Research Paper
The Relationship Between Food Insecurity, C-Reactive Protein and Some Socio-Economic Variables in Type 2 Diabetes

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Background
Food insecurity can contribute to health and nutrition problems. Thus, determining its associated factors seems necessary in all societies.

Objective
The current study determined the food insecurity, C-Reactive Protein (CRP) and some socio-economic factors in type 2 diabetic patients in Minoodar and Shohada comprehensive health centers of Qazvin in 2016.

Methods
This case-control study was performed on 200 type 2 diabetic patients with an average age of 47.1±8.2 and 200 healthy individuals with an average age of 46.3±8.6. Food security was determined using the Household Food Security Questionnaire. Data from anthropometric, was collected, Biochemical factors were assessed using a blood test and Physical activity was measured using International Physical Activity Questionnaire (IPAQ). Chi-square test to determine the relationship between independent qualitative variables and independent T-test to determine the relationship between quantitative variables for the comparison of mean for two independent groups of the Man-Vinet test and Kruskal-Wallis test for meaningful differences in general characteristics. Moreover, multivariate logistic regression was used to moderate the effects of misleading variables and software N4 for data analysis. The minimum significant difference was considered to be less than 0.05.

Findings
The mean±SD age of the patients and healthy subjects were 47.1±8.2 and 46.8±3.6, respectively. There was a significant correlation between food insecurity and socio-economic variables affecting type 2 diabetes. Food insecurity in the case group was significantly associated with fasting blood glucose (P=0.02) and inflammation factor (CRP) and WBC (P<0.001).

Conclusion
Increased food insecurity was associated with enhanced inflammation and type 2 diabetes; therefore, health planners should pay attention to reducing food insecurity in the community, especially in people with type 2 diabetes. This could be achieved by improving the economic situation and modifying household food patterns.

Keywords:
Type 2 diabetes, Food insecurity, Inflammation

ABSTRACT

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Extended Abstract

1. Introduction

Diabetes mellitus is a group of metabolic disorders associated with increased blood glucose level. This increase is due to the impaired secretion of insulin, insulin function, or both [1]. Food security indicates that all people at all times have access to adequate nutritionally designed foods to ensure healthy and active living, as well as to ensure people can access convenient food through approved methods [3-5]. The high prevalence of food insecurity and type 2 diabetes have been reported in Iran. Moreover, no study has been conducted in Iran on the relationship between the inflammatory factor and food insecurity. Thus, the present study examined the association of food insecurity, inflammation and some socioeconomic factors with type 2 diabetes.

2. Methods and Materials

In this study, 400 middle-aged individuals participated from Qazvin Province, Iran. Of whom, 200 were enrolled into the case group, including those with type 2 diabetes diagnosed with diabetes by a diabetic specialist. They had an electronic medical record since 2016. They also received a long-term treatment under the supervision of a diabetic specialist. In addition, 200 individuals were enrolled into the control group. This group included healthy individuals who were randomly selected via random sampling method from the comprehensive health centers of Shohada and Minoodar in Qazvin in 2017 and were homogenized in terms of age and gender. Considering the significance level of 5% and power of at least 90%, the sample size was estimated to be 200 for each group based on Najibi and Khosravi study [25, 26].

The inclusion criteria were the age range of 30-60 years, the lack of metabolic, infectious and inflammatory diseases, no estrogen hormones consumption (both study groups), type 2 diabetes (with a fasting blood glucose standard of >126 mg/dL) and no changes in the treatment method and medications regimen over at least two months (case group). Exclusion criteria included pregnancy and lactation, refusing to participate in the research, and people with a specific diet or diet changes over the past 2 months due to the history of heart diseases or heart strokes, cancer, and acute renal diseases.

The patients were tested at Shohada Health Center Lab. The latest biochemical tests data including fasting blood glucose and lipid profile were reviewed from the patient's records and recorded in a questionnaire. Household food security was assessed using the Household Food Security questionnaire entailing 18 items [19]. The validity and reliability of mentioned questionnaire have been surveyed in Rafiei et al. study [20]. All the questionnaires were completed using interview method by a trained person. By the Bikel method, the subjects were divided into 4 groups based on their obtained scores of this questionnaire [21] involving food secure, food insecure without hunger, food insecure with moderate hunger and food insecure with severe hunger.

The physical activity level was measured by the International Physical Activity Questionnaire (IPAQ) through conducting interviews with the subjects. This questionnaire contains questions that examine a person's physical activity level, which classifies the level of individuals’ physical activity into three weak, moderate and severe levels. This questionnaire has been used in various studies in Iran, which its validity and reliability have been previously reported [22].

Chi-squared test was applied to determine the relationship between the independent qualitative variables and the Independent Samples t-test was used to determine the relationship between the quantitative variables. For the comparison of mean scores of the two independent groups, the Mann-Whitney U test was used. The Kruskal-Wallis test was applied to explore the significant differences in general characteristics based on variance quartiles. Additionally, multivariate logistic regression was used to moderate the effects of misleading variables and software N4 was applied for data analysis. The minimum significant difference was considered to be <0.05.

3. Results

No significant difference was observed between the two groups in terms of age, gender, marital status, household dimension, and the occupational status. The two groups were significantly different with respect to the occupation (P=0.005), economic status (P<0.001), education (P<0.01), number of items of life (P<0.001), and Body Mass Index (BMI) (P<0.001). The prevalence of food insecurity was 24.9% and 71%, in the control and case groups, respectively. Of which, 65.5% were food insecure without hunger, 3.5% were food insecure with moderate hunger and 2% were food insecure with severe hunger.

The prevalence of food insecurity in the case and control groups was significantly different (P<0.001). The level of blood glucose in food insecure individuals was 1.16 times higher than that of food secure individuals, which this difference was significant (P=0.02). There was no statistically significant difference between the insecure food and secure food groups with regards to the serum level of lipid profiles and blood pressure (P<0.05). The rate of inflammatory factors in food insecure individuals were significantly higher than those
of food secure individuals (P<0.001) based on the results of final model of logistic regression.

The final independent variables affecting type 2 diabetes were food insecurity, BMI, occupational status of the individual responsible for household food supply, number of items of life, economic status, and education. Logistic regression model demonstrated that by moderating the effect of confounding variables (assuming the effect of other variables to be constant), the insecure food people were 4.74 times more overweight than secure food subjects, and obese people faced the risk of type 2 diabetes 1.13 times more than normal individuals.

The risk for type 2 diabetes is 3.5% higher in unemployed individuals responsible for household food supply (often themselves or their spouses), compared to those who are employed. Moreover, the risk for type 2 diabetes in households with fewer than 3 items of life is 1.78 times more than those who have more than 3 items of life. Additionally, households with a weak and average economic status experience the risk for type 2 diabetes for 1.66 times more than those households with good economic status. Furthermore, the risk for type 2 diabetes in households with a diploma and sub-diploma is 1.02 times more than higher-educated households.

4. Conclusion

The present study, conducted on the middle-aged people in Qazvin City, showed a significant direct relationship between food insecurity and type 2 diabetes. About 71% of people with type 2 diabetes and 24.9% of the controls showed mild to severe insecurity, so there was a statistically significant relationship between type 2 diabetes and food insecurity. Based on the association between food insecurity and type 2 diabetes, the prevalence of diabetes in food secure groups, mild food insecure, and severe food insecure groups were respectively 11.7%, 10%, and 16.1%. After adjusting for the factors related to social demography and physical activity, it was found that the prevalence of diabetes is higher within individuals with severe food insecurity compared to those with mild food insecurity and those without food insecurity [24].

Kendall et al. reported that underlying causes such as the low economic status and food insecurity make people spend less on food, reduce their food intake, and change the type of food they consume. Therefore, food diversity decreases and the consumption of high-calorie foods increases [27]. These high-calorie foods include refined grains, trans or saturated fat, which are nutritionally low in quality and cheaper than their counterparts with the same calorie [39].

These nutritional patterns will result in obesity, high blood pressure, increased blood lipids, and diabetes. There was a significant relationship between type 2 diabetes and poor economic status. In some studies, food insecurity has been proven to have a significant relationship with the economic level [40]. In general, the findings of the present study can be justified. That is unfavorable socioeconomic status can lead to limited access to nutrients and energy. This condition can scare people of food shortage, lack of choice, and inevitable change in food habits, all due to economic constraints, which is another aspect of food insecurity.

The level of fasting blood glucose demonstrated a significant positive relationship with food insecurity. Drewnowski et al. stated that food-insecure people eat cheap foods that are inadequately nutritious though they have a high energy density [41]. There was a significant positive correlation between CRP level, WBC count, and food insecurity. Gowda et al. demonstrated that diet patterns and dietary preferences would change within insecure people due to nutritional deficiencies and inadequate energy intake, [42].

The results of this study may indicate that food insecure individuals are more susceptible to inflammation, which may lead to noncommunicable diseases such as diabetes, hypertension, and cardiovascular disease. The present study is the first case-control study in Iran that investigated food insecurity and inflammatory factors. These factors can be mentioned as the strong points of this study and can serve as a basis for further research. Another strong point is adjusting the effect of potential confounding factors in multivariate regression logistic models.

Ethical Considerations

Compliance with ethical guidelines

There was no ethical considerations to be considered in this research.

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Authors' contributions

Conceptualization: Hamideh Janzadeh; and Research, edition and finalization: All authors.

Conflict of interest

The authors declared no conflict of interest.
پروپتین واکنشگر C و بی وری متغیرها اجتماعی اقتصادی با ابتلا به دیابت نوع 2

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هدف از این مطالعه، بررسی میزان امنیت غذایی، پروتئین واکنشگر C و برخی متغیرهای اجتماعی اقتصادی با ابتلا به دیابت نوع 2 در بیماران دیابتی نوع 200 در مراکز جامع سلامت شهدا و مینودر قزوین روی مطالعه مورد شاهدی در سال 1396 بود. ناامنی غذایی و برخی متغیرهای اجتماعی اقتصادی با دیابت نوع 2 دیابت، تعداد گلبول سفید و عامل التهاب (پروتئین واکنشگر C) با توجه به اینکه ناامنی غذایی می‌تواند پیش‌زمینه مشکلات سلامتی و تغذیه‌ای باشد، تعیین عوامل مرتبط با آن در هر جامعه ضروری به نظر می‌رسد.

مواد و روش ها

امنیت غذایی با استفاده از پرسشنامه امنیت غذای خانوار سازمان کشاورزی ایالات متحده آمریکا محاسبه و داده‌ها آنتروپومتری جمع‌آوری شد. عوامل بیوشیمیایی با آزمایش خون و فعالیت بدنی با استفاده از پرسشنامه بین‌المللی فعالیت فیزیکی اندازه‌گیری شد. برای تعیین ارتباط بین متغیرهای متناظر با آزمایش شرکتکردن در مطالعه، بررسی برقراری روابط ترکیبی بین متغیرهای متعدد از طریق آزمون کای‌دو استفاده شد. برای تعیین ارتباط بین متغیرهای کم‌تعدادی از آزمون تی مستقل، برای مقایسه میانگین دو گروه مستقل از آزمون من ونیتی و از آزمون کروسکال والیس برای تفاوت‌های معنی‌دار در ویژگی‌های کلی بر اساس چارک‌های تنوع برای آنالیز داده‌های غذایی استفاده شد. ناامنی غذایی و برخی متغیرهای اجتماعی اقتصادی با دیابت نوع 2 دیابت، مرتبه‌بندی ناامنی غذایی و از رگرسیون لجستیک چند متغیره به منظور تعدیل اثر متغیرهای مخدوشگر و از نرم‌افزار SPSS استفاده شد.

نتایج

میانگین سنی افراد مبتلا به دیابت نوع 200 ± 3/6 و سالم 47/1 ± 8/2 (P = 0/02) می‌باشد. ناامنی غذایی و برخی متغیرهای اجتماعی اقتصادی با دیابت نوع 2 دیابت، جایگاه نظامی (آنتروپومتری) و عامل التهاب (پروتئین واکنشگر C) با توجه به ارتباط معنی‌داری داشتند. ناامنی غذایی با قند خون ناشتا (P < 0/001) ارتباط معنی‌دار را نشان داد.

مقدمه

دیابت ملیتوس به گروهی از اختلالات متابولیکی گفته می‌شود که با افزایش سطح گلوکز خون همراه است. این افزایش به علت اختلال [1] در ترشح انسولین یا عملکرد انسولین یا هر دو به وجود می‌آید که حدود 2040 میلیون نفر بیماری در سال 2013 و 2035 به طور فراوانی در بین بالینی دیابت شیوع دیابت تا سال 2035 را حداکثر 740 میلیون نفر تخمین زده است. در ایران بیماران بی‌درمانی به این پیام بیماری دیابت ملیتوس شده‌اند که به‌اساس پیش‌بینی می‌شود که 300 میلیون نفر شخص در سال 2020 به دیابت مشغول عیان می‌شوند. در کنار عوامل خطر و ارتباط با استفاده از بیماری دیابت هموگلوبین ج نوع زیم غلیتی، کم‌تحرکی، خستگی (بیماری‌های قلبی شکمی) تن در جدی‌ترین مسمومیت‌ها در جهان می‌باشد. برخی از این عوامل در حال حاضر به‌طور کامل مشخص نیستند و به‌طوری‌که قابل قطع در مورد اثرات آنها به‌طور کامل مشخص نیستند.

کلیدواژه‌ها: دیابت نوع 2، ناامنی غذایی، التهاب
شرکت کنندگان چنین خواسته شدند که پرسش‌نامه‌ای در مطالعه‌ای خود انتخاب شود که با استفاده از آن می‌توانند وضعیت امنیت غذایی خانوار خود را تشخیص دهند.

4. International Physical Activity Questionnaire (IPAQ)

1. Redline Cornell Food insecurity measure
2. Household Food insecurity Access Scale (HFAS)
3. Truax دیابت نوع 2
5. ۲۰۱۶
همان و اسفند
در مطالعه حاضر بین ابتلا به دیابت نوع ۲ و تعداد اقلیم زندگی مبتلا به سطح اقتصادی مرتبط بود. چنین مراجعه به مطالعه گیفت (۱۴۸) در اثری این رابطه وجود نداشت.

| جدول ۱: بخشی و ستایش توزیع متغیرهای اجتماعی اقتصادی در گروه کنترل و آزمایش با کنک آزمون کا-اسکوئر و رگرسیون لجستیک ساده |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| متغیرها       | کنترل          | آزمایش          | شرایط           | شرایط           |
| T انسداد (سال) | ۶۳/۲۱۹۵/۱۶۶۶ | ۶۳/۲۱۹۵/۱۶۶۶ | ۶۳/۲۱۹۵/۱۶۶۶ | ۶۳/۲۱۹۵/۱۶۶۶ |
| جنس            | مرد             | زن              | مرد             | زن              |
| سیستم اقتصادی غذایی | ۴۷/۳۹/۱۱۸۸ | ۴۷/۳۹/۱۱۸۸ | ۴۷/۳۹/۱۱۸۸ | ۴۷/۳۹/۱۱۸۸ |
| متغیرهای شاخص اقتصادی، بین سطح درآمد، در سطوح مختلف امنیت | ۴۷/۳۹/۱۱۸۸ | ۴۷/۳۹/۱۱۸۸ | ۴۷/۳۹/۱۱۸۸ | ۴۷/۳۹/۱۱۸۸ |
| وضعیت توزیع | مبتلا به دیابت نوع ۲ | مبتلا به دیابت نوع ۱ | مبتلا به دیابت نوع ۵ | مبتلا به دیابت نوع ۱ |
| شاخص اقتصادی | ۴۷/۳۹/۱۱۸۸ | ۴۷/۳۹/۱۱۸۸ | ۴۷/۳۹/۱۱۸۸ | ۴۷/۳۹/۱۱۸۸ |

* o۲/۰۰۵*
نیز ارتباط دارد. نتایج مطالعه حاضر از طرفی دیگر چاقی و اضافه وزن به صورت غیرمستقیم از طریق معدود مطالعاتی که در آن ها چاقی با دیابت ارتباط نداشته است به اینکه سرما و انسولین در بروز دیابت دخالت کرده اند. برخی از مطالعات با نتیجه حاضر همسو بود و بین نمایه توده بدنی و اضافه وزن و چاقی رابطه معنی داری داشته. درصد بیشتری از ناامنی غذایی با دیابت نوع ۲ نسبت به گروه غیرمبتلا، مسئول تهیه غذای خانواده بود و در آن دیابت، ارتباط مثبت و معناداری وجود داشت.

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جدول ۴. توزیع اعداد کلی و رگرسیون چندمتغیری جهت محاسبه فاکتورهای اجتماعی و مصرفی‌های لجستیکی که به ابتلا به دیابت می‌پردازد

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از مطالعات ارتباط معکوس بین نمایه توده بدنی بالا و دیابت نوع ۲ و افراد خیم‌مبتلا مطالعه تیپه خاصی خارج به تریپ تایلی و فالکه رشک مولارد بیکر پوندن. نشان دهنده کاهش عمده شکل غذایی می‌گردد. نتیجه آن است که نمایه توده بدنی به طور مستقل یا به وسطه اسیدهای چربی می‌تواند عوامل احتمال ناامنی غذایی را افزایش دهد و به وسطه سنگین‌گام‌های متغیر مربوط به افزایش شکل غذایی محیطی نسبت به انسولین را افزایش می‌دهد و با پرسته‌گزاری با وسطه انسولین موجب دیابت نوع ۲ می‌شود.

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از طرفی دیگر می‌توان امکان پذیرفتن این نتایج را در نظر گرفت که بر خلاف نتیجه‌های تحقیقات قبلی در این مطالعه، این نتایج نشان دهنده کاهش از افراد مبتلا به دیابت نوع ۲ و افراد گروه غیرمبتلا می‌باشد که البته جمعیت‌های این مطالعه بسیار بزرگی به داشته و داده‌های آنها نتایجی دقیق و می‌تواند مرجع عایشی شود. نتایجه آن است که نمایه توده بدنی بالا و دیابت نوع ۲ ارتباط مثبت و معناداری داشته است.
پرکالری در معرض اضافه وزن و چاقی قرار دارند. همچنین محرومیت از غذا در خانواده های کم درآمد باعث پرخوری و کم خوری می شود. بنابراین، به عنوان یک رفتار غلط تغذیه‌ای باعث افزایش وزن و از دست دادن وزن به طور معنی‌داری می‌شود.

سطح خون ناشتا با ناامنی غذایی ارتباط مثبت و معناداری دارد. در مطالعهی غذایی مواد غذایی (وزری‌های) افراد ناامن غذایی از لحاظ مواد غذایی کیفی و قیمتی را مصرف می کنند اما این امر نیاز به تغذیه به طور کافی ندارند. افراد ناامن غذایی و مصرف کمتر میوه و سبزی و در مقابل افزایش دریافت کالری از کربوهیدرات‌های تصفیه‌نشده و چربی‌های تولیدی از این نظر از لحاظ تغذیه‌ای اهم‌تر نمی‌باشد.

همچنین نتایج این مطالعه نشان داده که افراد ناامن غذایی بیشتر در معرض التهاب قرار دارند که ممکن است زمینه بروز بیماری‌های عروقی مثل دیابت، فشار خون و بیماری قلبی عروقی گردد. در این مطالعه، بین سطح فاکتور التهابی و ناامنی غذایی ارتباط مثبت و معناداری دیده شد. غذا و همراه با افزایش دریافت کالری از کربوهیدرات‌های تصفیه‌نشده و چربی‌های تولیدی، سطح فاکتور التهابی افزایش می‌یابد.

نتایج مطالعه حاضر نشان می‌دهد که افراد ناامن غذایی بیشتر در معرض التهاب قرار دارند که ممکن است زمینه بروز بیماری‌های عروقی مثل دیابت، فشار خون و بیماری قلبی عروقی گردد.

پیشنهاد می‌شود در مطالعات بعدی تأثیر ناامنی غذایی بر دیابت و برخی متغیرهای اجتماعی‌اقتصادی با این نگداشت اولیه به دیدن توجه یک دریافت ناامنی غذایی تغییر خواهد کرد. این مطالعه، نخستین مطالعه‌ای در ایران است که درباره ارتباط ناامنی غذایی و عوامل التهابی و عوامل ارتباطی با ابتلا به دیابت نوع ۲، بررسی نموده است. همچنین مطالعه‌ی اقدامات جهت کاهش ناامنی غذایی در جامعه، به ویژه در میان زنان، می‌تواند به عنوان پایه‌ای برای پیشگیری از این افراد مردمی با ابتلا به دیابت نوع ۲ و برخی متغیرهای اجتماعی‌اقتصادی با اشاره برداشته شود.
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