Investigation of the relationship of serum lipid profile and glucose levels with different seasons of year in healthy individuals

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Abstract

Introduction: Glucose, cholesterol, low density lipoprotein (LDL-c), triglyceride, and high density lipoprotein (HDL-c) are the related biochemical factors to diabetes and cardiovascular diseases. The present study aimed to assess the seasonal changes in serum levels of these factors in healthy individuals.

Materials and methods: In the present applied study, demographic information and written informed consent forms were completed for all the individuals referring to laboratory of Mustafa Khomeini Hospital, Ilam, Iran during 2014-2015. Then, glucose, cholesterol, LDL-c, HDL-c, and triglyceride levels in the subjects were measured. After all, the data were entered into the SPSS statistical software and analyzed using Chi-square test and ANOVA. $P<0.05$ was considered as statistically significant.

Results: The results showed a significant increase in serum glucose and triglyceride levels in fall and winter compared to spring and summer ($P<0.001$). A significant increase was also observed in serum glucose level in winter compared to fall ($P<0.001$). On the other hand, serum HDL-c level significantly decreased in fall and winter in comparison to spring and summer ($P<0.001$). This biochemical factor also showed a significant decrease in winter compared to fall ($P<0.001$).

Conclusion: Identification of proper seasonal patterns can play a role in preparedness of transfer centers as well as emergency and treatment centers for sudden increase in the number of patients. It is also of great importance in providing the necessary facilities for treatment of such patients.

Keywords: Seasons, Diabetes, Cardiovascular Diseases

Introduction

Diabetes is one of the most serious chronic disorders with increasing prevalence in developed countries. One of the main indications of this disorder is insulin resistance. In this case, either the target tissue cannot use insulin properly or body cannot produce a sufficient amount of insulin (1). Type II diabetes comprises

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almost 85-95% of such cases, resulting in more attention to clinical and economic outcomes of this type of diabetes. According to the report by World Health Organization (WHO) in 2004, diabetes was the eighth cause of death in high-income countries (2). This high mortality rate can be attributed to the fact that diabetes increases the risk of Cardiovascular Diseases (CVDs). Risk of stroke is also 1.5-3 folds higher in diabetic patients compared to normal individuals (3).

CVDs are among the major causes of death in most countries around the world (4). Annually, 16.7 million CVD-related deaths occur all over the world (5). These diseases comprise one third of deaths in western countries (6). In Iran also, CVDsare responsible for 50% of deaths and are the leading cause of mortality (7). According to WHO's report, CVDs are least prevalent in the U.S., Japan, Australia, and western European countries, but are increasing in China, India, Pakistan, and middle-eastern countries including Iran (8, 9). Up to now, hypertension, blood lipid disorders, smoking, and family history have been reported to cause coronary artery diseases. These factors are also believed to play a role in the intensity of the disease, but there is no consensus among researchers in this regard (10). Moreover, various hypotheses have been mentioned concerning the effect of consumption of saturated fats and cholesterol on formation of atheromatous plaques and vasoconstriction (11, 12).

Furthermore, some studies have addressed the seasonality of various brain strokes. For instance, a study in Greece mentioned the seasonality of ischemic brain stroke (13). Besides, another study in Taiwan showed the maximum incidence ofintracerebral hemorrhage in winter (14). Nevertheless, limited studies have been performed on the relationship between temperature and different seasons of the year and CVDs and biochemical factors in Iran and Middle East (15). Hence, the present study aims to assess the relationship between lipid profiles and blood glucose level and different seasons of the year in the individuals referring to laboratories of Ilam, Iran.

Materials and methods

In the present applied study, a researcher-made questionnaire containing demographic information and written informed consent forms was completed for all the individuals referring to laboratory of Mustafa Khomeini Hospital, Ilam, Iran in 2014-2015. Then, 5 cc blood was taken from each individual and after separation of the sera through centrifuge, glucose, cholesterol, low density lipoprotein (LDL-c), high density lipoprotein (HDL-c), and triglyceride levels were measured using commercial kits (Pars Azmoon, Karaj).

After all, the data were entered into the SPSS statistical softwareand and analyzed using Chi-square test and ANOVA. The results were presented as mean±SEM and $P<0.05$ was considered as statistically significant.

Results

Among the 2376 individuals who had referred to the hospital's laboratory, 1462 (61.53%) were male and 914 (38.47%) were female. Considering the level of education, 107 individuals (4.5%) were illiterate and 731 (30.77%), 814 (34.26%), 257 (10.81%), 422 (17.76%), 27 (1.14%), and 18 (0.76%) individuals had below diploma, diploma, A.D., B.A./B.Sc., M.A./M.Sc., and Ph.D. degrees, respectively. Besides, 544 individuals (22.89%) were single and 1832 ones (77.11%) were married. The mean age of the individuals under study was 40.21±11.27 years.

The results showed a significant increase in serum glucose level in fall and winter compared to spring and summer ($P<0.001$). A significant increase was also

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observed in serum glucose level in winter compared to fall (P<0.001) (Figure 1).

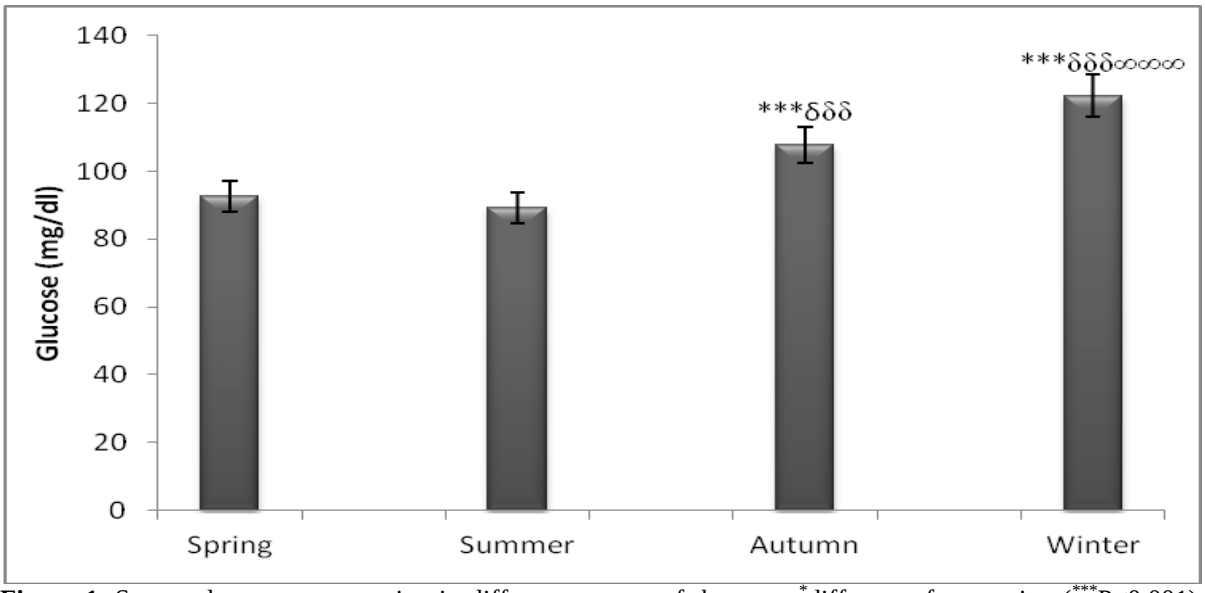


Figure 1. Serum glucose concentration in different seasons of the year. *difference from spring (***P<0.001), δdifference from summer (δδδP<0.001), ∞ difference from fall (∞∞∞∞P<0.001).

The study results revealed a significant increase in serum cholesterol level in fall and winter compared to spring and summer (P<0.01, P<0.001, respectively). serum LDL-c level in fall and winter compared to spring and summer (P<0.001). Serum triglyceride level also showed a significant increase in fall and winter compared to spring and summer (P<0.001). A significant increase was also observed in serum triglyceride level in winter compared to fall (P<0.05) (Figure 2).

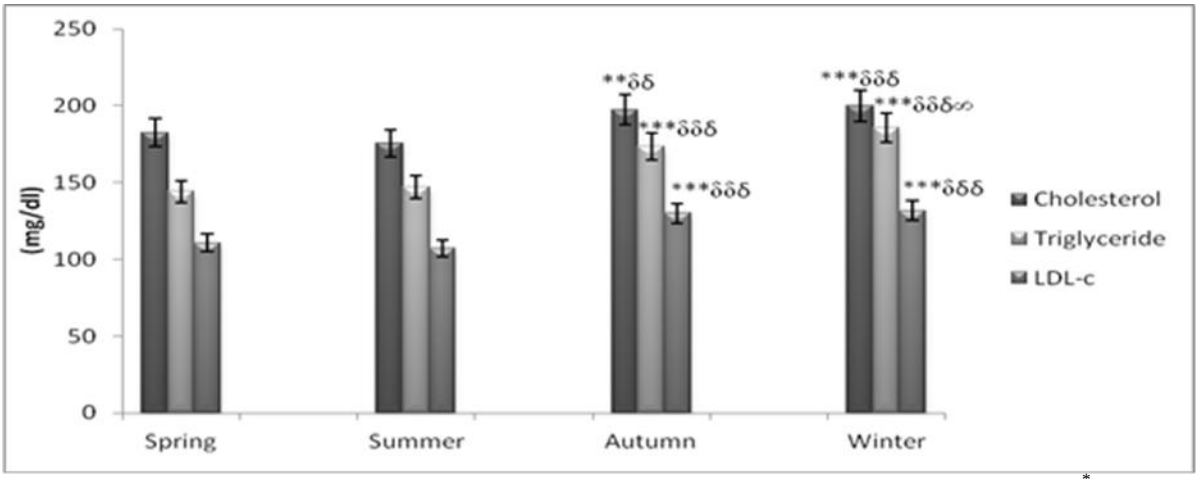


Figure 2. Serum cholesterol, LDL-c, and triglyceride concentrations in different seasons of the year. * difference from spring (**P<0.01, ***P<0.001), δ difference from summer (δδP<0.01, δδδP<0.001), ∞ difference from fall (∞P<0.05).

Serum HDL-c level significantly decreased in fall and winter in comparison with spring and summer (P<0.001). This biochemical factor also showed a significant decrease in winter compared to fall (P<0.001) (Figure 3).

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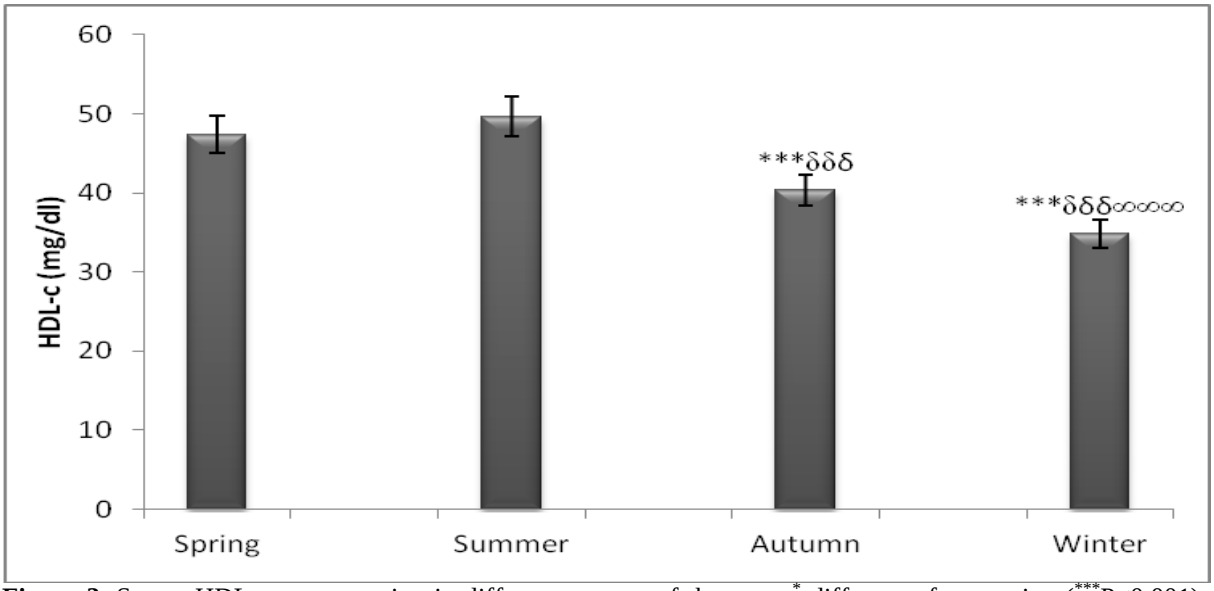


Figure 3. Serum HDL-c concentration in different seasons of the year. * difference from spring (***P<0.001), $^{\delta}$ difference from summer ($^{\delta\delta\delta}$P<0.001), $^{\infty}$ difference from fall ($^{\infty\infty\infty}$P<0.001).

Discussion

The results of the current study showed a significant increase in serum glucose, cholesterol, LDL-c, and triglyceride levels in fall and winter compared to spring and summer. Kalkstein et al. conducted a research in 1997 and stated that mortality rate was higher in winter compared to summer and that this rate might reduce in warmer winters. Moreover, biochemical factors, such as cholesterol and LDL, whose increase is among the risk factors of CVDs were higher in cold seasons; i.e., fall and winter (16). Similarly, Mohammadi performed a study in 2010 and indicated a relationship between weather and some disease risk factors (17). In another study performed by Mohammadi in 2006, the lowest number of diabetes- and CVD-related deaths had occurred in spring and summer, particularly May and June, when the weather is warm, while the number of these deaths increased in November, December, and January when the weather gets cold (18). In the same line, Smit carried out a research in 2004 and reported occurrence of winter deaths in Britain, Sweden, and Australia, while this difference was less considerable in places with slight difference between summer and winter temperatures (19). Farajzadeh et al. also conducted a study on the relationship between climatic parameters and mortality in Tehran in 2009. The study results demonstrated that annual, monthly, and daily climatic parameters were significantly associated with mortality rate and diseases under investigation. In other words, increase or decrease in climatic parameters changed the mortality rates of diseases, but the correlations were different (15).

Conclusion

Identification of proper seasonal patterns can play a role in preparedness of patient transfer centers as well as emergency and treatment centers for sudden increase in the number of patients. It is also of great importance in providing the necessary facilities for treatment of such patients.

In this preliminary study, the researchers made use of the laboratory data of the healthy individuals referring to the laboratory of Mustafa Khomeini Hospital in Ilam. Thus, for more accurate investigation, further studies with larger sample sizes are required to select random samples from different regions of the city.

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