



## Research Article

# The best journey in Turkish cuisine: Some Meat-based ethnic foods types and investigation of some water-soluble vitamins compositions by HPLC procedure

Büşra YUSUFOĞLU<sup>1,\*</sup>, Mustafa YAMAN<sup>2</sup>, Emine KARAKUŞ<sup>3</sup>

<sup>1</sup>Department of Chemistry, Science and Letters, Istanbul Technical University, Istanbul, 34485, Türkiye

<sup>2</sup>Department of Nutrition and Dietetics, Faculty of Health Sciences, Istanbul Sabahattin Zaim University, Istanbul, 34303, Türkiye

<sup>3</sup>Department of Chemistry, Faculty of Arts and Sciences, Yıldız Technical University, Istanbul, 343439, Türkiye

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## ABSTRACT

In this study, reversed-phase HPLC procedure was conducted for the synchronized amount of water-soluble such vitamins as thiamine (B<sub>1</sub>), riboflavin (B<sub>2</sub>), niacin (B<sub>3</sub>), pyridoxine (B<sub>6</sub>), and cobalamin (B<sub>12</sub>) in four Meat Based Ethnic Foods (MBEF) of Turkey. In this paper, we investigated MBEF Kelle-Paça, Arnavut Ciğeri, Erzurum Cağ Kebabı, Keşkek respectively. In this paper, rapid and a simple method was constructed for the determination of some water-soluble vitamins (B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>6</sub>, B<sub>12</sub>), by High-performance liquid chromatography. The B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>6</sub>, and B<sub>12</sub> content was determined high in Arnavut Ciğeri 498.68 µg /portion, 2.9857 µg/portion, 24.607 µg/portion, 2.2149 µg/ portion, 178.36 µg/portion respectively a significant amount B<sub>6</sub> ingredient in Erzurum Cağ Kebab 1.5320 µg/portion. The results of investigation showed that among these meat based ethnic foods are rich sources of vitamins Arnavut Ciğeri. In the food sector, the successful implementation of a simple, low-cost, and time-efficient approach is used to determine these vitamins. We have indicated our meat based ethnic foods are healthy and available. And also, the most commonly used method in the determination of vitamins of the B-groups is RP-HPLC is most suitable procedure. The procedures validation indicated that it is extremely sensitive, selective, and linear.

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## INTRODUCTION

Historical ethnic cuisines have special place such unique sensory features, cultural heritage, health benefits, and religious values among the communities. Geographical characteristics of Turkey has delicious cuisine history due to

its rich valuable cultural. Differences can be seen between regions in terms of cultural products; and sometimes could be seen different products in different districts of the same province [1-2]. Some meat based ethnic foods (MBEF) such as bounty soup, Albanian liver, Erzurum cağ kebab, and keskek. One of the high-nutrient and dense foods

### \*Corresponding author.

\*E-mail address: [yusufoglubusra@gmail.com](mailto:yusufoglubusra@gmail.com)

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for healing acceleration and callus formation is bounty soup and Albanian liver was obtained to roll in veal liver in mixture of flour, spices and frying process with oil and third Erzurum cag kebab familiar east of Turkey located at Erzurum and last one is keskek as one of the conventional dishes in Turkey, is a good example for the formation of the cultural component. It is commonly seen in various parts of Turkey in ceremonies such as wedding, circumcision feasts and funerals [2-4]. As of half of the twentieth century, most of the essential nutritional molecules were discovered and they characterized such vitamins, minerals, fatty acids, and some amino acids [5].

Many vitamins are unstable under particular processing and storage conditions. Furthermore, some vitamins function as co-enzymes, which are necessary for the enzyme to function as a biocatalyst. These co-enzymes are phosphorylated versions of vitamins that help in the metabolism of food's nutritional value. Vitamins play critical roles in human metabolism, as we've already established. Vitamins, which are split into two groups: water-soluble and fat-soluble vitamins, are an important component in human digestion systems [7]. One of the water-soluble vitamin B such as B<sub>12</sub> and B<sub>6</sub> are thought to be important micronutrients for bone health, as B vitamins are particularly effective on homocysteine levels. Especially, B<sub>12</sub> and B<sub>6</sub> are thought to be important micronutrients for bone health, as B vitamins are particularly effective on homocysteine levels. However, high concentrations of homocysteine increase the risk of fracture by decreasing bone mineral density and microarchitectural deterioration of bone tissue [8].

Some of vitamin B group act as coenzymes in the metabolism of nutrients to produce energy [9]. Riboflavin, also known as vitamin B<sub>2</sub> plays a crucial role for metabolism and a wide variety of cellular processes. When we comes to thiamine namely B<sub>1</sub>, it use for strengthening of

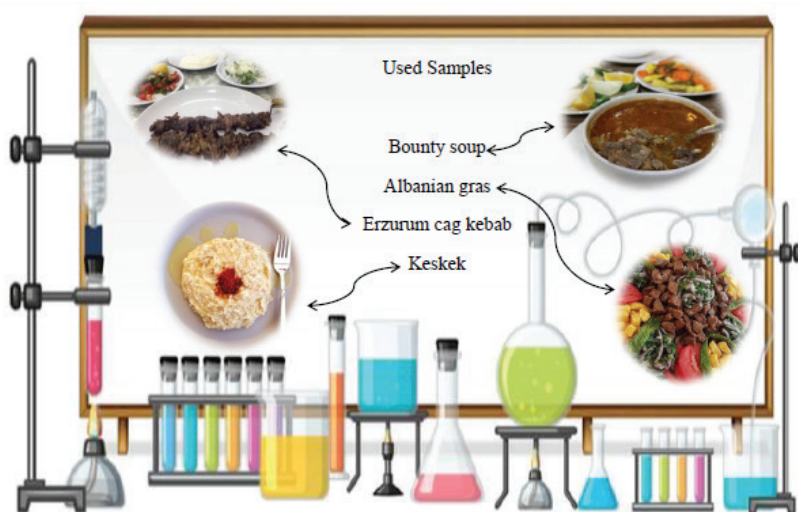
food products [10]. Vitamin B<sub>3</sub>, is plays an essential role for processing fat in the metabolism, lowering cholesterol levels and regulating blood glucose levels. Furthermore, this valuable compound is important in terms of DNA repair, Ca metabolism, intracellular respiration, and biosynthesis of steroid and carboxylic acids (fatty acid) [11]. The ring system of vitamin B<sub>12</sub> is complicated, with cobalt as the core atom. Only microbes create this vitamin, which accumulates in the liver. Vitamin B<sub>6</sub> and folic acid, as well as vitamin B<sub>12</sub>, are implicated in the lowering of homocysteine, a risk factor for arteriosclerosis. Cobalamins are found in the free form as well as bound to other molecules like proteins, according to studies [12].

## MATERIALS AND METHODS

### Materials

In this study, we used as a sample four different meat based ethnic foods (MBEF) such as bounty soup, Albanian liver, Erzurum cag kebab, keşkek. All ingredients were bought from local stores in Istanbul, Turkey. The portion quantity for each sample was determined by weighing separately; for bounty soup, Albanian liver, Erzurum cag kebab, keşkek it is 311g, 182g, 100g, 155g respectively (Figure 1).

Overall chemical solutions were prepared using distilled water via water purification system (Direct-Q 3 UV ultra-pure). During experiment we used HPLC Shimadzu brand Nexera-i LC - 2040C 3D type (Shimadzu Corp., Japan), shaking water bath (Memmert GmbH + Co.KG, Germany), refrigerator (Uğur Soğutma Makinaları, Turkey), grinder (Sinbo), precision scales, automatic pipettes, ultrasonic water bath, 0.45 µm filter. The HPLC analysis was performed using an analytical-scale C18 RP-column Fluorescence



**Figure 1.** Dishes of MBEF such as bounty soup, Albanian liver, Erzurum cag kebabi, Keskek.

detector, Shimadzu RF-20A (Shimadzu Corporation, Kyoto, Japan).

### Sample preparation

In this study, MBEF samples were homogenized with grinder. Samples are Kelle-Paça, Arnavut Ciğeri, Erzurum Cağ Kebabı, Keşkek respectively.

### Standard preparation

For each sample, standard stock solution of thiamin, riboflavin, nicotinic acid, and nicotinamide, pyridoxine hydrochloride, pyridoxamine, and pyridoxal hydrochloride in order to solve 0.1 N HCl solution were prepared, respectively. By doing dilution process was prepared working standard 1, 2, 3, 4 µg/mL. For analysis of vitamin B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>6</sub>, and B<sub>12</sub> modified some methods [12-17].

### Homogenization of Samples

Meat contained samples were homogenized, 5g sample was put into a flask. Next, 60 ml of the 0.1 N HCl solution was added before the mixture was transferred to an autoclave, where it was kept at 121°C for 30 minutes. The samples were cooled and then adjusted to pH 4.5 using a sodium acetate (2.5 mM) solution. 100mg taka diastase, 5mg acid phosphatase and 1mg distilled water were added to the sample before it was incubated for 3 h at 45°C in a shaking water-bath. The samples were cooled until they reached 25°C and a volume of 100 ml was complete 0.1 N HCl solutions. After that, samples were filtered, first with folding filter paper and then with a 0.45 µm filter, before being transferred into the HPLC.

### Investigation of vitamin B<sub>1</sub> (thiamin)

In this study, determination of vitamin B<sub>1</sub> used Tang's modified method [16]. All results are given HPLC. Mobile phase was prepared distilled water and acetonitrile 85:15. When column temperature of 25°C, separation was performed at 1 mL/min. Aliquots 20 µL were used for HPLC

and excitation wavelength and emission wavelength were set to 445 nm and 525 nm, respectively. Separation carried out 20 min.

### Investigation of vitamin B<sub>2</sub> (riboflavin)

In this step of the study, we used vitamin B<sub>1</sub> method, in addition separation was seen 40 min.

### Investigation of vitamin B<sub>6</sub>

All steps such as standard preparation, homogenization of samples, and determination of vitamin B<sub>6</sub> by means of HPLC procedure similar determination of vitamin B<sub>6</sub> except for type incubated 3 hours at 45°C in a water-bath [17].

### Investigation of vitamin B<sub>12</sub>

In this study, determination of vitamin B<sub>12</sub> used Guggisberg's modified method [12]. All results are given HPLC by using immune affinity colon. Mobile phase was prepared distilled water and acetonitrile 87:12. Separation was performed same conditions such investigation of vitamin B<sub>1</sub>. Aliquots 100 µL were used for HPLC emission wavelength were set to 361 nm.

## RESULTS AND DISCUSSION

The HPLC chromatogram of B<sub>12</sub> is seen in Figure 2. As seen in the chromatogram, Albanian liver was well-separated using the HPLC method. According to the chromatogram, first PL, then PN and finally PM peak are observed. The small peaks in the figure belong to the impurities, but in our example the discrimination is high. These peaks should be below the values specified for human health. As seen in the Table 1, the highest amount of vitamin B<sub>1</sub> was found in Albanian liver by 273.1±12.4 µg/100g, and the lowest amount was found in bounty soup by 19.9±0.9 µg/100g [12].

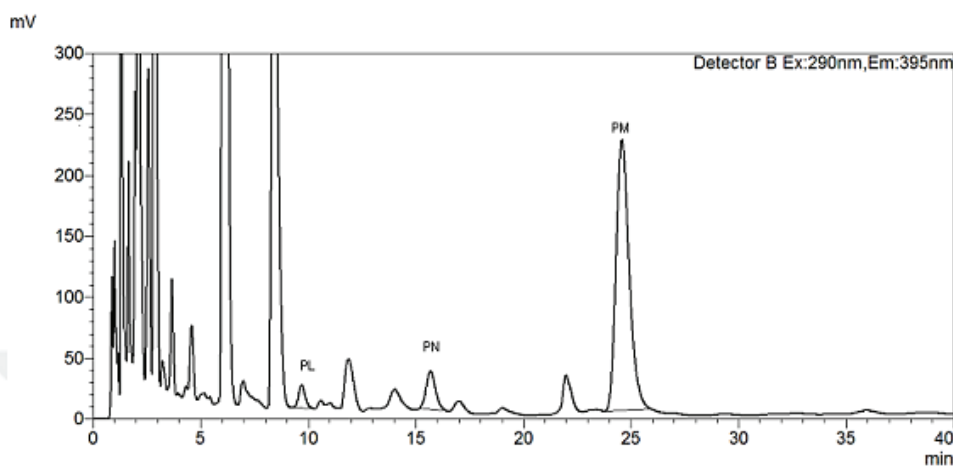


Figure 2. HPLC chromatogram of Albanian liver for B<sub>6</sub>.

**Table 1.** B<sub>1</sub> vitamin contents of MBEF as presented

Samples	µg/100g	µg/ portion	µg/ %
Bounty soup	19.9±0.9	64.200 <sup>a</sup>	5.35
Albanian liver	273.1±12.4	498.68 <sup>b</sup>	4.51
Erzurum Cag Kebabı	87.7±4.0	88.000 <sup>b</sup>	7.33
Keskek	84.7±3.8	131.75 <sup>b</sup>	10.9

The different letters in the same columns indicate statistical differences between samples (ANOVA  $p < 0.05$ , Tukey's test).

In this study, a value of riboflavin as a µg was given Table 2. As seen in the Table 2, the highest amount of vitamin B<sub>2</sub> was found in Albanian liver by 1640.5±74.2 µg/100g, and the lowest amount was found in Erzurum cag kebabı by 140.5±6.4 µg/100g.

Values of nicotinic acid and nicotin amid were given Table 3. as a µg in 100 g. As seen in the Table 3. Nicotinic acid was found substantially amount in Albanian liver 3207.3±145.1 µg in 100 g. The lowest amount was measured in the bounty soup sample 136.5±6.2 µg/100 g. However, nicotinamide was found substantially amount in Albanian

liver 10313.5±466.6 µg in 100 g. The lowest amount was measured in the keskek sample (35.9±1.6 µg/100 g).

The different letters in the same columns indicate statistical differences between samples (ANOVA  $p < 0.05$ , Tukey's test).

In our study, we were given values of PL, PN, and PM Table 4 as a µg in 100 g samples. As seen in the Table 4. Total vitamin B<sub>6</sub> concentrations in samples ranged from 1.217 to 566.2 µg/100 g.

In this study, it was given values of B<sub>12</sub> vitamin in Table 5 as µg in 100g samples. As seen in the Table 5., amount of measured total vitamin B12 98.0±4.4 µg in 100 g of food.

**Table 2.** B<sub>2</sub> vitamin ingredients of MBEF as presented

Samples	µg/100g	µg/portion	µg/ %
Bounty soup	162.5±7.4	523.23 <sup>a</sup>	40.2
Albanian liver	1640.5±74.2	2995.7 <sup>a</sup>	229.6
Erzurum cag kebabı	140.5±6.4	141.00 <sup>b</sup>	10.8
Keskek	310.0±14.0	482.05 <sup>b</sup>	37.0

The different letters in the same columns indicate statistical differences between samples (ANOVA  $p < 0.05$ , Tukey's test).

**Table 3.** B<sub>3</sub> vitamers ingredients of MBEF as presented (µg/100g)

Samples	Nicotinicacid	Nicotinamid	Total	µg/portion	µg/%
Bounty soup	136.5±6.2	1626.6±73.6	1.7631	5.659 <sup>a</sup>	40.4
Albanian liver	3207.3±145.1	10313.5±466.6	13.520	24.607 <sup>b</sup>	175.7
Erzurum Cag Kebabı	334.9±15.2	2424.9±109.7	2.7590	2.7590 <sup>b</sup>	19.7
Keskek	308.0±13.9	35.9±1.6	343.90	533.04 <sup>b</sup>	3.80

**Table 4.** B<sub>6</sub> vitamers ingredients of MBEF as presented (µg/100g)

Samples	PL	PN	PM	Total	µg/portion	µg/%
Bounty soup	9.0±0.4	11.0±0.5	71.8±3.2	91.80	294.67 <sup>a</sup>	22.6
Albanian liver	42.9±1.9	98.7±4.5	1075.4±48.7	1.217	2.2149 <sup>b</sup>	170.3
Erzurum Cag kebabı	1201.0±54.3	901.0±12.5	31.3±3.1	1.532	1.5320 <sup>b</sup>	117.8
Keskek	463.5±21.0	95.7±4.3	7.0±0.3	566.2	877.60 <sup>b</sup>	67.5

(PL: Pyridoxal, PN: Pyridoxine, PM:Pyridoxamine) The different letters in the same columns indicate statistical differences between samples (ANOVA  $p < 0.05$ , Tukey's test)

**Table 5.** B<sub>12</sub> vitamin in Albanian Liver as a presented

Samples	µg/100g	µg/portion	µg/ %
Albanian liver	98.0±4.4	178.36	5.94

The different letters in the same columns indicate statistical differences between samples (ANOVA  $p < 0.05$ , Tukey's test).

In a study, scientists studied in order to investigate effect of vitamin B<sub>12</sub> level at Parkinson's disease (PD) in serum diagnosis predicts time to develop dementia. A higher level of serum vitamin B<sub>12</sub> at the time of PD diagnosis was linked to a lower risk of dementia in the future, according to this study. The role of vitamin B<sub>12</sub> in the development of dementia among PD patients need advanced novel biotechnological based studies [18]. In another literature study, it aimed to determine correlation between dietary intakes of vitamin B<sub>2</sub>, B<sub>6</sub> and B<sub>12</sub> menstrual function among premenopausal women. Results have shown to higher intakes of riboflavin were associated with a small decrease in serum estradiol among healthy, regularly menstruating women [19]. Studied one of the about cereal foods have shown vitamin B<sub>1</sub> and B<sub>2</sub> as a simultaneous in complex, by means of reverse phase isocratic HPLC-UV. According to study, cereal foods contain 0.63 mg vitamin B<sub>1</sub> and 0.22 mg vitamin B<sub>2</sub> in 100 g [20]. Dietary recommendations in developed countries recommend intakes of meat ranging from 65 to 250 g/d for adults. As of 2010 according to U.S. Dietary Guidelines recommend consumption of 150 g/d, depending on age and gender of protein foods such as meat, poultry, seafood, eggs, beans, peas, soy, nuts, and seeds. [21]. Yusufoglu et al., 2019 have studied some traditional foods to determine their levels of vitamin B. According to the findings, mercimek köftesi has the greatest B<sub>1</sub> and B<sub>2</sub> levels, which are respectively 299.20 µg/portion and 364.32 µg/portion. The greatest vitamin B<sub>3</sub>-containing food is zeytinyağlı yaprak sarma, which has 1030.4 µg/portion, while the highest vitamin B<sub>6</sub>-containing meal is Kayseri mantı, which contains 623.0 µg/portion [22].

According to Turkish Food Composition Database, tablet of meat broth consists of 1.030 thiamin, 0.126 riboflavin, 2.479 niacin, 0.047 mg B<sub>6</sub>. While chicken broth consists of 0.584 thiamin, 0.071 riboflavin, 0.780 total niacin, 0.035 mg totals B<sub>6</sub> in 100 g of foods. Also, according to TURCOMP database, heat-treated sucuk consist of B<sub>12</sub> 0.72 µg, kavurma, meat, Erzurum 1.76 µg, Chicken, breast, without skin 0.84 µg edible 100 g of food [23].

According to literature, B vitamins (especially folate, B<sub>12</sub> and B<sub>6</sub>) are thought to be important micronutrients for bone health, as B vitamins are particularly effective on homocysteine levels. High concentrations of homocysteine increase the risk of fracture by decreasing bone mineral density and micro architectural deterioration of bone tissue [8].

Some studies show that high homocysteine and low levels of B<sub>12</sub> and folic acid have been linked to increase risk

of fractures. Vitamin B<sub>12</sub> and folic acid intake play a major role in homocysteine metabolism. Therefore, it is thought that the intake of group B vitamins may decrease the risk of fracture in elderly individuals by providing a decrease in homocysteine concentration [24]. In a study of celiac patients, the effect of folic acid, vitamin B<sub>12</sub>, B<sub>6</sub> and B<sub>2</sub> and associated homocysteine levels on bone mineral density was investigated. Since, this patient group is considered as a risky group in terms of bone health and osteoporosis [25]. In this study the B<sub>1</sub>, B<sub>2</sub>, B<sub>3</sub>, B<sub>6</sub>, and B<sub>12</sub> content was determined high in Albanian liver 498.68 µg /portion, 2.9857 µg/portion, 24.607 µg/portion, 2.2149 µg/ portion, 178.36 µg/portion respectively, a significant amount B<sub>6</sub> ingredient in Erzurum cag kebab 1.5320 µg/portion. It can also be found in meat, fish, egg and milk at very low concentrations (ng/g), but not in vegetable products. The daily demand for vitamin B<sub>12</sub> is about 1 µg, but a 3 µg supply is recommended due to its low absorption-rate in the small intestine. Meat, meat products, fish and cheese are good sources of vitamin B<sub>12</sub>. [12]. The aim of this research present understanding of the chemical compositions and physical factors that effect of vitamin to human diet in MBEF products. [5]. Vitamins are reported to reduce free radicals and control some degenerative disease. Additionally, vitamins B compositions important in cell metabolism. B group vitamins describe as thiamine, riboflavin, pyridoxine, niacin, pantothenic acid, biotin, cyanocobalamin and folic acid. The deficiency syndromes of some B vitamins are beri-beri (cardiac and dry), peripheral neuropathies, pellagra, and oral and genital lesions (related to riboflavin deficiency)—which were once vital public health problems in partly of the world. All vitamins in the B group function primarily as coenzymes in the production of energy from food metabolism [9]. The most frequent method for determining B-group vitamins is reversed-phase high-performance liquid chromatography, which is the most appropriate procedure. Among the two detectors used in this study, fluorescence detector detection is selective, highly sensitive for the determination of vitamins fluorescent B<sub>2</sub>, furthermore B<sub>6</sub> fluorescence detector not expensive in the HPLC procedure [26]. Also, by means of fluorescence detector detection a study was conducted by researchers. They studied about some sugar containing traditional foods. Results of this study, the amount of compositions of vitamins B of traditional dessert types were found as the highest vitamin B<sub>1</sub> 1917.4 µg/portion ashure, vitamin B<sub>2</sub> 224.20 µg/portion pumpkin dessert, vitamin B<sub>3</sub> 3.4202 µg/portion walnut rose and finally vitamin B<sub>6</sub> 573.30 µg/portion in kadayif stuffed [27].

## CONCLUSION

In conclusion, because of the structures of vitamins, some variables were tracked depend on time and temperature of processing or storage, environmental diversities such as the pH and the concentration of oxygen, metal ions, and various reducing or oxidizing agents, the chemical nature of other food components, the mechanism of chemical loss of vitamin activity in the food and the water activity of the food system. According to results, the animal-based foods contained high amounts of vitamin B<sub>6</sub> and B<sub>12</sub>. While the other meat based foods contained high amounts of vitamin B<sub>1</sub>, B<sub>2</sub> and B<sub>3</sub>. Because, this samples contains wheat flour and frying process. This study will be an essential source for various diets. Since vitamins are used as coenzymes in metabolic pathways, detailed and different studies are needed. In addition, B group vitamins show anti-inflammatory effects in some types of diseases. This study presented a method that will contribute to the creation, control and follow-up of new functional nutraceutical products. In particular, determining the vitamin values of traditional foods belonging to our country can help both the promotion of our country's healthy products and the creation of a specific database. In this respect, our study provides a resource to the public.

In recent years, both in our country and in the world, the desire to act consciously about healthy nutrition has been increasing. For this reason, it is important to know the nutritional values of the most frequently consumed foods in routine life. The purpose of the study was to create a response to this request. In this paper, B vitamins which are especially important for the activation of metabolic pathways and energy metabolism were examined and data were presented to consumers.

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## AUTHORSHIP CONTRIBUTIONS

Authors equally contributed to this work.

## DATA AVAILABILITY STATEMENT

The authors confirm that the data that supports the findings of this study are available within the article. Raw data that support the finding of this study are available from the corresponding author, upon reasonable request.

## CONFLICT OF INTEREST

The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## ETHICS

There are no ethical issues with the publication of this manuscript.

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