The Changes of Whole Blood Cells and Plasma Proteins in Donors After Plateletpheresis: 42 Donors With a Interval of 14-16 Days and More Than 20 Times

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Research Article

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Abstract

Background To study the changes of whole blood cells and plasma proteins in donors after plateletpheresis with multiple donations.

Materials and Methods From October 2015 to September 2019, 42 donors with a plateletpheresis interval of 14-16 days and more than 20 times were selected as the research subjects. The venous blood samples were collected from the first and the last screening before plateletpheresis. The result of last screening before plateletpheresis as the observation group, and the first as the control group. Then, the venous blood samples was detected.

Results The whole blood cells and plasma proteins in donors after plateletpheresis changes within a normal range in the two groups. The PLT counts in the the observation group was 220.1±40.4 $x10^9$/L, which was no statistically significant compared with the change of 216.6±44.5 $x10^9$/L in the control group(P>0.05). The HGB in the the observation group was 142.8±10.2 g/L, which was no statistically significant compared with the change of 142.1±8.3g/L in the control group(P>0.05). The HCT in the the observation group was 43.50±3.2%, which was no statistically significant compared with the change of 44.1±2.8% in the control group(P>0.05). The serum TP levels in the the observation group was 70.4±4.7g/L, which was no statistically significant compared with the change of 69.0±4.8g/L in the control group(P>0.05). The serum ALB levels in the observation group was 46.3±2.3g/L, which was no statistically significant compared with the change of 45.8±2.3g/L in the control group(P>0.05).

Conclusion There have no effect on the whole blood cells and plasma proteins in donors after plateletpheresis with multiple donations.

Introduction

The plateletpheresis is a procedure of collecting the platelets by a device, which can separate the platelets and return the others to the donor[1]. The plateletpheresis could reduce the risk of immediate transfusion reactions and disease transmission by blood transfusion[2]. Economic development and increased health coverage have increased the demand for blood products. Despite steady increases in total blood collections and voluntary donors, China faces challenges to its blood donation system[3]. The traditional idea is that plateletpheresis may cause the relative depletion of platelets in the blood, which will affect the blood composition, function and health of donors. It not only increases the psychological burden of donors, but also makes plateletpheresis at a low level compared with whole blood, which can not meet the needs of clinical rapid growth. Therefore, regular monitoring of donor health is an important task. In most countries, strict selection criteria have been established for the blood donors[4]. According to the health examination requirements for blood donors (GB18467-2011) promulgated by China, the interval of plateletpheresis is changed into 14 days, and less than 24 times of donation. In China, the platelets were mainly suspended in plasma, and the storage capacity was 250–300 ml. Moreover, there inevitably remains 50–100 ml blood in the instrument after plateletpheresis, which can not be completely

returned to the donors. These factors may change the plasma protein in the peripheral blood of donors. However, plasma proteins in peripheral venous blood were not screening before plateletpheresis. Some reported the changes of blood cells in donors after plateletpheresis with multiple donations, but there have been few reports on changes in plasma protein[5–8]. Therefore, We studied the changes of plasma protein in donors after plateletpheresis with multiple donations, especially changes in serum TP and ALB levels, and to provide more health examination and guidance.

Materials & Methods

Subjects

The study was undertaken in the Chongqing Blood Center. From October 2015 to September 2019, 42 donors with a plateletpheresis interval of 14–16 days and more than 20 times were selected as the research subjects. The result of last screening before plateletpheresis as the observation group, and the first screening as the control group. In the observation group, two venous blood samples were collected from the last screening before plateletpheresis. In the control group, two venous blood samples were collected from the first screening before plateletpheresis. One venous blood samples used EDTA-K_2 anticoagulant tube, and the other used a dry tube without anticoagulant. According to the standard operating procedures, blood routine(PLT, HGB and HCT) and blood biochemistry(TP and ALB) were measured and compared.

Detecting method

The blood routine in donors after plateletpheresis were detected using an automated blood cell counter (Medonic M-series, Sweden). The serum TP and ALB levels were detected, by the blood biochemical analyzer (HITACHI 7180, Japan). All the equipment has been calibrated and can be used normally. The detection is carried out in strict accordance with the instructions of the kit. All kits and quality control materials are within the validity period.

Ethics statement

This research has been approved by the Chongqing Blood Center Ethics Committee. Informed consent was obtained from 42 plateletpheresis donors. All methods were carried out in accordance with relevant regulations.

Statistical analysis

The test results were analyzed using SPSS version 16.0. The data obtained by the test conformed to the normal distribution and were expressed by Mean ± SD. The values were compared using the paired t test, and $P < 0.05$ was a significant difference.

Results

The general situation of blood donors

From October 2015 to September 2019, 42 plateletpheresis donors, all male, aged 25–54 years, with a donation interval of 14–16 days. The changes of PLT, HGB and HCT were within the normal range in the two groups. The PLT counts in the the observation group was 220.1 ± 40.4 x10^9/L, which was no statistically significant compared with the change of 216.6 ± 44.5 x10^9/L in the control group(P = 0.707). (Fig. 1)

The HGB in the the observation group was 142.8 ± 10.2 g/L, which was no statistically significant compared with the change of 142.1 ± 8.3 g/L in the control group(P = 0.731). (Fig. 2)

The HCT in the the observation group was 43.50 ± 3.2%, which was no statistically significant compared with the change of 44.1 ± 2.8% in the control group(P = 0.363). (Fig. 3)

The plasma protein test

The changes of serum TP and ALB level were within a normal range in the two groups. The serum TP levels in the the observation group was 70.4 ± 4.7 g/L, which was no statistically significant compared with the change of 69.0 ± 4.8 g/L in the control group(P = 0.181). (Fig. 4)

The serum ALB levels in the observation group was 46.3 ± 2.3 g/L, which was no statistically significant compared with the change of 45.8 ± 2.3 g/L in the control group(P = 0.322). (Fig. 5)

Discussion

Platelets were produced by the division of megakaryocytes in the bone marrow hematopoietic tissue, and involved in the process of hemostasis, clotting and maintaining the integrity of the capillary wall. At present, it has been widely used in the supportive treatment of patients with abnormal blood coagulation function caused by the decrease of platelet count and abnormal platelet function. In recent years, with the continuous advancement of blood collection technology and equipment, the clinical demand has increased significantly every year. The plateletpheresis is a type of platelet collected by a blood cell separator that separates platelets and returns others to donors, have been shown to be relatively safe[9, 10]. The plateletpheresis, which is obtained from a single donor and reduce the risk of transfusion reactions and disease transmission after blood transfusion. Moreover, platelets have high purity, low mixing of red blood cells and white blood cells, and the low risk of causing HLA and HPA were favored. Therefore, the plateletpheresis has become a routine procedure in most countries[11], and more and more widely used in patient[12–14]. Because the instruments need to be imported at present, the parameters suitable for Chinese population are still improving and developing. Will plateletpheresis lead to the relative consumption of platelets in the blood, thereby affecting the health of donors? This not only increases the psychological burden of donors, but also makes donors less enthusiastic about plateletpheresis due to safety concerns. Therefore, gradually eliminating the safety concerns of donors is particularly important for the continued and good development of the work of plateletpheresis.

It is well known that the blood flows through the blood vessels throughout the body, transporting various substances and tissues. The blood consists of tangible red blood cells, white blood cells and platelets, as well as invisible liquid components plasma. Therefore, blood plays an important role in communicating internal and external environments. Under physiological conditions, the internal environment of the body can remain relatively stable, and all indicators are within the normal range. The body has established a very delicate and perfect system to allow people to quickly repair themselves when they encounter external stimuli or injuries. When external conditions break some kind of balance in the internal environment, the body will establish a new balance as soon as possible, for example plateletpheresis. After plateletpheresis, the blood volume and the blood cell gradually recovered, and the body entered a "rebalanced" state again. However, multiple plateletpheresis may cause transient clinical problems, such as anemia[9]. Generally, the blood volume can be recovered after 1–2 h when drinking enough water. The survival period of leukocytes and platelets in the body is shorter and faster, and they can be restored to the original level within a few days after plateletpheresis[6]. When donating the whole blood, the red blood cells and hemoglobin need 7–10 days to recover to the level before blood donation. The results showed that the PLT, HGB, and HCT all remained stable in donors after plateletpheresis with multiple donations, and similar to previous research[5, 7]. The plateletpheresis is generally a safe procedure as long as the available guidelines are adhered strictly.

The storage of platelets in different countries is different[15]. In China, the platelets were mainly suspended in plasma, and the storage capacity was 250–300 ml. Moreover, there inevitably remains 50–100 ml blood in the instrument after plateletpheresis, which can not be completely returned to the donors. According to the health examination requirements for blood donors (GB18467-2011) promulgated by China, the interval of plateletpheresis is changed into 14 days, and less than 24 times. However, plasma proteins in peripheral venous blood were not screening before plateletpheresis. Therefore, we should pay attention to whether the donors after plateletpheresis with multiple donations can cause a decrease of plasma protein.

The plasma protein refers to the protein part of plasma, and plasma protein is the general name of many kinds of proteins. The plasma proteins were divided into ALB, globulin and fibrinogen by salting out method. The ALB is the most abundant protein in human plasma, about 45 g/L, accounting for 60% of the total plasma protein. The ALB has two main physiological functions: maintaining plasma colloid osmotic pressure. The ALB content in plasma is the highest and a small molecular weight, it has the largest number of molecules in plasma. Therefore, 75–80% of plasma total colloid osmotic pressure is provided in plasma colloid osmotic pressure, and it binds to various ligands to act as transportation function. Although a small amount of plasma protein is lost after plateletpheresis, it can stimulate the liver to increase synthesis. This study examined the changes in the serum contents of TP and ALB of 42 donors after plateletpheresis with multiple donations. The data suggest that the serum contents of TP and ALB in donors changes within a normal range, and the change was not statistically significant. It is proved that the interval of plateletpheresis should be no less than 2 weeks and no more than 24 times per year, which is beneficial to the recovery of plasma protein of donors, and will not affect their health.

Thus, there have no effect on the whole blood cells and plasma proteins in donors after plateletpheresis with multiple donations.

Abbreviations

TP: total protein ALB: albumin HCT: hematocrit HGB: hemoglobin PLT: platelet

Declarations

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Disclosures

None

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Figures

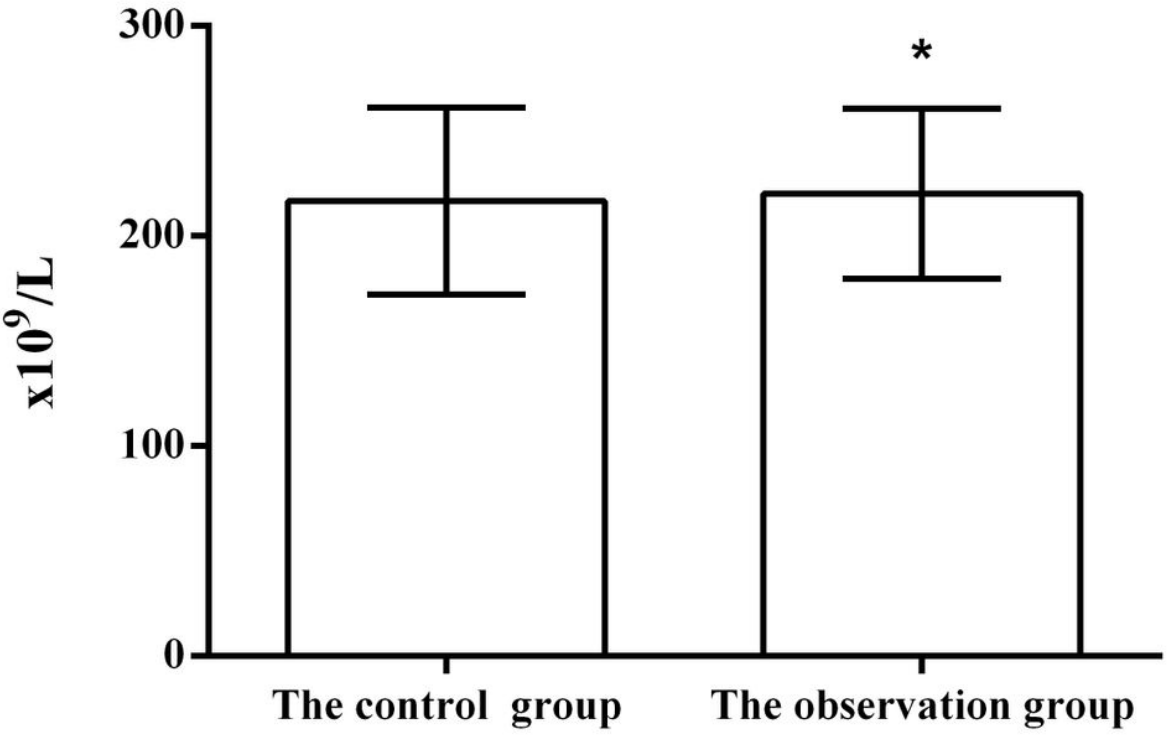

Figure 1

The changes of PLT in peripheral blood of blood donors

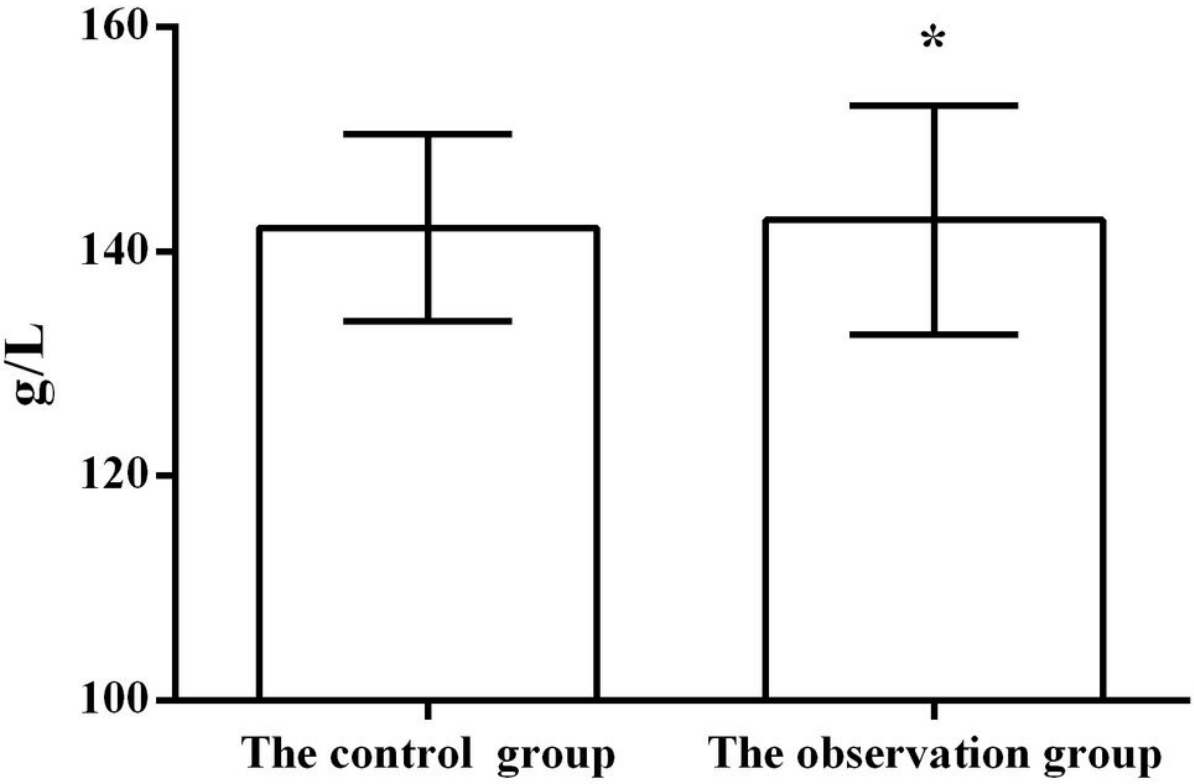

Figure 2

The changes of HGB in peripheral blood of blood donors

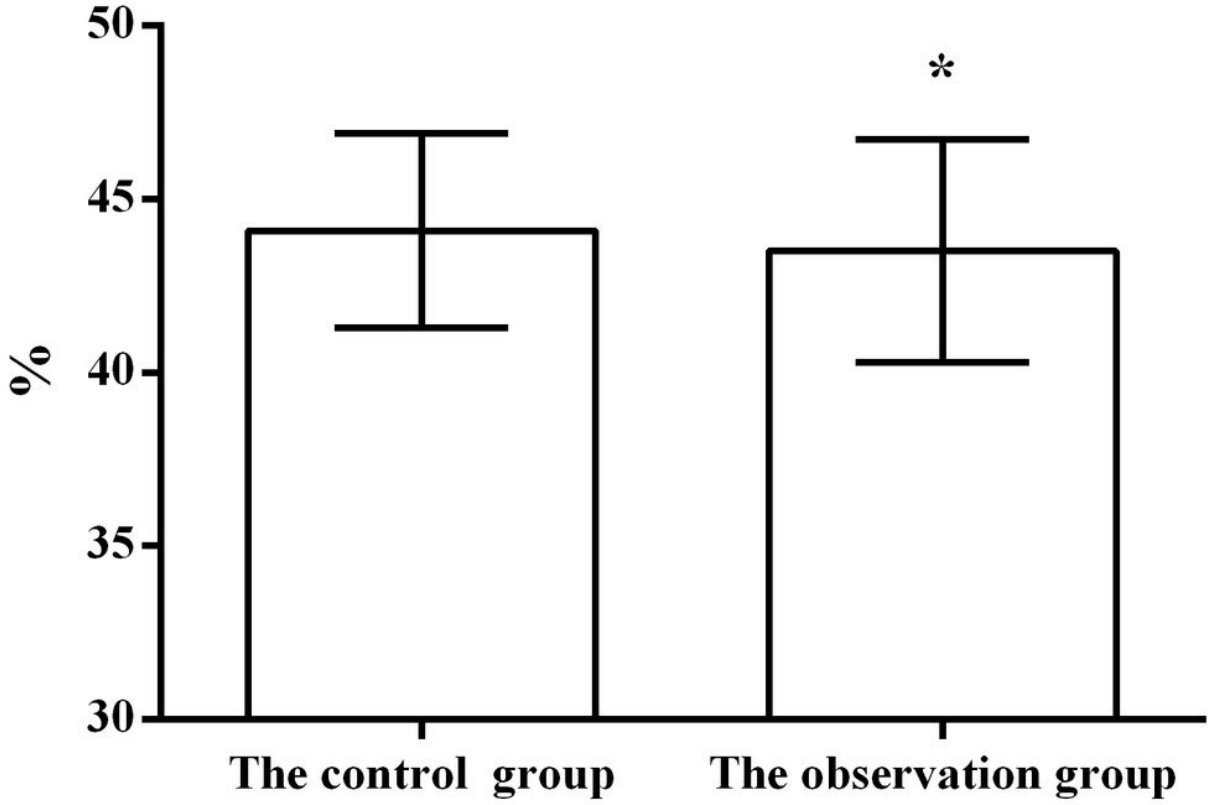

Figure 3

The changes of HCT in peripheral blood of blood donors

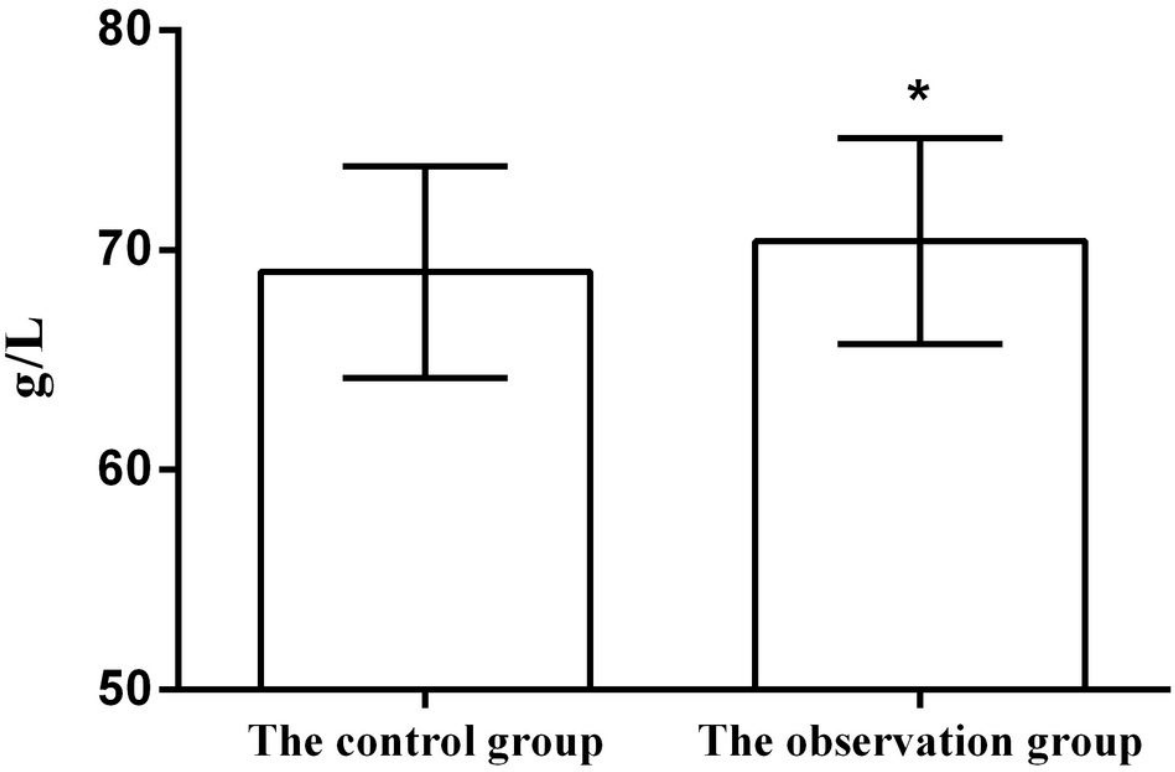

Figure 4

The changes of serum TP level in peripheral blood of blood donors

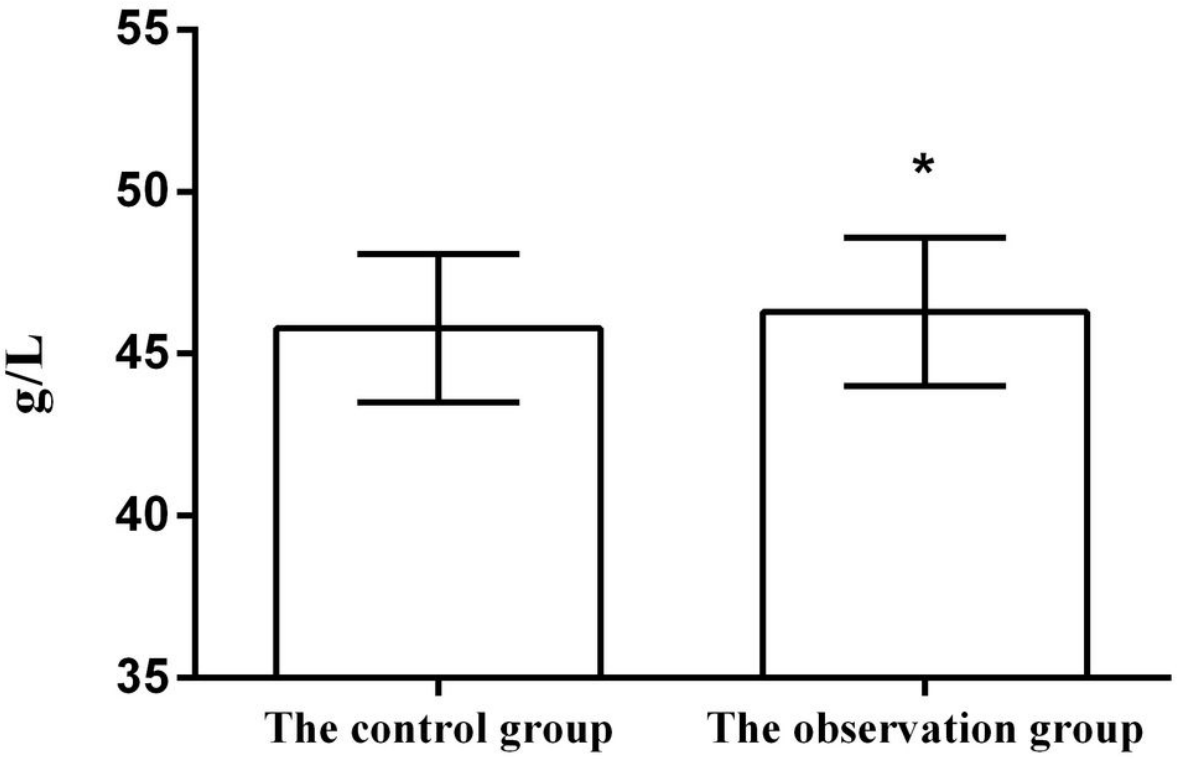

Figure 5

The changes of serum ALB level in peripheral blood of blood donors