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Original article

The impact of multiple blood donations on the risk of cardiovascular diseases: Insight of lipid profile

L'impact du don de sang multiple sur les maladies cardiovasculaires : aperçu du profil lipidique

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Abstract

Objectives. – The reduction in blood viscosity and iron store were proposed to be connected to the reduction in the risk of cardiovascular disease (CVD) among multiple blood donors. Herein, we evaluated the modulation of serum lipids levels in accordance with donation events. Furthermore, atherogenic impacts on the risk of CVD were investigated.
Materials and methods. – A total of 100 voluntarily male donors were included in the study. Fifty donors were multiple time donors (MTD) and 50 were single time donors (STD). Levels of serum lipids were determined and atherogenic indices including TG/HDL and CHO/HDL ratios were calculated. QRISK2 parameters were determined to evaluate the 10-years risk of developing CVD.
Results. – Among MTD, there were significantly higher serum levels of triglycerides (TG) and very low-density lipoproteins (VLDL) combined with significantly lower HDL level. These modulations were significantly correlated to the extent of donation. Both CHO/HDL and TG/HDL ratios were also significantly higher among MTD. However, only TG/HDL ratio was strongly correlated to the donation extent even when controlled for age, BMI and smoking status. Despite the significant difference in QRISK2 parameters between study groups, none of these parameters was correlated to the extent of donation when controlling for age, BMI and smoking status.
Conclusion. – We demonstrate that multiple blood donation is associated with an unfavorable modulation of serum levels of lipids that is influenced by donation extent. This modulation is not associated with an increased risk of CVD but may weakly contribute in a higher risk for coronary heart disease (CHD).

Keywords: Cardiovascular disease; Blood donation; Cholesterol; Triglyceride; QRISK

Résumé

Objectifs. – Il a été postulé que la réduction de la viscosité sanguine et du taux de fer dans le sang sont liés à la réduction du risque de maladies cardiovasculaires (CVD) chez les donneurs de sang répétés. Dans cette étude, nous avons évalué la modulation des taux de lipides sériques en relation avec la répétition des dons sanguins. Par ailleurs, nous avons recherché les effets athérogènes sur le risque de maladies cardiovasculaire.
Matériel et méthodes. – Au total, 100 donneurs masculins volontaires ont été inclus dans l'étude. Parmi eux, 50 étaient des donneurs répétés (MTD) et 50 étaient des donneurs uniques (STD). Les taux de lipides sériques ont été déterminés et les indices athérogènes, tels que les ratios TG/HDL et CHO/HDL furent calculés. Les paramètres du score de risque QRISK2 ont été déterminés pour établir un risque cardiovasculaire global à 10 ans.
Résultats. – Dans le groupe MTD, on a observé des taux sériques de triglycérides (TG) significativement plus élevés ainsi qu'une très faible densité lipoprotéique (VLDL) associée à des taux HDL significativement inférieurs. Ces modulations furent significativement corrélées à la répétition des dons sanguins. Les ratios CHO/HDL et TG/HDL étaient eux-aussi significativement plus élevés dans le groupe MTD. Cependant, seul le ratio TG/HDL fut significativement corrélé à la répétition des dons sanguins, même après pondération en fonction de l'âge, de l'IMC et du tabagisme. Malgré les différences significatives dans les paramètres du score de risque QRISK2 entre les deux groupes, aucun de ces paramètres n'a pu être corrélé à la répétition des dons sanguins une fois pondérés par l'âge, l'IMC et le tabagisme.

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Conclusion. – Nous avons démontré que la répétition des dons sanguins est associée à une modulation défavorable des taux de lipides sériques, qui est influencée par la répétition des dons sanguins. Cette modulation n'est pas associée à un risque de maladie cardiovasculaire (CVD) accru, mais peut légèrement contribuer à accroître le risque de maladie coronarienne (CHD).

Mots clés : Maladie cardiovasculaire ; Don du sang ; Cholestérol ; Triglycérides ; QRISK

1. Introduction

The theme of World Health Organization (WHO) campaign for the world blood donor day was "Thank you for saving my life" and the slogan was "Give freely, give often. Blood donation matters" [1]. A variety of advantageous impacts of regular blood donation on the overall health status of donors were postulated and represented by its inverse correlation with mortality rate and cancer incidence[2–4].

Frequent blood donation has been proposed to have protective effects against cardiovascular disease (CVD) and coronary heart diseases (CHD) [5,6]. The reduced risk of cardiovascular events has been correlated to the loss of excess iron through blood donation [7]. According to "iron hypothesis", the loss of iron through donation should result in lower oxidation of lipids, which in turn provides protection against the development of atherosclerotic events [6]. In response to that, a letter to the editor explained a mechanical mechanism for the reduction in CVD events through the associated reduction in hematocrit resulting in reduced blood viscosity and subsequent reduction of residence time of atherogenic particles [8]. However, these findings were not convenient to others due to defective statistical evidences and accordingly indicated that the proposed association is hypothetical [9].

In regard of coronary heart disease, it has been proposed that regular blood donation is associated with a reduced risk for acute myocardial infarction among middle-aged men [5]. Among middle-aged and elderly white men, elevated fasting serum triglyceride is determined to be a strong independent risk factor of ischemic heart disease [10]. A study among Indian population, blood donors have been shown to be protected against coronary heart disease (CHD) upon recent blood donation and that beneficial effect is reduced accordingly with time post donation [11].

Considering the dilemma in the association of multiple blood donation on the risk of CVD and CHD, here in this study, we investigated the association of blood donation on the risk of CVD through evaluating the impact of multiple blood donation on the serum levels of lipids. Serum lipids are key determinants in the pathogenesis of both CVD and CHD [12,13]. The risk of developing CVD was determined using QIRSK® 2 which has been validated to be a reliable and beneficial in estimating the risk of CVD [14,15].

2. Materials and patients

A total of 100 voluntarily male blood donors visiting central blood bank branch in Irbid, Jordan were randomly selected and included in the study. Among these donors; 50 were having a previous history of multiple events of blood donation (multiple-time donors, MTD) with their last previous donation was 3 to 11 months ago (average 4.5 months). The remaining 50 donors were having no history of blood donation (single-time donors, STD). Donors were eligible for blood donations in accordance with the inclusion criteria that comply the American Association of Blood Banks (AABB) standards and regulations. All participants were whole blood donors with an approximately 450 milliliter of blood being donated per donation event. Weight and height were determined to investigate the risk for cardiovascular disease development using QRISK® 2-2015 risk calculator.

A questionnaire was prepared and obtained for each participant including donation history information such as number of previous donations and the date of the latest donation, age, gender as well as smoking status. Frequency of donation events for MTD was determined by calculating the average number of donation events that each participant through dividing the total number of donation events by the time interval (in years) since their first donation event. Accordingly, donors were categorized into infrequent (with 1 to 2 donations events per year) and frequent (with at least 3 donation events per year). It is worthy to mention that AABB regulations necessitates that timing between consecutive donation events is at least three months which subsequently allow a maximum four times donation a year.

Donors were informed about the study and voluntarily agreed on participation and were requested to sign an informed consent in that regard. The study was approved by the Institutional Research and Planning (IRP) committee at Jordan University of Science and Technology (JUST)/Jordan.

3. Methods

3.1. Lipid profile measurements

Plain blood samples were withdrawn from participants following to the completion of their current blood donation event. Blood was allowed to clot for 30 minutes at room temperature after which samples were centrifuged to obtain serum. Serum levels of triglyceride (TG), total cholesterol (CHO), high-density lipoprotein (HDL), low-density lipoprotein (LDL) were measured using automated analyzer (Abbot Diagnostics; Abbot Park, IL) available in the Department of Laboratories at King Abdullah University Hospital, Irbid/Jordan. Serum VLDL was calculated using Friedewald's formula; VLDL = Total CHO/TG [16]. The ratio of TG to HDL concentration (TG/HDL) and

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