug (Ordinance of Ministry of Health and Welfare No. 28 of March 27, 1997). No ethics committee meeting was held. We got the informed consent from the subjects concerning this questionnaire.

Results

The BMI, TG, HDL, LDL, LDL/HDL, and AI distributions among the 76 subjects are shown in ***Fig. 1***, and the results for these parameters and the ratios of respondents with normal values are shown in ***Table 2***. With regard to these parameters, the values were often within their respective normal ranges for 84.2%-98.6% of the respondents. The normal ranges in this study are citied from the ordinary clinical laboratory values which is broadly used in Japan.

Correlations between various marker combinations were examined, and the results for correlations among all markers are shown in ***Table 3***. Combinations of parameters found to have a significant correlation consisted of BMI and TG (r = 0.31), BMI and AI (r = 0.22), TG and HDL (r = 0.52), TG and AI (r = 0.57), and TG and HDL/LDL (r = 0.29).

Table 1. Age distribution of the subjects

age	40 -	45 -	50 -	55 -	60 -	65 -	70 -
n	10	23	10	8	11	8	6

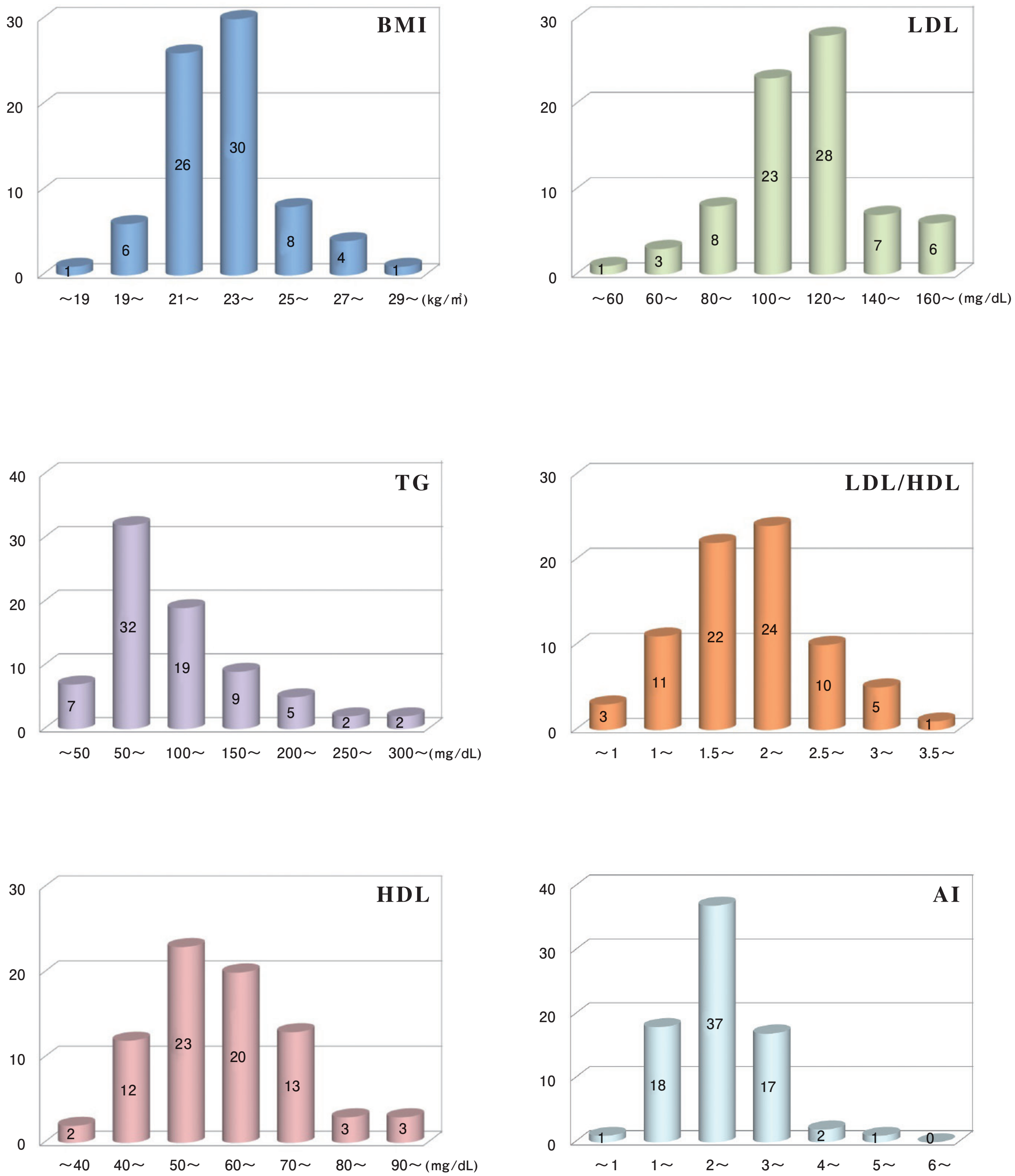

Fig 1. **Profiles of serum lipids in masters athletes.**

BMI, body mass index; TG, triglyceride; LDL, low-density lipoprotein cholesterol; HDL, high-density lipoprotein cholesterol; AI, atherogenic index.

Table 2. Data of the subjects and the normal ratio of each marker.

	data of the subjects (n = 76)					normal	normal	normal
	Mean	SD	max	min	median	range	number	ratio (%)
BMI (kg/m^2)	23.4	2.1	30.1	18.1	23.3	< 25	64 / 76	84.2
TG (mg/dL)	119	64.5	339	34	97	< 150	58 / 76	76.3
HDL (mg/dL)	61.3	14.3	109	33	61	≧ 40	75 / 76	98.6
LDL (mg/dL)	121	25	183	47	76	< 140	64 / 76	84.2
LDL/HDL	2.08	0.62	3.78	0.72	2.02	≦ 3.0	71 / 76	93.4
AI	2.5	0.9	5.3	0.9	2.5	≦ 4.0	74 / 76	97.4

BMI, body mass index; TG, triglyceride; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; AI, atherogenic index; SD, standard deviation.

Table 3. p and r values of correlation among lipid markers.

		BMI	TG	HDL	LDL	LDL/HDL	AI
p value	BMI	–	0.003 *	0.06	0.43	0.06	0.03 *
	TG	0.003 *	–	< 0.001 *	0.12	0.005 *	< 0.001 *
	HDL	0.06	< 0.001 *	–	0.22	< 0.001 *	< 0.001 *
	LDL	0.43	0.12	0.22	–	< 0.001 *	< 0.001 *
	LDL/HDL	0.06	0.005 *	< 0.001 *	< 0.001 *	–	< 0.001 *
	AI	0.03 *	< 0.001 *	< 0.001 *	< 0.001 *	< 0.001 *	–
r value	BMI	–	0.31	0.18	0.02	0.18	0.22
	TG	0.31	–	0.52	0.13	0.29	0.57
	HDL	0.18	0.52	–	0.09	0.72	0.83
	LDL	0.02	0.13	0.09	–	0.69	0.41
	LDL/HDL	0.18	0.29	0.72	0.69	–	0.89
	AI	0.22	0.57	0.83	0.41	0.89	–

BMI, body mass index; TG, triglyceride; HDL, high-density lipoprotein cholesterol; LDL, low-density lipoprotein cholesterol; AI, atherogenic index.

Discussion

In this study, we examined the lipid profiles of masters athletes in ice skating, a model of anti-aging research. The subjects represented a population exclusively with nearly uniform lifestyles. Since no study of such a limited population has been reported to date, the present study is believed to be of highly clinical significance as it provides relevant basic data for significant research.

Reported studies using AAQOL revealed that masters athletes in ice skating and those in field and track events had less symptoms physically and mentally, and had favorable lifestyle profiles [7-9]. Moreover, genetic and metabolic adaptive pathways are known to be altered by exercise habit in masters athletes [13]. AAQOL has been the simple and useful tool for evaluating more than 50 physiological / psychological symptoms. The limitation of AAQOL, however, would be unable to cover all other clinical symptoms and problems.

In the anti-aging and sports medicine, people with daily exercise habits are reported to have low BMI values and appropriate HDL and TG concentrations [14]. Skating and rowing have similarity for its strong powerful load and long-time endurance exercise. A study on lipids in rowing athletes (mean age: 64 years; 17 subjects) revealed that their LDL/HDL ratios were lower than those of subjects at similar ages and young rowing athletes, indicating that rowing was suitable for health promotion [15]. In addition, habitual rowing exercise in the elderly did not influence arteriosclerosis [16].

No study on BMI or lipid profile data from a limited study population as middle-aged and elderly masters athletes in ice skating has thus far been reported; the present report is the first such report. In the present study, the BMI value tended to be lower than the normal range, whereas the ratio of subjects with normal TG, HDL, LDL, LDL/HDL ratio, and AI values was higher at 76-98% (Fig. 1, Table 2).

With regard to correlations between various combinations of parameters, many significant correlations were found, including the correlation between high HDL and low TG, which was characteristic of masters athletes in ice skating (Table 3). This appears to be related to the fact that the study population consisted of subjects having a limited range of conditions.

On the other hand, the correlation between BMI and HDL or LDL/HDL ratio was found to have a p-value of 0.06, which was slightly lower than the cutoff value for a significant correlation ($p < 0.05$); this was attributable, in part, to the low LDL/HDL ratio values in patients with extremely high HDL values.

Persisting aerobic exercises do not always result in increased HDL. In a review of 84 articles, including 58 randomized controlled trials (RCTs), studies were roughly classified according to exercise conditions [17]. That review found significantly increased HDL at 3-25% incidences (6/28 articles) and decreased TG at 18-25% (3/27 articles) with moderate aerobic exercises, significantly increased HDL at 2-21% (22/37 articles) and decreased TG at 2-20% (12/35 articles) with intense aerobic exercises, decreased LDL at 5-23% (9/23 articles) and decreased TG at 11-28% (3/23 articles) with resistance exercises, and decreased LDL at 4-34% (3/8 articles) and increased HDL at 3.5-23% (3/8 articles) with both aerobic and resistance exercises.

Separately, a review of 1833 subjects in 31 RCT reports found that aerobic exercises produced a reduction of TG of 7.1 mg/dL and a rise of HDL of 1.9 mg/dL [18]. A review of 46 articles, including 8 RCT articles and 3 articles on quasi-experimental studies, suggests that the intensity and duration of aerobic exercises may have a differential effect on HDL increases [19]. Changed ratio of HDL and TG levels are higher in athletes than that in non-athletes [20]. The age-dependent worsening of lipid profiles is observed in sedentary elderly subjects, but the beneficial effects of motor activities on lipid profile observed, recommending of physical exercises to the elderly [21]. Moreover, in the masters athletes and normal healthy subjects, persisting aerobic exercise (inspiration and expiration) influence the changes of TG and HDL levels [22].

A practical demonstrative study reviewed 25 RCT articles encompassing a period of 40 years, showing that the HDL level began increasing at an exercise volume of 120 minutes/week, with a 1.4 mg/dL increment of HDL every 10 minutes [23]. We can apply these results to the data obtained in the present study, with the data of average exercise volume of 60-90 minutes/day and ≥ 3-4 days/week for masters athletes in ice skating. The weekly exercise volume was calculated as approximately 240-360 minutes, and the increase in HDL as approximately 16-32 mg/dL. The present data seems to be in agreement with the aforementioned result (Table 2).

A study conducted from the viewpoint of anti-aging research showed that perceptions of the 5-year age competitive categories influence the competitiveness in masters sports, and it identified five mental factors (expectancy, motivation, training, awareness of advantages, and physiological capacity [24]. It is hoped that further investigations will be conducted to clarify not only lipid profiles, but also associations with AAQOL findings, cardiopulmonary function, exercise capacity, and other related factors.

Conclusion

Lipid profiles were examined in masters athletes in ice skating, the model of anti-aging research. The observed BMI, TG, HDL, LDL, LDL/HDL, and AI values were found to often be within their respective normal ranges associated with low glycation stress, and were attributable to exercise habits over many years.

Acknowledgement

A summary version of this article was presented at the 10th Scientific Meeting of Japanese Society of Anti-Aging Medicine (Kyoto) in 2010. Thereafter, further investigations were conducted with an expanded sample size yielding the additional data presented in the present article.

Statement of conflict of interest

Non contributory.

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