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Looking at One of The Local Food: Effects Of Etli Ekmek On Type 2 Diabetics

Tip 2 Diyabetli Türk Hastalarda Karbonhidrat ve Yağların Etkiler

Muteber Gizem Keser[1], Hülya Hacişahinoğullari[2], Kubilay Karşıdağ[2], Hüsamettin Vatansev[3], Süleyman Hilmi İpekçi[4], Hafize Yağcılar Tan[3]

[1]KTO Karatay University, Department of Nutrition and Dietetics, Konya, Turkey
[2]İstanbul University, Istanbul Faculty of Medicine, Department of Endocrinology and Metabolism, Istanbul, Turkey
[3]Selcuk University, Selcuk Faculty of Medicine, Department of Biochemistry, Konya, Turkey
[4]Istanbul Atlas University, Department of Nutrition and Dietetics, Istanbul, Turkey

Abstract

Aim: This study was designed and aimed for assessing the effects of etli ekmek on blood glucose, insulin, and serum lipid values of type 2 diabetic patients.

Materials and Method: A total of 33 diabetic patients consumed two kinds of meal differ in carbohydarate and fats. Blood samples of patients taken at prior to consumption of meal and 0',30',60',90',120',150', 180' min after consumption of meal. Blood glucose, insulin levels and lipid parameters were analyzed by ELISA method.

Results: There was no significance between the values of the change in blood glucose before and after consumption of the standard meal and etli ekmek. After the consumption of the etli ekmek difference between the participants' mean insulin level values at 60 and 90 minutes was lower than the standard meal. 30 minutes after the consumption of etli ekmek and standard meal, the mean triglyceride level of participants was 218.79±91,2 mg/dL and 245.46±8 mg/ dL, respectively (p<0,05). Postprandial high density lipoprotein cholesterol and low density lipoprotein cholesterol were not significant between the meals (p>0.05).

Conclusion: As with other research in the literature, in comparison with foods high in carbohydrates, foods high in fat later have glycemic effects. This study concluded that "etli ekmek" may not elevate blood sugar acutely. It is necessary to conduct more detailed studies on the effect of traditional and common foods on the blood parameters of diabetics.

Keywords: Type 2 Diabetes mellitus, blood glucose, insulin response, diet

Öz

Amaç: Bu çalışma, etli ekmeğin tip 2 diyabetli hastalarda kan şekeri, insülin ve serum lipid değerleri üzerine etkilerini değerlendirmek amacıyla tasarlanmış ve amaçlanmıştır

Gereç ve Yöntem: Toplam 33 diyabetik hasta karbonhidrat ve yağ bakımından farklılık gösteren iki çeşit öğün tüketmiştir. Hastalardan yemek yemeden önce ve yemekten 0',30',60',90',120',150', 180' dakika sonra kan örnekleri alınmıştır. Kan şekeri, insülin seviyeleri ve lipid parametreleri ELISA yöntemi ile analiz edilmiştir.

Bulgular: Standart öğün ve etli ekmek tüketimi öncesi ve sonrası kan şekerindeki değişim değerleri arasında anlamlılık yoktur. Etli ekmek tüketiminden sonra katılımcıların 60 ve 90 dakikadaki ortalama insülin düzeyleri arasındaki fark standart öğüne göre daha düşüktür. Etli ekmek ve standart yemek tüketiminden 30 dakika sonra katılımcıların ortalama trigliserit düzeyi sırasıyla 218,79±91,2 mg/dL ve 245,46±8 mg/dL idi (p<0,05). Postprandiyal yüksek yoğunluklu lipoprotein kolesterol ve düşük yoğunluklu lipoprotein kolesterol öğünler arasında anlamlılık mevcut değildir (p>0.05).

Sonuç: Literatürdeki diğer araştırmalarda olduğu gibi, karbonhidrat oranı yüksek gıdalarla karşılaştırıldığında, yağ oranı yüksek gıdalar daha geç glisemik etkilere sahiptir. Bu çalışma, etli ekmeğin kan şekerini akut olarak yükseltmeyebileceği sonucuna varmıştır.

Anahtar Kelimeler: Tip 2 diyabet, kan glikozu, insülin yanıtı, diyet

Corresponding *(İletişim)*: Muteber Gizem Keser, Lecturer, KTO Karatay University, Department of Nutrition and Dietetics, Konya, Turkey
E-mail *(E-posta)*: gkeser@windowslive.com
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INTRODUCTION

Diabetes is a complex disease that results in partial insülin deficiency or some disorders in the insülin effect cells cannot benefit from carbohydrates, fat, and proteins sufficiently. High blood glucose requiring constant medical follow-up and care, ıf the treatment process and precautions are not taken, it can cause mortality.[1] According to the International Diabetes Foundation (IDF), 2019 data; There are 463 million people are diabetic worldwide. This means that 1 out of the 11adults is diabetic now and this number will increase by 2045 to 629 million people.[2]

The ideal postprandial glycemic level is associated with reduced risk of cardiovascular diseases, obesity, and mortality. To provide maintaining blood glucose balance, many factors play a role such as quantity and quality of foods, gastric emptying rate, glucose absorption rate, incretin hormones, and insulin secretion.[3,4] The two most prominent factors are eating habits and food preferences. Some studies pointed out that foods rich in carbohydrate and fat content plans predispose to obesity-related type 2 diabetes.[5] Foods with high protein content, slow down gastric emptying and stimulating with GLP-1, affect postprandial glucose level.[6] The negative postprandial effect of dietary fat on is also many in some studies.[7,8] Etli ekmek is a low- cost, satisfying meal, frequently consumed in Konya that has a high prevalence of diabetes and obesity.[9] It is noteworthy that this research is the first study to assessing etli ekmek effects on blood parameters of diabetics. The purpose of this paper is to assess two different kinds of meals which similar in total energy-dense, differ in the amount of carbohydrate and fats, on some blood parameters.

MATERIAL AND METHOD

Participants

This prospective study consist of patients, visited the outpatient clinic in the one of the University Hospital, Division of Endocrinology and Metabolism, Department of Internal Medicine before. Inclusion criteria of study is that patients' age should be ranged from 18 to 65 years old; have been diagnosed as diabetic before and has being an at most 10 years diabetic. Other inclusion criterias for participating study were participants' body mass index (BMI) were should between 25 and 30 kg/m², HbA1c level is ≤7.5% (≤ 58 mmol/ mol), and no receiving insulin therapy. Patients were excluded from the study if they were pregnant, lactated, drug or alcohol abused, received anticoagulants/diuretics, and any other endocrine disease except for diabetes, tend to lactose/gluten intolerance, and had an intense physical activity level. Approval was taken (IU/2018-271) to carry out the study along with the approvals of the patients as informed consent forms.

Study Design

The HbA1c level in the last 6 months is in the desired range for the study first applied to Selçuk University Medical Faculty Endocrinology outpatient clinic, individuals who meet the other criteria for participation in the study nearly 900 individuals, evaluated by the researcher. Individuals who agree to participate and meet the criteria of the study were be participants. These patients' routine blood tests scanned. Scanning routine parameters apart from the researcher's anthropometric measurements by the researcher himself (height, body weight, waist, and hip circumference) were taken.

Participants should pay attention to before body analysis: Not consuming caffeine 24 hours before, waking up 3 hours before the study, have not eaten/drunk anything in the last 4 hours of the study, 12 hours before the study, no intense exercise before, and not use diuretic 7 days before the study and not being in a menstrual period during the study. There was a survey, that assessed include data on age, marital status, primer/secondary disease, usage of drug, smoking, alcohol consumption of participants. Food consumption records were taken from participants for 3 days. One of them is chosen from the weekend. According to the the study protocol, two different lunches, their portions, and detail were determined by researchers, were served to patients. Patients were asked to consume these lunches for a 1-week interval.

Standard and Test Meal

The carbohydrate of the etli ekmek, test meal, and standard meal presented for the study; carbohydrate; protein; fat ratios (**Table 1**) respectively; 41.60: 12.28: 46.12 and 48.07: 12.88: 39.05 as the researcher calculated by. Standard and test meals were isocaloric. Participants at lunch on the first day of the study, the researcher determines the content and the nutritional values are reached from the nutrition ınformation system named BEBIS, etli ekmek was presented in the standard portion. The nutritional values of the etli ekmek, which is the test meal, are shown in **Table 2**. One week later, patients consumed standart meal, consists of Ezogelin soup, vermicelli rice, roasted meat, lettuce salad, whole-wheat bread, ayran, orange, and apple. Nutritional values of the standard meal is shown in **Table 3**. Blood samples were taken from the participants before and after the meal, every 30 minutes, until the 180th minute. Blood insulin, glucose, triglycerides, HDL cholesterol, and LDL cholesterol in all time frames cholesterol levels were analyzed.

Table 1. Dietary components of study meals

Macronutrients	Test meal-Etli ekmek	Standard meal
Carbohydrate (%)	41,60	48,07
Protein (%)	12,28	12,88
Fat (%)	46,12	39,05
Total calori (kcal)	707,25	711,79

Table 2. The nutritional values of the test meal (etli ekmek)

Test Diet	Quantity (g)	Energy (kcal)	Carbohydrate (g)	Protein (g)	Fats (g)
Etli ekmek	230	707,25	73,72	21,72	36,16

Table 3. Nutritional values of the standard meal

Energy Dense and Nutritional Values					
Meals	**Quantity (g)**	**Energy (kcal)**	**Carbohydrate (g)**	**Protein (g)**	**Fats (g)**
Ezogelin soup	100	60	5,22	0,89	4
Vermicelli rice	100	154	27,62	2,84	3,37
Roasted meat	100	142,90	1,50	10,80	10,40
Lettuce salad	50	41,85	1,00	0,70	3,85
Whole-wheat bread	50	108	22,27	3,02	0,75
Ayran	200 ml	71,20	4,70	3,60	4,00
Orange	100	47,1	9,20	1,00	0,20
Apple	175	83,7	18,4	0,5	0,6

Statistical Analysis

This study was designed as clinical, experimental and do not consist of control group. Statistical analyses were done by statistical package for social sciences (SPSS) program Version 23. For determination of the sample size, it was found necessary to include 24 participants for 80% statistical power (β:0.20, d: 0.79) after analysis of G Power 3.1.9.2 program based at Almario et al.[10] Based as a reference article. However; for possible loss to follow-up, the sample size was increased. The results were evaluated at a 95% confidence interval. The threshold for significance was $p<0.05$ for all statistical test results. Qualitative variables were expressed as frequencies and percentages, and quantitative variables were expressed as means and standard deviations.

The normality of the data was controlled with the Kolmogorov-Smirnov test. The significance between the blood glucose, insulin, triglyceride, HDL-C, and LDL-C levels of the foods in two different lunch menus was evaluated by the paired t-test if the data were distributed normally. Calculating the area under the curve (AUC) in the blood glucose graph of the test and standard meals are effective in determining the blood glucose responses of the participants t (AUC).[11] In the study, the 3-hour post-meal insulin and glucose curve-AUC was calculated for glycemic and insulin response. The total area under the blood glucose response curve of the two meals, two times with the difference between the two time periods. It is calculated by multiplying it by two (trapezoid area). Blood glucose and insulin of the two meals analysis of significance between t (AUC) values calculated for values of paired t-test was carried out with.

RESULTS

Participants

This study comprised 33 type 2 diabetic patients. 39.4% of the participants (n: 13) were women and 60.6% (n: 20) of them were men. The mean age of the sample was 54,94±6,1 years old. Their mean duration of having diabetes was 7.6±6.7 years.

The minimum and maximum of participants' body mass index (BMI) values, respectively; 24.88 kg/m² and 30.60 kg/m² and the average body mass index value of the sample is 28.68±1.9 kg/m².

The baseline characteristics of the study popuşation indicated in **Table 4**. 54.5% of the participants (n: 18) pay attention to their nutrition, 45.5% (n: 15) of the states that he does not pay attention to their nutrition. According to the three-day food consumption record of the individuals in the sample average daily energy, intake is 1287.41±458.8 kcal. 19 participants of 33 patients were diabetics for 6-10 years, 12 of them were diabetics for 1-5 years.

Table 4. Baseline participant characteristics

Characteristic	Value		p value
Sex	**Women**	**Men**	
Participants	13	20	
Age (yr)	56.30±5.5	54.05±6.4	[a]0.489
Body weight (kg)	75.94±5.2	84.43±8.2	[a]0.045
Height (m)	1.60±0.5	1.72±0.7	[a]0.698
BMI (kg/m²)	29.35±1.8	28,24±1,9	[b]0.146
Waist Circumference (cm)	103,87±6,4	105,64±8,9	[a]0.561
Hip Circumference (cm)	109,38±4,3	108,18±5,6	[a]0.121
HbA1c (%)	6,6±0,4	6,7±0,4	[a]0.926
Trigliserit (mg/dL)	160,09±62,2	175,26±93,8	[a]0.128
HDL-C (mg/dL)	47,35±8,0	43,54±8,5	[a]0.889
LDL-C (mg/dL)	108.80±38.5	115.59±37.1	[a]0.875

aIndependent T-Test, bMann-Whitney Test, Values are expressed as mean±standard deviation or number (%). HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; * Values with plus/minus signs are means±SD.

Changes in Glucose Level

The mean blood glucose of participants before the etli ekmek (test meal) was 101.88±25.5 mg/dL while before the standard meal was 113,21±28,6 mg/dL ($p>0.05$). Blood glucose response after consuming two meals was shown in **Figure 1**.

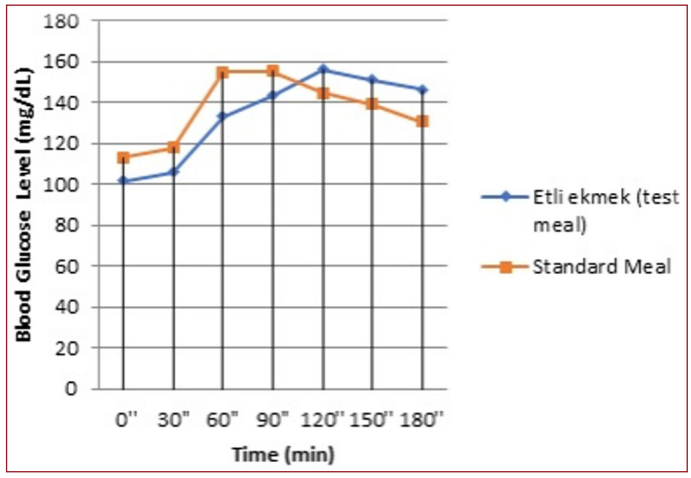

Figure 1. Blood glucose response after consuming two meals

30 minutes after consuming etli ekmek and standard meal mean glucose levels of participants were 106.21±23.0 mg/dL and 118.07±25.5 mg/dL respectively. There were significant differences between them (p<0.05). 60 minutes after consuming etli ekmek and standard meal mean glucose level of participants were 133.09±25.4 mg/dL mg/dL and 154.75±30.1 mg/dL respectively (p<0.05). The area under the plasma concentration versus time curve (AUC) for glucose was not significant (p>0.05) (**Table 5**).

Table 5. AUC values for the 180 min glucose profiles

	Time (min)	Etli ekmek (Test Meal) $\bar{x} \pm S$	Standard Meal $\bar{x} \pm Sa$	bp
(AUC)Glucose (mg/dLx min)	0-180	24436±543.2	25018±377.5	0.92

a Values with plus/minus signs are means±SD. bp<0,05 level of significance

Insulin Response

Sixty and 90 minutes after consumption of the test meal participants' mean insulin level was lower than the standard meal. Sixty minutes after consuming of etli ekmek and standard meal, the mean blood insülin level was 27.84±16.9 IU/mL and 51.17±38.4 IU/mL, respectively (p<0,05). Blood insülin levels of participants' were shown in **Figure 2**. The area under the plasma concentration versus time curve (AUC) for insulin was a significant (p<0.05). It was indicated in **Table 6**.

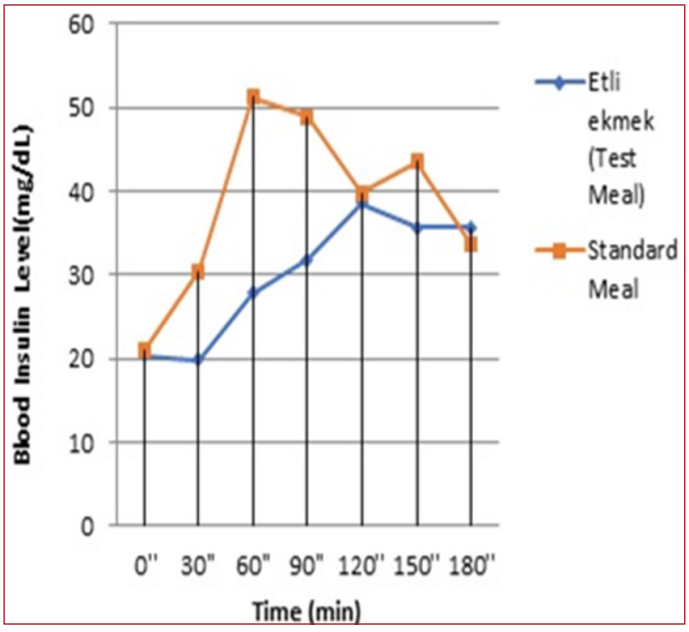

Figure 2. Blood insulin response after consuming two meals

Table 6. AUC values for the 180 min insulin profiles

	Time (min)	Etli ekmek (Test Meal) $\bar{x} \pm S$*	Standard Meal $\bar{x} \pm Sa$	Pb
İnsulin t(AUC) (IU/dLxmin)	0-180	4387± 372.0	7235± 222.2	p<0.05

a Values with plus/minus signs are means±SD. bp<0,05 level of significance

TG response

As a result of this study, 30 minutes after the consumption of etli ekmek and standard meal, the mean triglyceride level of participants was 218.79±91.2 mg/dL and 245.46±8 mg/dL, respectively (p<0.05). A significant difference was found between the average blood triglyceride levels between the 30th and 60th minutes after the consumption of etli ekmek (p <0.05). Blood triglyceride levels of participants at all times were shown in **Figure 3**.

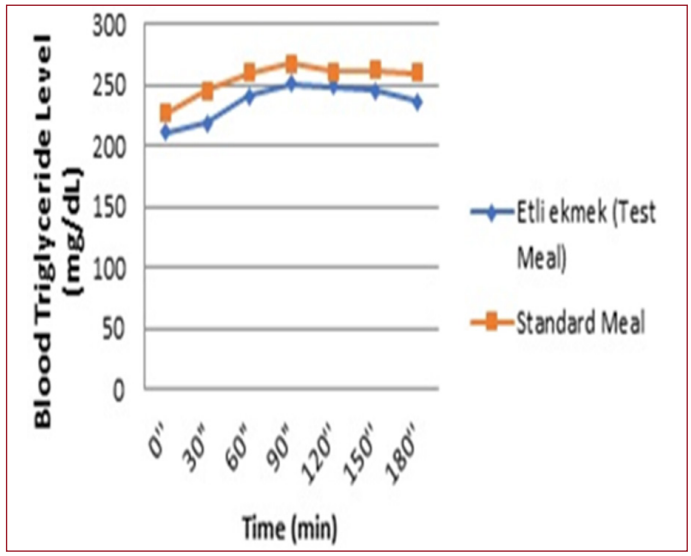

Figure 3. Blood triglyceride response after consuming two meals

Blood lipid response

In this study carried out in Konya, in terms of LDL-C, there were no meaningful differences between the two meals. In terms of HDL-C, 60, and 90 minutes after consumption of etli ekmek, the mean blood HDL-C level of participants was 42.67±8.4 mg/dL and 41.88±8.3 mg/dL, respectively (p<0.05). 60 and 90 minutes after consumption of the standard meal, the mean blood HDL-C level of participants was 41.04±7.0 mg/dL and 40.29±6.7 mg/dL respectively (p<0.05).

DISCUSSION

To the best of our knowledge, this was the first study to examine the effects of etli ekmek in some blood parameters of patients with type 2 diabetes. This study included 33 type 2 diabetic participants, who consume two isocaloric meals, differ in carbohydrate and fats ratio. After and before the consumption of these meals, some of the blood parameters such as triglyceride and blood lipids of patients were assessed.

This study indicated that etli ekmek (test meal) raised blood sugar later than the test meal. The peak blood glucose level was measured at 120th and 90th minutes for etli ekmek and standard meal. After this, the mean blood glucose of participants was starting to decrease. This result was correlated with literature knowledge which is 'high-fat content foods cause postprandial hyperglycemia'.

The blood glucose t(AUC) of the participants after the standard meal (25.01± 377.6) was higher than the test meal (25.01± 377.6). While there was no significant result between two different pre-fasting blood insulin levels of the studies, a significant result was found between the mean postprandial 90th-minute blood insulin levels ($p < 0.05$). It was observed that the blood insulin levels of the participants increased later, after the etli ekmek (test meal). Similar results with studies in the literature emerged on the blood glucose levels of the participants for both meals. The values were found to be 4387±372.0 IU/dLx min and 7235±222.2 IU/dLx min, respectively, and there was a statistically significance between them ($p < 0.05$). In a study published in 2004 that overweight persons consumed one of the meals: included low in carbohydrate and low in fat. There were no differences between both groups in terms of blood glucose levels. However; there was a recovery in insülin sensitivity in carbohydrate riched meal consuming groups.[12] In a meta-analysis study conducted in 2009, participants consumed isocaloric meals which were low in fat, high in carbohydrate, and high in fat, low in carbohydrate. In this meta-analysis, which included 19 studies and 306 patients, the carbohydrate and fat ratios of two low-fat, high-carbohydrate, and high-fat, low-carbohydrate meals were respectively; 58%/24% and 40%/40%. The two meals did not make a significant difference as varying between the HbA1c, fasting plasma glucose level, total and HDL-C administration of the participants.

It was observed that after a low-fat, high-carbohydrate meal, fasting blood insulin and triglyceride levels increased and HDL-C levels decreased significantly compared to other diets. [13] After low in fat, high in carbohydrate meal consumption, the mean fasting blood glucose level of the participants was found to be higher. While fasting plasma glucose and HbA1c levels did not make a significant difference between the two meals, low fat, high carbohydrate meal, postprandial 2-hour insulin produced a significant increase. It was stated by the authors that the reason for this might be the attempt to compensate for the increased postprandial glucose level with insulin secretion. In this study, there was no significance between the fasting insulin response of the participants to both meals. A significant difference between the blood triglyceride levels of the participants 30 minutes after consumption of the high in carbohydrate test meal and the lower carbohydrate included etli ekmek (218.79±91.2 mg/dL and 245.46±76 mg/dL respectively).

While after consumption of a standard meal, decreasing the blood triglyceride level of participants was much more slowly than after consumption of etli ekmek. While the decrease in triglyceride levels of participants after the standard meal was slower, the decrease in the triglyceride amount of the participants with etli ekmek consumption was faster. This shows that, apart from glucose metabolism, etli ekmek is a more appropriate meal than the standard meal, as it can be associated with insulin resistance in the long term. After the fluctuations of blood, triglyceride level is explained by the amount of carbohydrate in the , as a result of Anderson and Herman's study[14], low in carbohydrate and high in fat meals caused to increase free fatty acid and decreasing insülin secretions. Clark et al.[15] conducted a study that type 2 diabetic patients participate and consume meals, low in glycemic index meal (lower in energy-dense, lower in carbohydrate, higher in fat and fiber) and high in glycemic index meal (higher in energy-dense, higher in carbohydrate, lower in fat and fiber) for three weeks. A standard lunch was then planned. As a result of this study result, (AUC) for the post-breakfast blood insulin level with a low glycemic index was lower than the post-breakfast blood insulin level (AUC) with a high glycemic index. Besides, the free fatty acid levels were higher after the consumption of a meal, which high in fat ($p > 0.05$).

In this study carried out in Konya, in terms of LDL-C, there were no meaningful differences between the two meals. This is consistent with a study by Snorgaard et al.[16] In this study evaluated the effects of meal, which was low and high in carbs in type 2 diabetics. This study indicated that a meal that has a low glycemic index was more successful, but has no differences in weight management and LDL-C for a long time. In our study, after the consumption of a standard meal, the blood LDL-C levels of participants were peaking at 60th minutes. There was a significant difference between the blood LDL-C levels of the participants 150 minutes after consumption of etli ekmek and standard meal.

As a result of this study, blood HDL-C levels of participants in the study before the consumption of etli ekmek, observed by decreasing until the postprandial 180th minute. The effect of the test meal on participants' blood levels was not clear. It may be because HDL-C was not affected by changes in unit time. Even so, after the standard meal consumption, the mean HDL-C level of participants at 30 and 60th minutes was 43.14±7.3 mg/ dL and 41.04±7.03 mg/dL, respectively ($p < 0.05$). Besides, after the standard meal consumption mean HDL-C level of participants at 60 and 90th minutes was 43.14±7.3 mg/dL and 41.04±7.03 mg/dL, respectively ($p < 0.05$). In agreement with this study, in a study involving 105 overweight individuals with type 2 diabetes, the effects of low carbohydrate and low-fat meals on blood glucose, HDL-C, and body weight loss were assessed. Body weight and HbA1c levels decreased in the first 3 months in both groups; however, weight loss occurred faster in individuals fed a low-carbohydrate diet. In the long term, there was a similar weight loss between the two groups. However, the HDL-C level increased significantly in the group fed a low-carbohydrate diet.[17]

This study has several limitations. One of them is the small number of participants and it can affect the reliability of the research. However, the fact that the carbohydrate and fat ratios of etli ekmek and standard meal have different percentages than each other may provide a new perspective for the studies to be conducted after this study. In this study, the participants' consumption of etli ekmek and standard

meals occurred in 1-week intervals. The study takes longer and consists of different stages will help to handle the results in more detail and in many ways. In addition blood parameters such as HDL-C and LDL-C reflected on the venous blood value in the long term may not fully reflect the truth in a study that lasted for 1 week.

Apart from this as a result of this study consumption of etli ekmek at proper portion may have positive effects on the progression of insulin resistance of type 2 diabetic individuals compared to the standard meal. As a result, many cardiovascular diseases, especially cardiovascular diseases and co-morbidities are believed to be preventable. Based on the result of this study, depending on the portion, consumption of etli ekmek may increase insulin sensitivity, comparing other foods in type 2 diabetic individuals. It may constitute the fact that hyperinsulinemia can be prevented and damage to β cells may be minimized.

CONCLUSION

In conclusion, as with other research in the literature, in relation to carbohydrate-rich foods, fat-rich foods have later glycemic effects. It is the first study to assess the effects of etli ekmek on type 2 diabetics.

It should not be forgotten that the portion of etli ekmek is effective of the effects on obesity and other diseases. It is necessary to conduct more detailed studies on the effect of local and common foods on the blood parameters of diabetics as well as on the various aspects of the subject concerned.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of İstanbul University Medical Faculty Clinical Research Ethics Committee (Date: 06.04.2018, Decision No: 2018/271).

Informed Consent: All patients signed the free and informed consent form.

Referee Evaluation Process: Externally peer-reviewed.

Conflict of Interest Statement: The author has no conflicts of interest to declare.

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Author Contributions: All of the authors declare that they have all participated in the design, execution, and analysis of the paper, and that they have approved the final version.

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