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An Archaeogastric Study on the Basic Food Sources and Their Values Consumed in the Roman Army*

Kadir ÇETİN^a, Salih SOSLU^{**b}

^a Burdur Mehmet Akif Ersoy University, Faculty of Tourism, Department of Gastronomy and Culinary Arts, BURDUR, E-mail: kctetin@mehmetakif.edu.tr ORCID: 0000-0003-0102-8913

^b Burdur Mehmet Akif Ersoy University, Faculty of Arts and Sciences, Department of Archaeology, BURDUR, E-mail: ssoslu@mehmetakif.edu.tr ORCID: 0000-0003-2045-116X

Abstract

In order to understand how important the nutrition of military personnel was in the Roman Period, it is necessary to examine the military power of the Roman army and the nutritional culture that maintained this power. When soldiers do not have access to adequate and balanced nutrition during campaigns and wars, their combat abilities, strength and influence can be seriously affected. For this reason, it is very important for military managers to take into account the nutritional needs of soldiers when making strategic planning, to choose products with high nutritional value, and to provide adequate supply and logistics support. The aim of this study is to determine the main food sources consumed by the army in the Roman Period and to examine their nutritional values. In order to be suitable for the purpose of the thematic topic, systematic literature review and content analysis methods were adopted in order to obtain a wide data set on the basic food sources consumed by the army and to examine these data within a certain framework. Accordingly, the army's grain (wheat, barley, oats); vegetables and fruits (beans, peas, lentils, apples, apricots, pomegranates, dates, peaches, pears, plums, grapes, cherries, mulberries, walnuts, hazelnuts, olives, chestnuts); meat, dairy and seafood, poultry and animal foods (beef, pork, lamb, sheep, kid, goat, deer, rabbit, goose, duck, chicken, fish, periwinkle, snails, oysters, mussels, It was determined that he consumed products such as cheese) and olive oil, wine, beer, honey, fish sauce and salt. According to these findings, a Roman soldier consuming approximately 830 grams of wheat daily provides approximately 1675 calories of energy. This provides 57.26% of a soldier's total daily calorie needs. A soldier's daily consumption of smoked meats, cheeses, boiled or fried pork, beans and lentils is estimated to be approximately 212.2 grams of protein. This is proof that the diet of Roman soldiers was very rich in protein and met their daily needs.

Keywords: Archaeogastronomics, nutritional values, nutrition culture, Roman army.

Roma Ordusunda Tüketilen Temel Besin Kaynakları ve Değerleri Üzerine Arkeogastrik Bir Çalışma

Öz

Roma Dönemi'nde askeri personelin beslenmesinin ne kadar önemli olduğunu anlayabilmek için Roma ordusunun askeri gücünü ve bu gücü koruyan beslenme kültürünü incelemek gerekir. Sefer ve savaşlarda askerlerin yeterli ve dengeli beslenmeye erişimi olmadığında, savaş yetenekleri, gücü ve nüfuzu ciddi bir şekilde etkilenmektedir. Bu sebeple askeri yöneticilerin stratejik planlama yaparken askerlerin beslenme ihtiyaçlarını dikkate almaları, besin değeri yüksek ürünleri seçmeleri, yeterli ikmal ve lojistik desteği sağlamaları oldukça önemlidir. Bu çalışmanın amacı Roma Dönemi'nde ordunun tükettiği başlıca besin kaynaklarını belirlemek ve besin değerlerini incelemektir. Tematik konunun amacına uygun olması açısından, ordunun tükettiği temel besin kaynaklarına ilişkin geniş bir veri seti elde etmek ve bu verileri belirli bir çerçevede incelemek amacıyla sistematik literatür taraması ve içerik analizi yöntemleri benimsenmiştir. Buna göre ordunun tahıl (buğday, arpa, yulaf); sebze ve meyveler (fasulye, bezelye, mercimek, elma, kayısı, nar, hurma, şeftali, armut, erik, üzüm, kiraz, dut, ceviz, fındık, zeytin, kestane); et, süt ürünleri ve deniz ürünleri, kümes hayvanları ve hayvansal gıdalar (sığır eti, domuz eti, kuzu eti, koyun, oğlak, keçi, geyik, tavşan, kaz, ördek, tavuk, balık, deniz salyangozu, salyangoz, istiridye, midye, peynir) ve zeytinyağı şarap, bira, bal, balık sosu ve tuz gibi ürünleri tükettiği belirlenmiştir. Bu bulgulara göre günlük yaklaşık 830 gram buğday erzak tüketen Romalı bir asker yaklaşık 1675 kalori enerji sağlamaktadır. Bu bir askerin toplam günlük kalori ihtiyacının %57.26'sını karşılamaktadır. Bir askerin günlük olarak tükütülenmiş et, peynir, haşlanmış ya da kızarmış domuz eti, fasulye ve mercimek tüketmesi ise yaklaşık 212.2 gram protein olarak hesaplanmıştır. Bu, Romalı askerlerin beslenmelerinin protein açısından çok zengin olduğunun ve günlük ihtiyaçlarını karşıladığının kanıtıdır.

Anahtar Kelimeler: Arkeogastronomik, besin değerleri, beslenme kültürü, Roma ordusu.

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** Corresponding author E-mail: ssoslu@mehmetakif.edu.tr

INTRODUCTION

Rome, the capital of the Roman Empire, is today one of the largest cities in Europe (Scheidel, 2007; Lo Cascio, 1994). Given that the Roman urban population reached its peak during the imperial period, feeding this population was a major concern for political authorities (Morley, 1996; Scheidel, 2009). Because this situation has positively or negatively affected the public health, administrative and social organization of the city (Dyson, 2010). Therefore, the importance given to nutrition during the imperial period was seen as a critical factor in the resilience and sustainability of Roman society. In this period, developing local businesses and logistics systems, increasing food production and meeting the nutritional needs of the public were considered important steps (Millar, 1981). It is emphasized in various sources that this understanding is important in the continuity of effective military power, in the high efficiency and morale of military personnel during war, and in the proper nutrition of those living in a besieged city (Davies, 1989; Santosuosso, 2018). It is understood from the words of Vegetius (4.7), one of the Roman military historians, that “*those who do not meet their provisions (food) and other needs will be conquered without fighting*” (Milner, 1996; Charles, 2007). There are many examples of this situation in history. The case of the Salassi, a Gallic tribe that surrendered to the Roman General Vetus, demonstrated how rapid and devastating food shortages could be. Moreover, when the Salassi tribe's access to salt resources was blocked by the Romans, they were quickly exhausted and had to surrender (Armstrong, 2023).

To understand how important the issue of nutrition was for military personnel and army commanders, it is necessary to examine the military power of the Roman Empire. Because the Roman army has constantly expanded and strengthened since its foundation. For example, the army established by Servius Tullius in the 6th century BC (Goldworthy, 2003) initially consisted of 4,000 people, but by the end of the 5th century BC it reached 6,000 people (Sekunda & Northwood, 1995). It is stated that in the last days of the Etruscan kings, this number increased to 20,000 people (Demircioğlu, 1953). It is known that especially in the Battle of Cannae in 216 BC, each *consul* commanded approximately 40,000 soldiers (Grant, 2000) and a total of approximately 80,000 soldiers and 6,000 cavalry participated in the war (Macdonald, 2018). A huge army of 250,000 infantry and 23,000 cavalry recruited from the allies and 330,000 infantry and 31,000 cavalry participated in the Battle of Carthage (Second Punic War), (Sage, 2008). It is thought that in the last quarter of the 2nd century AD, there was an army of 480,000

people in the capital, including 30 *legions*, 12,000 soldiers, approximately 483 *auxiliary* units, 36 of which were *alae* or *cohortes* *miliariae*, and naval personnel (Kehne, 2007). In a way, these figures show the size and complexity of the imperial army.

The nutritional needs of large armies are also of great importance. When soldiers do not have access to adequate and balanced nutrition during large-scale campaigns and wars, their combat abilities and endurance can be seriously affected. Accordingly, military leaders must take into account the nutritional needs of soldiers during strategic planning and provide adequate supply and logistics support. Therefore, meeting the nutritional needs of the army became a critical part of the war strategy.

The various strategies have been developed to meet the nutritional needs of soldiers. One of these strategies is the purchase of local materials by state governors and their collection and distribution by military officials (Southern, 2006). Towards the end of the 4th century BC, the *stipendium* (financial aid) payment system was established (Brunt, 1950; De Light, 2007; Erdkamp, 2007; Jahn, 1984). This system is an advanced logistics system that allows the seasonal period of military operations to be extended until December and even early January, essentially allowing the taxes collected from the enemy's products at harvest time to be provided to their armies free of charge (De Light, 2007). In addition, in the 2nd-1st centuries BC, food supplies obtained through direct taxes from the provinces called *tributum* constituted the logistical support of military activities (Roth, 1999). Especially the islands of Sardinia and Sicily played an important role in feeding the overseas army (Erdkamp, 2007). An important component of this system is the spoils obtained from the defeated enemy in battle. This booty not only provided material wealth and valuable objects, but also vital supplies for the Roman army. It is possible to see one of the most concrete examples of this supply method in the conditions imposed on the Seleucid King Antiochus III by the Treaty of Apamea made in 188 BC (McDonald, 1967). According to the treaty, the king was obliged to provide 540,000 *modii* (approximately 27,000 tons) of grain to feed the Roman army of 40,000 people for three months (Roth, 1999). Finally, food gathering activities, called *frumentatio*, were carried out by small but tactically powerful armies for limited periods of time and at appropriate times of the year. In other words, thanks to “*life based on land*”, the short-term needs of military personnel can be met (Erdkamp, 2007).

This research aims to determine the main food sources consumed by Roman soldiers during the Roman period and to examine the nutritional values of these food sources in detail. The eating habits of the

Roman army are thought to be an important historical and cultural reflection not only in terms of their military success, but also in terms of the general influence and power of the empire. These nutritional habits will contribute to our understanding of how they affect the mobility of the army and the morale and endurance of soldiers during long-term operations. It is predicted that the geographical spread and cultural interactions of the empire could have a significant impact on the diversity of dietary habits. Examining nutritional values will help us understand how the Roman army met its daily energy, protein, vitamin and mineral needs.

In conclusion, this research deals with an important aspect of the Roman period. It is aimed to present a new perspective on history and gastronomy by examining the dietary habits of the Roman army in detail. It is expected to help us better understand the impact of the nutritional culture in ancient times on military success and the general welfare of the society and to provide important perspectives when compared to today's nutritional habits.

METHODOLOGY

In order to conduct an in-depth and objective analysis to determine the main food sources consumed by members of the Roman army during the Roman period, a systematic literature review and content analysis method was adopted in this research. These methods will allow a large data set on the primary food sources consumed by the Roman army to be obtained and allow researchers to examine this data in depth. These data were obtained from various archaeological findings, ancient texts, field studies and other sources (articles, books, articles, etc.). It is also thought that it will increase the comparability and reproducibility of the results obtained with other studies and the scientific validity of the research. This research is among the research that does not require ethics committee approval.

Systematic literature review

Systematic literature review is critical for every research to avoid duplication of studies in the literature and to determine the contributions of these studies. It is an important method that requires the same level of academic rigor as other types of research. It can be broadly defined as a systematic method in which previous research is collected and synthesized (Tranfield et al., 2003). This method utilizes transparent and highly reproducible procedures in searching, selecting, collecting (Tolkes, 2018), and analyzing source documents (research notes, books, articles, etc.), (Liberati et al., 2009; Snyder, 2019).

Therefore, systematic reviews require greater academic rigor (Petticrew & Roberts, 2006) and allow for reproducibility (Pickering & Byrne, 2014).

Content analysis

It is a method used to identify trends, themes, and relationships in data using a systematic coding approach to examine and interpret information (Vaismoradi et al., 2013). The data of this method can be divided into books, book chapters, articles, images, audio recordings, etc. It can create all kinds of resources (Krippendorff, 2018). Content analysis enables similar data to be collected within the framework of certain concepts and themes and interpreted in a way that the reader can understand (Creswell, 2012). It provides researchers with the opportunity to systematically examine meanings and contexts and conduct constant comparative evaluation (Manimozhi & Srinivasan, 2018).

Literature review is of critical importance for every research in order to prevent repetition of studies in the literature and to accurately present the contributions of these studies. In this context, it should be noted that it is an important method that requires the same level of academic rigor as other types of research. In this regard, systematic literature review can be defined as a systematic method in which previous studies are collected and synthesized (Tranfield et al., 2003). This method uses questionable and highly reproducible procedures in searching, selecting, accumulating, collecting (Tolkes, 2018) and analyzing source documents (research notes, books, articles, etc.) (Liberati et al., 2009; Snyder, 2019). Therefore, systematic reviews require more academic rigor (Petticrew and Roberts, 2006) and allow for reproducibility (Pickering and Byrne, 2014).

The data collection process is very important in content analysis. Accessing a data source suitable for the purpose of the research will prevent the research findings from being meaningless and complex (Güler et al., 2015). At this stage, researchers tried to prevent this situation by conducting a systematic literature review.

Data collection procedures

Our systematic review attempts to describe, analyze, and synthesize the existing literature on the identification of primary food sources consumed by members of the imperial army. JSTOR platform was chosen as the data source. This platform offers access to more than 12 million journal articles, books, visual materials and primary sources in 75 different disciplines (Schonfeld, 2003). In addition to these features, the JSTOR database was chosen for its ability to provide comprehensive access to research in archaeology.

This study followed a five-step process in obtaining data from the JSTOR database and printed sources: (1) identification, (2) screening, and (3) included. In the first stage, the research question “*What are the daily nutritional habits of the Roman Army?*”, keywords and database were determined for preliminary analysis. This stage is very important for the research to be a clear and documented process (Tranfield et al., 2003). In the second stage, databases and printed sources were scanned, taking into account the criteria determined. In addition, inclusion criteria were determined and the accessibility of the identified resources and their suitability for the research question and purposes were evaluated. In the final stage, the sources to be included in the content analysis process were determined. The flowchart of the search and selection process is shown in Figure 1.

The scanning was carried out on June 15, 2023, using the keywords “*Roman army**”, “*Roman food**”, “*Roman diet**” ve “*Roman food supply**” and boole operators (AND, OR and NOT) determined in line with the research. The researchers also scanned available printed sources. The final evaluations of the identified resources were made taking into account the criteria determined during the inclusion process. As a result, the 9452 scientific publication on the subject was reached.

Analysis of data

First of all, the obtained sources were read and notes were taken. In the second stage, open coding of food consumed or supplied to the Roman army was made (Corbin & Strauss, 2007). In the third stage, draft main themes were created by taking open coding into account. The constant comparison method was used throughout the analysis of the data to assess the

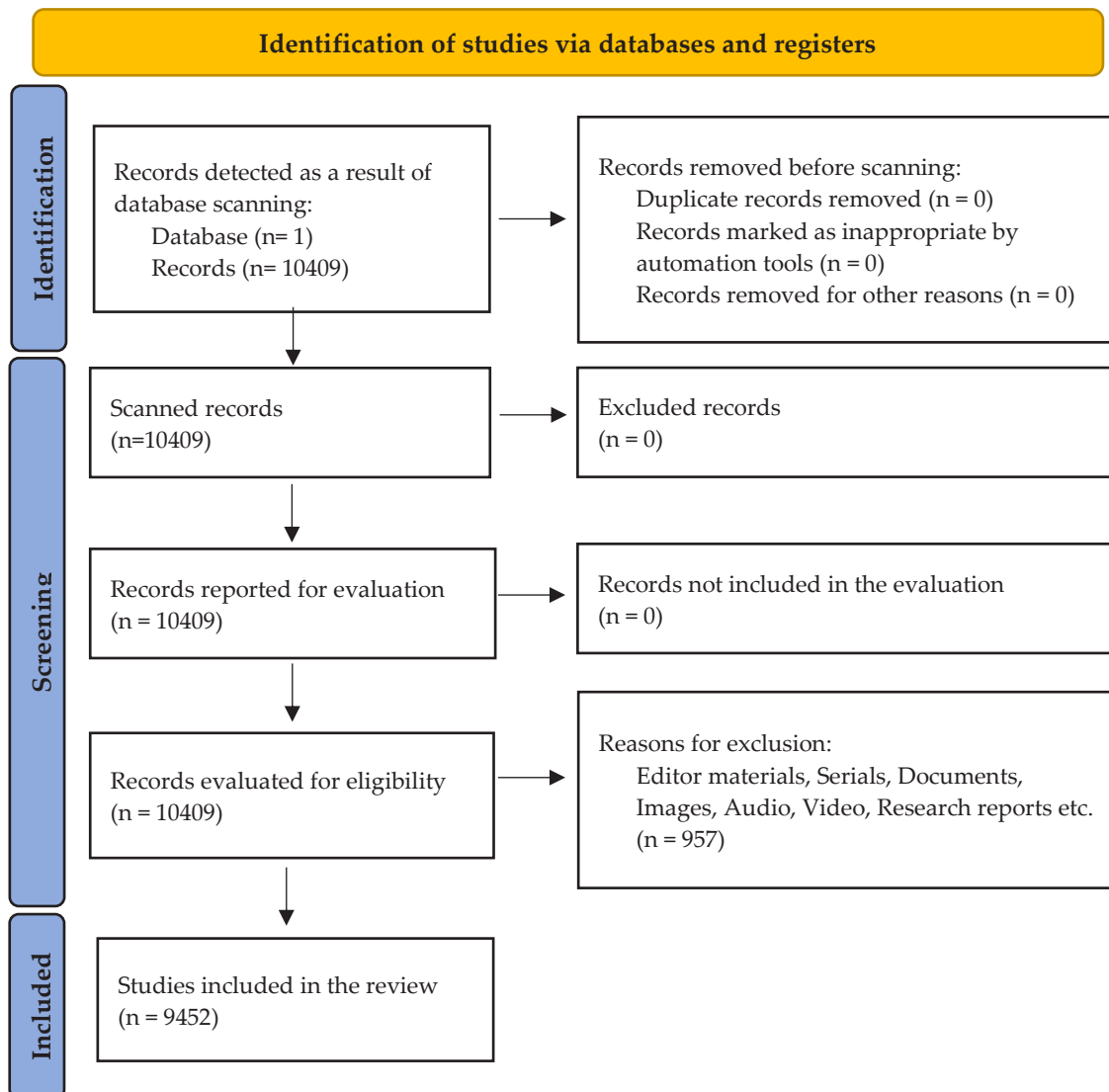


Figure 1. Flowchart of the search and selection process.

consistency of themes and codes (Glaser & Strauss, 2000). In the final stage, the emerging themes and sub-themes were evaluated and organized by two different researchers.

FINDINGS

Foods Consumed in the Roman Army

Grain group (wheat, barley, oats)

As in the kingdoms, states and societies of ancient times, the grain (*frumentum*) group was the main source of nutrition for ancient Roman society and especially its army. As the ancient writer Vegetius (*mil.* 3.3) said, famine often does more harm to an army than war and is more deadly than the sword. In this regard, grain is very important for Roman soldiers. The fact that they procured grain from societies under Roman rule in exchange for taxes reveals the importance of this situation (*Veg. mil.* 3.3). The grain group consists of wheat, barley and oats. The most consumed product among these is wheat. The daily wheat ration of a Roman soldier was 830 grams (Kehne, 2011). Wheat was mostly used for making bread. Using salt and olive oil, they made bread called rusks (*bucelatum*) from wheat (Kehne, 2007) and wheat porridge (*panis militaris*) from coarsely ground wheat (Dery, 1997). These are defined as soldiers' bread. Pliny (*Nat. V.* 24) stated that the wheat porridge in question was whole wheat (*bran*) and was a type of bread used by soldiers. Two types of bread were produced in Roman military camps. Normal quality is called "*panes militares castrenses*" and high quality is called "*panes militares mundas*". The first type of bread was consumed by soldiers, and the second type was generally consumed by officers (Davies, 1971). In addition, since the Roman army was constantly on the move, these types of bread needed were made in portable ovens (Turan, 2016; for types of bread in the Roman period, see Albustanlıoğlu, 2019).

After wheat, another basic food source is barley. It has been defined as the grain product of poor people (Jacob, 2007). There is a very interesting phenomenon of barley consumption in the Roman army. It was also used in compulsory and emergency situations and especially for the purpose of punishing (*decimation*)^{***} soldiers for the crimes they committed.

^{***} In Latin, "decimation" means "decem = ten", meaning "killing of the tenth". It was a punishment given to soldiers in the Roman army who were rebellious, disrupted order, fled from battle, or showed cowardice. The military unit (cohort) that carries out the punishment is divided into groups of ten people, and these groups draw lots among themselves. Soldiers who lose the lot are killed by their colleagues with stones and sticks. The remaining soldiers are given barley instead of wheat.

There are important historical events on this subject. The Battle of Carthage (Second Punic War) took place between Rome and Hannibal between 218-202 BC. During this war, Roman soldiers were given barley instead of wheat due to their undisciplined behavior (*Liv. perioch.* 24.18, 27.13.9). During the conquest of Illyria (Dalmatia) in 34 BC, when Octavian's soldiers showed cowardice and withdrew from the war, he punished the weak military unit with massacre and forced them to feed barley (Appian. 5.26).

Another product consumed in the grain group is porridge. It is made from grains boiled by mixing them with water or milk. In particular, Emperor Iulianus (361-363) ate porridge with soldiers of different ranks to restore the Roman army (*Amm. Marc.* 25.2.2), (Frazer, 1983).

Meat, seafood, poultry and animal foods

The meat consumption was the most important food source after the grain group, which was one of the basic food sources of the Roman army. A Roman soldier had the right to consume 163 grams of smoked meat, called "*lardum*" or "*lardum*", daily (Roth, 1999). It should be noted that the numerical data here relates to meat supplies from the Roman period. However, while F. Haverfield (1920), whom we know for his studies on this subject, claimed that the Roman army did not consume meat and was a vegetarian army, R. W. Davies (1971) opposed this and stated that the Roman army also consumed a lot of meat. Likewise, on the column erected by Emperor Traianus in memory of the Dacian Wars (101-102, 105-106 AD), there are scenes in which animals such as cattle, pigs (*pocus*) and sheep (*oves*) are sacrificed (Lancaster, 1999; Roth, 1999). Taking into account the discussions here, we believe that realistic explanations should be made based on archaeological data and ancient sources. In this context, excavations and historical developments in the settlements where the Roman headquarters were located provide important information for our subject. Accordingly, many cattle bones were found in excavations in military settlements in Britain (England, Scotland and Wales) and Germany (King, 1984; Davison, 1989). Bones of animals such as pigs, goats (*hircum*) and sheep were also found during the same excavations. According to the analysis performed on these bones, it was determined that the animals were slaughtered before reaching adulthood and some of their bones were broken (Davies, 1971). This development can be explained by the habit of Roman soldiers of making soup from bone marrow (Appian. 85). Rulers and rulers such as Marcus Porcius Cato Uticensis (Young Cato), (*Plut. Cat. Min.* 56.3), Lucius Licinius Lucullus (Appian. 9.54) and Julius Caesar (*Gall.* 1.48, 5.21.6,

6.3.2, 6.1). It is known that commanders used cattle herds to meet the meat needs of their military units. In 170 AD, Emperor Marcus Aurelius captured herds of cattle after defeating Germanic tribes (Cass. Dio. 72.11.2). The military emperor Septimus Severus procured cattle from the settlements under his rule to meet the meat needs of his soldiers during the Parthian Campaign in 197 AD (Veg. mil. 3.9.103). Sallustius (*lug.* 90.2, 91.1) describes how Gaius Marius distributed among his soldiers the herd of cattle he captured near Capsa in 107 BC.

The Roman administration procured meat from the provinces in exchange for taxes for purchasing, hunting or sacrificial ceremonies (*lustrati*). Sacrifice of cattle and other animals (*hostia*) was a relatively common occurrence in the Roman army and was a source of fresh meat (Watson, 1969; Davies, 1971; Rüpke, 1990). It was a Roman tradition to perform purification (*lustratio*) in the army before the war, and each soldier received his share of the sacrifices offered to the gods (Roth, 1999). Plutarch (*Brutus*. 39.1) noted that before the battle, Roman rulers distributed sacrificial cattle to the cohorts that formed the legion unit. It is learned from the ancient writer Joseph (*Bell. lud.* 7.16), who describes the siege of Jerusalem by Emperor Titus, that after the emperor captured the fortified castle, his soldiers were given sacrificial cattle. A papyrus from Dura-Europos, dated to 223-227 AD, records the calendar of sacrifices performed by the military unit stationed there. It is written in the calendar that sometimes a cow, sometimes an ox, and sometimes both are sacrificed (Roth, 1999).

The Romans were especially fond of lambs (*agni*) and kids (*haedi*). It was determined that Roman soldiers ate a lot of goat during the siege of Jerusalem in the 70s AD (Price, 1992). In addition to domestic animals, they are also seen to hunt and consume wild animals such as deer and rabbits. Many rabbit bones were unearthed during excavations at the Roman fort on Waddon hill near the town of Beaminster in Dorset, England (Davies, 1971). The historical events we learn from ancient sources about the meat consumption of the Roman army also provide important information. Appianus (*Hisp.* 9.54) mentioned that Lucullus' troops in Spain consumed game such as rabbits and deer. He points out that as part of military discipline in Spain, strict military commanders insisted that their soldiers eat only "plain boiled or roasted meat" (Appian. *civ.* 14.85). His troops must be preparing meat in a way that was not previously of a military nature. It is known that soldiers also ate pack animals and horses in emergency situations (Appian. *civ.* 8.54; Tac. *Hist.* 4.60). In this context, Frontinus (*strat.* 4.5.18) declared that in times of emergency soldiers could eat "animals of all kinds".

The pork was an indispensable source of food for military units; roasted and boiled bacon, "forciminia" sausages, and smoked pork and the ham called "perna" were produced (Schlippschuh, 1987: 24; Roth, 1999: 26). Polybios (*Hist.* 2.15.2-3) mentioned that Roman soldiers serving in northern Italy (Po valley) consumed pork. In the *Historia Augusta* (*Hadr.* 10), pork is described as part of the standard camp meal (*cibus castrensis*). Considering the archaeological data obtained from written documents, ancient sources and historical developments on this subject, it has been revealed that the determination of F. Haverfield, who claimed that the Roman army was vegetarian, is not valid.

During the excavations carried out in the fortified areas where the Roman army established its headquarters, seafood remains (especially fish bones) were found. Remains of sturgeon were detected at Saalburg, pike at Butzback, cod at Waddon and Hood hill settlements, and perch at Chester. Fish remains were found during excavations in Brecon, Caerlean, Vindonissa and Carbridge, but their species could not be identified (Turan, 2016). A fishing rod used in fishing was also unearthed during excavations at the headquarters of Roman soldiers in Vindonissa, Switzerland. In this regard, it is possible for soldiers to hunt in the Aare river, which is geographically located within the borders of Vindonissa. Similarly, fishing rods were unearthed during excavations at Richborough (Cunliffe, 1968). In the excavations carried out in the castle near the Rehn river in Valkenburg, whale, cuttlefish and porpoise species, as well as sturgeon and pike remains, were found (Davies, 1971). Seashell remains were also found during the excavations. Minerals, snails, oysters and mussels have been identified in military settlements in the geographically parallel ports of South Shields and Maryport (Alcock, 1998). Additionally, interesting information was obtained from written documents (*papyrus*) regarding a fish poisoning case that occurred in the city of Alexandria. In the 2nd century AD, a Roman soldier named Terentian wrote a letter apologizing for not being able to meet his father in Alexandria. In this letter, he reported that the entire garrison had suffered a terrible and severe fish poisoning and therefore could not leave the camp for several days (Alcock, 2006).

Poultry was also among the main food sources of the Roman army. Remains of geese, ducks and chickens were unearthed during excavations in walled military settlements. Remains of wild game birds were found during excavations in Germany in areas where the Roman army's auxiliary units were stationed. In this context, according to the remains, it is thought that the soldiers went goose hunting (Davies, 1971). Vegetius (*mil.* 4.7) stated that poultry should not be harmed

because the supply and feeding conditions of poultry were easy during siege periods. It is understood from the egg shells unearthed during excavations that it was fed to obtain eggs from poultry (Dixon & Southern, 1997).

Soldiers are known to consume animal foods. According to research, a Roman soldier consumed 27 grams of cheese per day (Roth, 1999). Pliny (*Nat.* 11.237-242) mentioned that the Romans made cheese from cow, sheep and goat milk. In *Historia Augusta (Hadr. 10)*, it is stated that Emperor Hadrian liked to eat cheese in the open, in addition to foods such as bacon and vinegar consumed at the headquarters. The materials used in cheese making were found during excavations in military settlements (Davies, 1971). The presence of cheese squeezing machines in various military areas suggests that soldiers produced their own cheese (Davies, 1971; Junkelmann, 1997).

Vegetable and fruit consumption

Vegetable (*holus*) group plants such as wheat, barley and oats, which are in the grain group, are one of the main food sources of soldiers. Especially legumes (*fabaceae*) such as beans (*fabae*), peas (*fisa*) and lentils (*Lens culinaris*) were widely consumed (Davies, 1971; Junkelmann, 1997). So much so that it is known that the emperor Septimius Severus was very fond of his country's beans (*legumina patrii*), (Roth, 1999). Like grain, vegetables were probably given to Roman soldiers. Because in addition to their grain ration, the soldiers also had 620 grams of additional food consisting of legumes and various vegetables and fruits (Turan, 2016). For example, a sextarius bean (about 0.54 liters) weighed approximately 110-130 grams (Prestwisch 1967). When the plants obtained from excavations in a Roman military settlement in Neuss (*Novaesium*), Germany, were examined, it was determined that the consumption of the legume group was approximately 53% (Junkelmann, 1997). Plutarch (*Crass. 19.5*) mentions that lentils were widely consumed by soldiers. Herbs such as garlic (*Allium sativum*) were also part of the military diet. Suetonius (*Vesp. 8*) tells the following story about Vespasian, who boasted of being a soldier-emperor: When a young man smelling of perfume came to thank him [as governor], Vespasian turned his head back in disgust and said, "*I would rather have him smelling of garlic*", he scolded him harshly. It is also known that soldiers consumed roots, bushes and herbs in forced and emergency situations (Tac. *Hist.* 4.60). After the Pompeian victory in 89 BC, soldiers retreating from the battlefield consumed acorns while crossing the Apennine Mountains (Appian. *civ.* 1.6,50).

It has been determined that various fruits are also consumed in addition to vegetables. During

excavations in Vindonissa, remains of apples, peaches, pears, plums, grapes, cherries, mulberries and walnuts, hazelnuts and chestnuts were found (Davies, 1971). Excavations carried out in Saalburg, one of the military units of Emperor Hadrian, revealed that the II. Raetorum cohort consumed peaches, plums, cherries, walnuts and hazelnuts in the region (Wacher, 2002). During the excavations carried out during the Roman Siege of Masada, it was determined that the soldiers consumed plums, apricots, grapes, pomegranates, dates and olives (Potter, 2010). Because the types of vegetables and fruits consumed by soldiers during the campaign were important, food vendors called "*lixae*" were allowed to wander around the areas where the army was stationed (Roth, 1999). In fact, during the Battle of Carthage (Third Punic War) in 146 BC, the Roman commander Scipio Aemilianus warned the merchants to ensure that the soldiers had a healthy diet (Appian. *civ.* 17.116).

Use of olive oil, wine, beer, honey, fish sauce and salt

For the Mediterranean world, olive oil is an important consumption product both for cooking and as a condiment. In this respect, it was called "*oleum*" by Roman soldiers and took its place among the main food sources. It was widely used in cooking, lighting and cleaning. Apart from this, it has been revealed that it is also used in medical work. According to research, the daily amount of olive oil that a Roman soldier should consume was determined as 4.4 centiliters (40 ml), (Roth, 1999). Appian (*Hisp.* 9,54) stated that olive oil had an important place in the meals of Roman soldiers in the 2nd century BC. Similarly, Plutarch (*Crass. 19.5*) says that Crassus gave his troops oil as a regular part of their rations during the Parthian campaign (54-53 BC). It is known that Caesar collected oil along with other essentials during his food drive (Roth, 1999). From a papyrus found in Egypt, it is learned that olive oil should be given to soldiers who are in the hospital (*vale tudinarium*) for various reasons. Based on the narratives of Queen Boudicca, who rebelled against Rome in 60-61 AD, ancient writer Cassius Dio (62.2.25) provides information that olive oil was one of the products most consumed by Roman soldiers after bread and wine.

The wine, a popular type of liquid beverage in ancient Roman society, also had an important place in the Roman army. In addition to the consumption of grain, vegetables and fruits, vinegar (*acetum*) and especially wine were also a ration that the empire was obliged to provide. The products in question were distributed to soldiers every three days (Kehne, 2007). Therefore, preserving wine is very important.

Amphoras used to preserve wine were found during excavations in military settlements in Vindonissa. Some terminological uses related to wine attract attention. Old wine is called “*oinos*” and sour wine is called “*oxos*” (Dalby, 2003). Ancient comedy writer Plautus (*Soldiers*. 3.2.837) mentioned that the lower classes of society consumed a diluted wine called “*posca*”. It is rumored that soldiers also consumed this type of wine. However, although it is known that soldiers sometimes consume quality wine, these behaviors of the soldiers are shown as an example of indiscipline (Turan, 2016). In addition, it is stated in the work *Historia Augusta* (*Hadr.* 10.2) that Hadrian stayed with the soldiers in the camp, ate the camp's food with them, and even consumed lard, cheese, and *posca* with pleasure (Akkurnaz, 2024). Apicius (IV.1.3), on the other hand, mentioned a different use of *posca* and stated that it was used to soften slices of bread. It is learned from Sallustius (*Jug.* 44.5) that disciplined generals prohibited the importation of old wine. Roman statesman, jurist and orator Cato the Elder favored “*Vinum Regum*” or “*Rex Vinorum*” wine, which was called “*the wine of kings or the king of wine*”, (Liv. *perioch.* 37.33.2; Plin. *Nat.* 3.15). Livius (*perioch.* 37.27.2; 37.28. 2-3) noted that during Rome's war against Antiochus (192-189 BC), the army's stock of stale wine (*vinum*) was so large that several cargo ships were needed to transport it. It is known that Pescennius Niger, who was known for his Eastern politics, was the Governor of Syria and had a say in the Asian Province, instructed his soldiers to drink sour wine (*Hist. Aug. Nig.* 10.3).

It seems that the auxiliary troops recruited from the lands under Roman rule used beer made from barley water as a local beverage. It is the traditional drink of the Germanic peoples of the north. Roman soldiers serving in the north consumed beer due to their relationships. Ancient writers Appian (2.10.64) and Tacitus (*germ.* 23) also mentioned that Germanic auxiliaries in Caesar's army drank wine. This development is a situation resulting from the coexistence of military units.

Romans used honey to sweeten their meals. It was determined that the phrase honey was written on the amphoras unearthed during the Vindonissa excavations (Dawies, 1971).

Romans, who consumed seafood a lot, often used fish sauce called “*garum*” or “*liquamen*” in their traditional dishes (Toussaint-Samat, 2009). However, it is known that soldiers generally consumed “*muria*” sauce, which is a clear brine formed by cleaning the fish before salting and removing its active enzymes (Todd, 2004). M. Junkelmann, whom we know for his studies on this subject, stated that the remains of

“*garum*” used in military camps have not yet been found (Junkelmann, 1997).

Salt (*sal*) was among the basic needs of soldiers as well as daily life in Rome. They made great use of salt, especially to preserve the meat they consumed, to flavor food, and for medicinal purposes (Veg. *mil.* 3.3; Appian. 9.54, 4.17; Caes. *civ.* 2.37.5; Plut. *Crass.* 19.5).

Calculating the Nutritional Values of Food Consumed in the Roman Army

The nutrition and diet of soldiers is a vital element to consider in every military formation. As a matter of fact, a solid and strong diet has been accepted as the first step to achieving victory (Milner, 1996). However, although adequate calorie intake was important for the health of Roman soldiers, it can be said that it alone was not sufficient. Therefore, in addition to macronutrients (protein, fat and carbohydrates), they also need to take micronutrients such as vitamins and minerals. Regarding the subject, we learn from Polybius that the army of Hannibal of Carthage suffered from scurvy, also known as vitamin C deficiency, due to malnutrition and harsh conditions while passing through Italy. In order to prevent Roman soldiers from encountering a similar situation, attempts were made to obtain vitamin C from various foods they consumed (vine leaves, currants, etc.), (Curtis, 1926).

There are two important factors that determine the exact daily caloric needs of a soldier. These are the soldier's weight and height (Tharion et al., 2005). In addition, daily calorie need is affected by various factors such as age, gender, activity level and environment (Gaman & Sherrington, 1996; Tharion et al., 2005). Soldier nutrition must be carefully planned, taking into account a wide range of activities and environmental impacts, as well as maintaining health and well-being (Friedemann et al., 1959). Physical activity and environmental factors directly affect the calculation of energy needs and carbohydrate intake in military rations (Sotelo-Díaz & Blanco-Lizarazo, 2019). It is known that Roman soldiers were inspected through a process called “*probatio*” before being recruited and that there was a minimum height requirement (Horsmann, 1991; Le Bohec, 2000). However, although it is not known exactly what the minimum height requirement is (Roth, 1999), it is learned that it varies according to different military units (Veg. *Epit.* 1.5; Watson, 1969; Silhanek, 1972). According to data, it has been determined that the average height of a soldier in the army is approximately 170 cm (Bisel, 1986; Junkelmann, 1997). In most societies, the height-to-weight ratio does not change significantly over time, with some exceptions such as obesity. Therefore, within the scope of the research, the height-weight table of

the modern US army was used to estimate the average weight of Roman soldiers (U.S. Army, 1961). When this table is examined, a Roman soldier approximately 170 cm (67") tall would weigh 76.65 kg (169 lbs). The main reason why the US army is preferred is that, just as some of the Roman army in ancient times was formed by recruiting non-Romans, the US army was formed by bringing together people from different nationalities (provided that they had the right to citizenship).

Another important point in terms of nutritional needs is the age of Roman soldiers. Because some studies have shown that metabolism and calorie needs decrease significantly after adolescence and remain relatively constant until middle age (Webster et al., 1941; Helgeson et al., 2008). Therefore, in this research, the military age and length of service of the Romans were taken into account in order to estimate the average age. In the Late Roman Imperial inscription, it is stated that the age for conscription is 18, and this is thought to be valid during the Principate period as well (Le Bohec, 2000; Pharr, 1969). Additionally, the information in Dio Cassius's (53.20.2) history of the Roman Empire shows that the age of compulsory military service during the empire was the same as the Roman Republic Period. A study of the military careers of the imperial *legions* found that 75% of soldiers were recruited between the ages of 18 and 23 (Davies, 1989; Forni, 1953). The 16-year military service period initiated by Augustus was increased to 25 years in the 1st century AD (Cass. Dio. 54.25.6, 55.1.23; Kromayer & Georg, 1928; Webster, 1985). This era event dates back to the 2nd-3th centuries AD. It is known that it continued to increase over the centuries and reached 28 years in the time of Caracalla (Le Bohec, 2000). Based on this information, it can be said that the average age of a Roman soldier was close to 30 (Roth, 1999: 12). As a result, the daily nutritional requirement for a Roman soldier who was 170 cm (67") tall, weighed 76.65 kg (169 lbs), and was 30 years old was 3439 calories (US Army, 1961), or possible calculation errors - 15% (Foxball & Forbes, 1982) and calculated as 2923.15 calories. In addition, the daily protein requirement of a Roman soldier was calculated as approximately 77.32 grams.

Within the scope of the research, it was calculated how much food (2923.15 calories) the Roman soldiers should consume to meet their daily energy needs. Accordingly, it was determined that a Roman soldier consumed 830 grams of wheat ration per day as wheat porridge (whole wheat), (*panis militaris*), (Dery, 1997) and rusks (*buccelatum*), (Kehne, 2007). Considering that wheat is mostly used in bread making, it is estimated that approximately 580 grams of flour, 165 grams of bran and 45 grams of coarse wheat are obtained from grinding 830 grams of wheat. Wheat porridge (whole

wheat), (*panis militaris*), when prepared with 165 grams of bran, 45 grams of coarse wheat and water, can provide 370 calories of energy. If bread is made with the remaining 580 grams of flour, an average of 600 grams of bread can be produced. Considering that this bread is consumed in one day, it can be said that it contains approximately 1305 calories****. In addition, it can be said that Roman soldiers received 374 calories from 163 grams of smoked meat (Roth, 1999), 74 calories from 27 grams of cheese (Roth, 1999), and 141 calories from approximately 110-130 grams of beans (Prestwisch 1967). The total amount of energy provided by the foods consumed by Roman soldiers on a daily basis and whose amounts are known is 1894 calories. However, there are also foods (pork, lentils, wine, fruit and nuts) that were consumed by a Roman soldier but it is not clear how much they were consumed. In order to complete the remaining 1029 calories, the consumption amounts of these foods were calculated in parallel with known foods. It is known that pork was part of the standard camp meal (*cibus castrensis*), (Hist. Aug. Hadr. 10). Considering the military camp environment, 250 grams of pork cooked by boiling or frying is an average of 487 calories. When ancient sources are examined, it is seen that lentils were consumed excessively (Plut. Crass. 19.5; Davies, 1971; Junkelmann, 1997). In the light of this information, it is possible to say that it is consumed more than beans (110-130 grams), (Prestwisch, 1967). Additionally, Turan (2016) stated that Roman soldiers had supplementary food consisting of 620 grams of legumes, various vegetables and fruits, in addition to their grain ration. 260-300 grams of boiled lentils cooked by boiling method provide an average of 290 calories of energy. They can get an average of 105 calories from 190 grams of fruit. It is known that a Roman soldier drank different types of wine (Hist. Aug. Nig. 10.3; Liv. *perioch.* 37.27.2; 37.28.2-3; Turan, 2016). This means that 200 ml of wine per day can provide an average of 150 calories of energy. Finally, 163 grams of smoked meat is about 40.75 grams, 27 grams of cheese is about 5.4 grams, 110-130 grams of boiled beans is about 19.25 grams, 250 grams of boiled or fried pork is about 68.75 grams, and 260-300 grams is about 68.75 grams. Contains grams of beef. Boiled lentils can provide about 78 grams of protein. In light of this information, it turns out that a Roman soldier could consume a total of 212.2 grams of protein per day.

**** These values are reduced by 15% of normal values, accounting for the presence of indigestible shell fragments, etc. (Foxball & Forbes, 1982).

CONCLUSION AND RECOMMENDATIONS

Nutrition, logistics and supply chains were of great importance for the Roman army to continue its activities within the expanding borders. The research reveals that in addition to basic food groups such as grain, meat products and vegetables, materials such as olive oil, cheese, wine, fruit and salt were of strategic importance in Roman military rations. These nutrients appear to help support soldiers' health and prevent disease, as well as provide energy during peacetime and military operations. For example, in military rations, a certain amount of grain and meat is distributed to meet the calorie and protein needs of the soldiers, while vegetables and fruits rich in vitamin C, etc. Attempts were made to prevent scurvy with edible foods (vine leaves, currants, etc.). However, when the nutritional habits and plans of the Roman army are examined, it is seen that nutrition was effective not only on physical endurance and health, but also on morale and social harmony. Cereals, especially wheat and barley, appear to be of critical importance in meeting the energy needs of soldiers and as a source of carbohydrates in long-term operations. Because it can be said that grains such as wheat and barley are not only food but also have strategic importance due to their long shelf life, flexible use and logistic advantages (Westermann, 1920). It was determined that the 830 grams of wheat allocated daily to a Roman soldier was used to make bread and wheat porridge.

In this research, as a result of detailed examination of the diet of the Roman army, it was tried to elucidate how the military power of the ancient world was supported by nutritional engineering. It also focuses on calculating the nutritional values of foods included in military rations, revealing how these foods optimized the performance of Roman legions in battles and campaigns. Data from research shows that carbohydrate-rich foods, such as grains, support long-term physical efforts by keeping energy levels high. In particular, nutritional value analyzes of wheat reveal how effective this grain was in meeting the calorie needs in the diet of Roman soldiers. Because a Roman soldier who grinds and processes a daily ration of 830 grams of wheat (in the form of bread and whole wheat porridge) provides approximately 1675 calories of energy. This provides 57.26% of a soldier's total daily calorie needs. Considering this situation, it can be stated that bread preparation constitutes an important part of the soldiers' daily routine. Additionally, when archaeological data were examined, it was calculated that a Roman soldier provided approximately 212.2 grams of protein from the foods he consumed daily (smoked meat, cheese, boiled or fried pork, boiled beans and lentils). In line with these data, it was

calculated that a Roman soldier met approximately three times his daily protein needs from the food he consumed. This shows that the diet of Roman soldiers was very rich in protein and more than met their daily needs.

The nutritional hierarchy in Roman military camps; It appears to be influenced by a complex set of factors, including status, military strategy, physical fitness, social behavior and practical considerations. As a result, it can be said that this structure is quite diverse and dynamic. Torres (2010) and Wei-jiang (2008) emphasize that military strategy and physical fitness have an important role in shaping this hierarchy. When the nutritional hierarchy in Roman military camps is examined, it is seen that there was a nutritional structure based on the hierarchical nutritional theory. A good example of this is that in Roman military camps, normal quality bread was consumed by "*panes militares castrenses*" soldiers, and quality bread was consumed by "*panes militares mundas*" officers. Because the quality and consumption patterns of bread have often been a staple food reflecting social hierarchies (Samper, 2002). Additionally, the research reveals the implications of Rome's supply and logistics strategies for modern military and civilian logistics practices. Ancient Rome's supply chain management developed effective methods for transporting supplies and food from diverse and remote locations within a vast empire. These methods offer strategies that can be taken as reference even today when developing applications in logistics and supply chain management.

As a result, it is emphasized in this study that the nutritional habits of soldiers in the Roman period should be considered within a historical and cultural framework and that these habits should be examined not only from a military perspective but also from a socio-cultural perspective. It is also thought that this research will bring a different perspective to the military and social history of Rome within the scope of food products, will have a positive impact on the studies planned in this field in Turkey and will make valuable contributions to the establishment of a bridge between gastronomy and archaeology research.

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