

Analysis of Blood Lipids, Blood Glucose, Blood Uric Acid, and Blood Routine Test Results in Retired Employees of a Unit in the Civil Aviation System

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Abstract: *Objective:* To investigate and analyze the annual physical examination results of retired employees from a unit in the civil aviation system, focusing on blood lipids, blood glucose, blood uric acid, and blood routine results. The study aims to provide relevant references for formulating reasonable disease management measures for preventing and controlling hyperlipidemia, hyperuricemia, and other conditions in retired employees. *Methods:* The examination results of 231 participants were collected and analyzed. The participants were divided into four groups based on age: middle-aged group, young-old group, middle-old group, and old-old group. The blood test results were compared across these groups, and an assessment of atherosclerotic cardiovascular disease (ASCVD) risk levels was completed in conjunction with medical history. Blood test results were also compared by gender. *Results:* There were no significant statistical differences in blood test results when grouped by age. However, the prevalence of hyperuricemia was higher in males than in females, while the prevalence of hypercholesterolemia was higher in females than in males. The LDL-C target achievement rate was lower in the moderate-and-high-risk group as well as the very high-risk group as defined by ASCVD risk levels. *Conclusion:* Management of hyperuricemia and hyperlipidemia in retired employees (elderly patients) should be strengthened to reduce the risk of ASCVD events and alleviate the potential medical burden associated with disease progression.

Keywords: Physical examination; Blood routine; Blood lipids; Blood uric acid; Blood glucose; Atherosclerotic cardiovascular disease

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1. Introduction

As the aging population progresses and the average life expectancy of the elderly in Beijing increases, the

health status of retired employees has garnered increasing attention. Indicators such as blood lipids, blood glucose, blood uric acid, and routine blood tests are basic parameters for assessing individual health status and are of great significance for the early identification of common diseases and the management of chronic diseases. The prevalence of atherosclerotic cardiovascular disease (ASCVD) (such as ischemic heart disease and ischemic stroke) continues to rise and currently ranks as the leading cause of death among urban and rural residents in China, accounting for more than 40% of all causes of death ^[1]. The rates of disability and mortality increase with age ^[2].

This study selected 231 retired employees from a unit within the civil aviation system as research subjects. By deeply analyzing their annual physical examination results, including blood lipids, blood glucose, blood uric acid, and routine blood test indicators, the study aims to reveal the potential health management risks among retired and elderly populations. The goal is to promote the early identification and intervention of ASCVD risks by health management personnel and to provide a basis for developing reasonable measures to reduce the occurrence of ASCVD events, thereby comprehensively improving the quality of life and health levels of retired employees.

2. Materials and methods

2.1. Study subjects

The study included the physical examination data of 231 retired employees from a unit within the civil aviation system who underwent physical examinations at the Civil Aviation General Hospital in Chaoyang District, Beijing, from September 2023 to November 2023.

2.2. Research methods and diagnostic criteria

2.2.1. Research methods

This study is a cross-sectional study that collected information on the examinees through the Civil Aviation General Hospital's health examination management information system (Tongfang Weikang Technology T-PES2005), including past medical history and examination items. All participating retired employees completed the relevant examinations after fasting for at least 8 hours, starting in the early morning of the next day. The following examinations were completed by nurses, technicians, and physicians in our department who received uniform training. Examinees had the right to choose or refuse certain examination items. Laboratory tests included routine blood tests (using the SYSMEX XN-9000 automated hematology analyzer by Sysmex Corporation, Japan) and biochemical tests (using the Beckman Coulter AU5800 automated biochemistry analyzer).

2.2.2. Diagnostic criteria

- (1) Blood glucose: The diagnosis of diabetes was determined based on the diagnostic criteria proposed by the WHO Expert Committee on Diabetes in 1999, which also includes individuals previously diagnosed with diabetes and currently undergoing treatment. In this study, patients were generally required to fast before the examination, so fasting venous blood glucose levels > 6.1 mmol/L were considered elevated.
- (2) Blood lipids: In the fasting state during the examination, appropriate blood lipid levels were defined as follows: total cholesterol (TC) < 5.2 mmol/L, triglycerides (TG) < 1.7 mmol/L, low-density lipoprotein cholesterol (LDL-C) < 3.4 mmol/L, and high-density lipoprotein cholesterol (HDL-C) ≥ 1.0 mmol/L. Otherwise, it was considered dyslipidemia ^[3]. According to the guidelines ^[3], in combination with the

examinee's serological results and their provided medical history, a risk assessment was conducted, which included an overall ASCVD risk assessment process. The subjects were then classified into different groups based on whether their blood lipid levels reached the target value after lipid-lowering interventions (categorized into low-risk group [LDL < 3.4 mmol/L], moderate-and-high-risk group [LDL < 2.6 mmol/L], and very high-risk group [LDL < 1.8 mmol/L] based on the different target values for lipid reduction).

- (3) Liver function: According to the reference values provided in the reagent instruction manual, normal liver function was defined as alanine aminotransferase (ALT) < 50 IU/L and aspartate aminotransferase (AST) < 45 IU/L; otherwise, liver function was considered abnormal.
- (4) Uric acid: According to the reference values provided in the reagent instruction manual, elevated blood uric acid levels were defined as UA > 422 µmol/L for males and UA > 387 µmol/L for females.

2.3. Statistical analysis

Data entry and processing were performed using Excel, and statistical analysis was conducted using SPSS 29.0 software. Qualitative data were described using frequencies and percentages, and non-normally distributed quantitative data were described using medians and interquartile ranges. For comparisons between groups where the grouping variable and the test variable were both binary, Pearson's chi-squared test or Fisher's exact test was used. For comparisons where the grouping variable was ordinal and the test variable was binary, the linear-by-linear association chi-squared test was used. A *P*-value of < 0.05 was considered statistically significant.

3. Results

3.1. Age and gender of examinees

Among the 231 examinees, 64 were male (27.70%) and 167 were female (72.30%); the age range was 55 to 90 years, with a median age of 68 years (interquartile range: 62–75 years). The age groups were divided as follows^[4]:

- (1) Middle-aged group (55–59 years): 24 people (10.40%); male/female: 0/24, 0%/10.4%
- (2) Young-old group (60–69 years): 114 people (49.40%); male/female: 36/78, 56.30%/46.70%
- (3) Middle-old group (70–79 years): 69 people (29.90%); male/female: 20/49, 31.30%/29.30%
- (4) Old-old group (80 years and above): 24 people (10.40%); male/female: 8/16, 12.50%/24.00%

The examination indicators were analyzed according to gender and age group.

3.2. Examination results

3.2.1. Summary of examination results

An analysis of abnormal examination indicators (see **Table 1**) revealed that the most prevalent abnormalities were elevated total cholesterol, elevated low-density lipoprotein (LDL), elevated fasting blood glucose (FBG), elevated triglycerides (TG), and increased platelet distribution width (PDW). Among these, liver function abnormalities were more frequently detected in males, while females were more likely to show abnormalities in hemoglobin (low detection) and platelets (high detection). The differences in other items were not significant.

Table 1. Top 10 abnormal examination indicators [*n* (%)]

No.	Male		Female		Overall	
	Physical examination	<i>n</i> (%)	Physical examination	<i>n</i> (%)	Physical examination	<i>n</i> (%)
1	Elevated TC	23 (35.94)	Elevated TC	82 (49.10)	Elevated TC	105 (45.45)
2	Elevated FBG	21 (32.81)	Elevated LDL	53 (31.74)	Elevated LDL	72 (31.17)
3	Elevated LDL	19 (29.69)	Elevated TG	45 (26.95)	Elevated FBG	60 (25.97)
4	Elevated PDW	17 (26.56)	Elevated FBG	39 (23.35)	Elevated TG	60 (25.97)
5	Elevated TG	15 (23.44)	Elevated PDW	39 (23.35)	Elevated PDW	56 (24.24)
6	Hyperuricemia	13 (20.31)	Decreased Hb	24 (14.37)	Decreased Hb	28 (12.12)
7	Decreased HDL	13 (20.31)	Decreased eGFR	16 (9.58)	Hyperuricemia	26 (11.26)
8	Decreased eGFR	8 (12.50)	Hyperuricemia	13 (7.78)	Decreased eGFR	24 (10.39)
9	Abnormal lymphocyte count	5 (7.81)	Abnormal lymphocyte count	12 (7.19)	Decreased HDL	17 (7.36)
10	Abnormal liver function	5 (7.81)	Elevated platelets	11 (6.59)	Abnormal lymphocyte count	17 (7.36)

Abbreviations: TC, total cholesterol; FBG, fasting blood glucose; LDL, low-density lipoprotein; TG, triglyceride; PDW, platelet distribution width; Hb, hemoglobin; HDL, high-density lipoprotein; eGFR, estimated glomerular filtration rate;

3.2.2. Gender-based analysis of examination results

Table 1 shows that elevated total cholesterol (TC) was found in 45.45% of the examinees (35.90% in males and 49.10% in females). Elevated low-density lipoprotein (LDL) was found in 31.17% (29.70% in males and 31.70% in females). Elevated triglycerides (TG) were detected in 25.97% (23.40% in males and 26.90% in females). Lowered high-density lipoprotein (HDL) was detected in 7.36% (20.30% in males and 2.40% in females).

From a gender-based perspective, significant differences were observed between males and females in the prevalence of hyperuricemia, reduced high-density lipoprotein levels, and increased basophil counts (**Table 2**).

Table 2. Comparison of examination results by gender [*n* (%)]

Physical examination	Gender		χ^2 -value	<i>P</i> -value
	Male (<i>n</i> = 64)	Female (<i>n</i> = 167)		
Hyperuricemia	13 (20.30)	13 (7.80)	7.270	0.007
Decreased HDL	13 (20.30)	4 (2.40)		< 0.001
Basophilia	5 (7.80)	3 (1.80)		0.039

3.2.3. Age-based analysis of examination results

Grouped by age, significant differences were observed in elevated TC, increased PDW, hyperuricemia, and decreased eGFR across different age groups ($P < 0.05$). The trend chi-squared test indicated that with increasing age, the proportion of individuals with elevated total cholesterol and increased platelet distribution width gradually decreased. Fisher's exact test showed significant differences in hyperuricemia and estimated glomerular filtration rate among different age groups. Pairwise comparisons revealed that for hyperuricemia, significant differences existed between the 55–59, 60–69, and over 80 age groups. Regarding decreased estimated glomerular filtration rate, significant differences were found between the 55–59, 60–69, 70–79, and the over 80 age groups, with the detection rate of decreased estimated glomerular filtration rate significantly

increasing after the age of 80.

Table 3. Comparison of examination results by age groups [*n* (%)]

Physical examination	Age (years)				χ^2 -value	<i>P</i> -value
	55–59	60–69	70–79	≥ 80		
Elevated TC	12 (50.00)	61 (53.50)	25 (36.20)	7 (29.20)	6.181	0.013
Elevated PDW	7 (29.20)	33 (28.90)	15 (21.70)	1 (4.20)	5.63	0.018
Hyperuricemia	2 (8.30)	8 (7.00)	8 (11.60)	8 (33.30)		0.007
Decreased eGFR	0 (0.00)	5 (4.40)	7 (10.10)	12 (50.00)		< 0.001

3.3. Analysis of LDL-C target achievement by gender and age under ASCVD grouping

According to ASCVD risk levels, the guidelines^[3] established LDL-C target standards for different population categories and determined whether these targets were met (see **Table 4**). The low-risk group included 83 people (14 males and 69 females), the moderate-and-high-risk group included 106 people (36 males and 70 females), and the very high-risk group included 42 people (14 males and 28 females). There were no significant differences in LDL-C target achievement between age groups and genders. The low-risk group had the highest target achievement rate (80.72%), followed by the moderate-to-high-risk group (22.64%), and the very high-risk group had the lowest achievement rate (14.29%).

Table 4. LDL-C target achievement and chi-squared test results for examinees in different ASCVD categories [*n* (%)]

Categories	Low risk	Moderate-and-high risk	Very high risk	χ^2 -value	<i>P</i> -value	
Age group (years)	55–59	6 (85.71)	1 (7.69)	0 (0.00)	1.704	0.192
	60–69	38 (82.61)	8 (15.09)	1 (6.67)		
	70–79	17 (73.91)	12 (38.71)	3 (20.00)		
	≥ 80	6 (85.71)	3 (33.33)	2 (25.00)		
Gender	Male	9 (64.29)	10 (27.78)	2 (14.29)	3.062	0.080
	Female	58 (84.06)	14 (20.00)	4 (14.29)		

4. Discussion

The data from this study suggest that 11.26% of the retired employees from a certain unit within the civil aviation system have elevated uric acid levels, which is significantly lower than the 30.41% reported in a certain region of Shanghai^[5]. Among these retired employees, the prevalence of abdominal obesity and hypertension in males is higher than in females, which indirectly increases the prevalence of hyperuricemia in the overall population, consistent with the finding that hyperuricemia is more common in males than in females. The lower prevalence of hyperuricemia among retired employees from a certain unit within the civil aviation system may be related to the following factors: (1) They have mostly lived in Beijing for decades, with dietary habits that rarely include high-purine foods such as seafood and animal organs; (2) During retirement, their social activities primarily include hiking, traditional Chinese painting, calligraphy, travel, performing arts, chess, and gardening, involving a certain amount of physical exercise and minimal alcohol consumption; (3) Study data (creatinine and urea results) indicate that few patients have renal insufficiency, which may be related to the previous work

environment and nature of work, as well as the unit's annual free employee health check-up benefits. Therefore, retired employees are relatively health-conscious and are generally able to detect and treat issues early.

This study shows that dyslipidemia is prevalent among retired employees, with a high proportion of elevated blood lipid levels, exceeding those reported in Guangzhou^[6] and the national average^[7]. A study in Guangzhou indicated that among elderly residents included in the National Basic Public Health Service, elevated TC was found in 21.70%, elevated TG in 14.20%, and reduced HDL-C in 9.80%^[6]. The analysis of the high blood lipid levels among the retired employees from a certain unit within the civil aviation system may be attributed to the following reasons: (1) Unhealthy dietary habits: The geographical location of Beijing in the north, along with the unhealthy dietary habits prevalent in northern regions (relatively high in oil, fat, and sugar), may contribute to a higher incidence of hyperlipidemia; (2) Psychosocial factors: The psychosocial stress in northern regions differs from that in southern regions, with more sources of stress, such as family pressure and the fast pace of life, which may affect the psychosocial health of residents and indirectly influence blood lipid levels; (3) Environmental factors: Environmental pollution in northern regions may be relatively more severe, indirectly increasing the risk of dyslipidemia^[8].

The China Chronic Disease and Risk Factor Surveillance (CCDRFS) study, which surveyed 163,641 adults, showed that LDL-C and TG levels increased with age in adults under 70, but contrary to this, they decreased after 70 years of age. The trend observed in the data of this study is consistent with this^[9]. Extensive evidence from epidemiological, genetic, and clinical intervention studies indicates that LDL-C is a major pathogenic factor for ASCVD^[10,11]. A clinical study published in China in 2021 indicated that the lipid target achievement rate in the very high-risk group for ASCVD was only 13%^[12], and the result of 14.29% in this study's group is close to that.

Regarding clinical studies and this study, the proportions of the moderate-and-high-risk group and the very high-risk group were relatively close. The poor achievement of lipid targets may be due to the following reasons:

- (1) Insufficient treatment: Some studies have shown poor medication habits among Chinese ACS patients. For example, the DYSIS II ACS China study indicated that the medication regimen for Chinese ACS patients mainly consisted of moderate-dose statin therapy, mostly statin monotherapy, which may lead to suboptimal lipid-lowering results during the course of the disease. In addition, insufficient use of high-intensity statins and the very low proportion of combination therapy with cholesterol absorption inhibitors may also contribute to the low lipid target achievement rate^[12];
- (2) Insufficient awareness and understanding of their own disease: Among Chinese adults aged ≥ 35 years, the awareness rate of dyslipidemia is very low, with some data indicating that it is only 16.1% of the total population, and most patients do not know their corresponding lipid-lowering target values^[3];
- (3) Drug tolerance and adverse reactions: The Chinese population has relatively poor tolerance to high-dose statins, which may lead to treatment interruptions during the treatment process, or an increase in adverse reactions during dose adjustments, leading to decreased patient acceptance and adherence to medical advice, thus affecting the effectiveness of lipid control^[13];
- (4) Coexistence of multiple risk factors: Patients in the moderate-and-high-risk group and very high-risk group often have multiple ASCVD risk factors and many comorbidities, such as hypertension and diabetes. Considering that some elderly people have limited mobility and cannot always access timely and effective lipid management services, there may be a lack of individualized treatment plans for lipid management in these patients, increasing the complexity of lipid control^[14].

In summary, the analysis of the health check-up results of retired employees from a certain unit within the

civil aviation system suggests that there should be strengthened promotion and active intervention in reducing hyperuricemia and hyperlipidemia among retired employees (elderly patients) to improve their physical health and quality of life.

Disclosure statement

The authors declare no conflict of interest.

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