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MEDICINAL PROPERTIES OF BEER: FROM ANCIENT TO EARLY MODERN TIMES

LJEKOVITA SVOJSTVA PIVA: OD ANTIKE DO RANOGA MODERNOG DOBA

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SUMMARY

Ale and beer brewing and drinking have apparently been part of the human experience since the dawn of civilization. Beer is one of the most consumed alcoholic beverages around the world. It is rich in nutrients such as carbohydrates, amino acids, minerals, vitamins, and other compounds. Historically, ale and beer have served as sources of potent nutrient food and have also been used for their medicinal properties. It was believed that the process of fermentation changes simple ingredients such as grain and water into sacred produce, and the introduction of medicinal plants enhances its properties. The earliest records show that in Sumer, beer was used for medicinal purposes as early as 2000 BCE. In the early Middle Ages, ales became popular among the Celts, Germans, and Scandinavians, who were great ale drinkers. Ales were brewed without hops; instead, a specific herb or a combination of herbs called gruit was used for flavouring. Ale and beer were thought to have both magical and medicinal powers, and were often prescribed for medicinal purposes. The introduction of hops revolutionized the brewing and beer trade. Hops improved the quality of beer and gave beer greater durability and protection against bacteria. The aim of the paper is to present the history of ale and beer used for their medicinal properties.

***Keywords**: ale, beer, gruit, hops, herbs, recipes*

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Introduction

Beer is defined as an alcoholic beverage produced by extracting raw materials with water, boiling (usually with hops), and fermenting (Encyclopaedia Britannica, 2023). In this article, the term 'beer' is used generically to refer to a beverage produced through the brewing process. However, 'beer' is also commonly understood to specifically denote a beverage made with the addition of hops. Conversely, 'ale' typically describes a drink without hops, often incorporating other additives.

The purposeful production of alcoholic beverages is widespread across many cultures. Ale and beer have played a significant role in nearly all cultural groups globally. While they served as staple beverages during the Middle Ages and early modern times, ale and beer possessed a distinct character and significance. They resulted from fermentation, a process transforming simple ingredients such as grain and water into what was believed to be 'sacred' and often psychotropic beverages. Many contained medicinal herbs or plants with healing properties and were brewed for therapeutic purposes. Frequently, ale and beer were integrated into various dishes when food was regarded as medicine. According to humoral theory, both beverages were believed to positively influence human health, offering more benefits than drawbacks. Jane O'Hara-May, in her book, gathered opinions of ale and beer as perceived by ancient and Renaissance writers. Among them, we find descriptions stating that beer "engenders gross humours...augments the strength...increases flesh...'breeds' blood...provokes urine...cools moderately" (O'Hara-May, 1977, p. 218).

Contemporary research confirms that moderate beer consumption can offer certain health benefits due to its composition, which includes protein, B vitamins, minerals, antioxidants, ethanol, dietary fibres, and prebiotic compounds. However, it is important to note that excessive alcohol intake carries significant risks for both individuals and society. As noted by Andrew Boorde (1870), a sixteenth-century English physician, beer was believed to contribute to weight gain and abdominal bloating, a condition that is now commonly referred to as 'beer belly' in modern terminology. Modern studies further indicate that overconsumption of beer and other alcoholic beverages can lead to various health disorders. These include allergic reactions, elevated uric acid levels, mutations, and an increased risk of certain cancers such as breast, colorectal, and upper digestive tract cancers. Additionally, excessive alcohol consumption is associated with cirrhosis, dementia, obesity, alcohol dependence, and social misconduct. Furthermore, excessive beer consumption may negatively impact dental health due to its high sugar content (Sohrabvandi, 2012).

The emergence of beer: tracing its ancient roots

The exact origins of beer remain unknown, however, it is believed that brewing likely began during the Neolithic period. Between 9000 and 7000 BCE, the transition from a nomadic hunter-gatherer lifestyle to settled agriculture marked a significant shift known as the Neolithic Revolution, profoundly impacting early human history. Beer may have been brewed even before these transformative changes occurred as some fermentation materials necessary for brewing were likely available in sufficient quantities to pre-Neolithic nomadic humans (Swinnen, 2011). Some of the earliest evidence suggests the existence of a beverage resembling beer, known as *kui*, brewed in China around 7000 BCE (Patterson & Hoalst-Pullen, 2014). Chemical analyses conducted on ancient pottery fragments indicate that Chinese villagers were indeed brewing alcoholic drinks during this period. The oldest known Chinese texts from the Shang dynasty (1200 BCE to 1046 BCE) mention three types of alcoholic beverages, suggesting that fermented drinks might have been developed much earlier, as evidenced by the similarity of older bronze vessels and pottery to those used during the Shang dynasty (Hecht, 2004). Over 5,000 years ago, in the grasslands of southern Babylonia, situated between the Tigris and Euphrates rivers, people were actively engaged in beer production.

The earliest documented beer brewing process originated in Sumer, located in southern Mesopotamia, which corresponds to present-day southern Iraq. The Sumerians emerged as one of the earliest known beer-drinking societies, crafting a variety of beers from wheat, barley, and mixed grains (Gately, 2008). Ceramics dating back to approximately 3500 BCE, unearthed in the Zagros Mountains of modern-day western Iran, contain traces of beer, offering tangible evidence of early brewing practices (Curtis, 2001). Pottery fragments from the Sumerian period are marked with calcium oxalate, commonly referred to as 'beerstone', a residue that accumulates on vessels used in breweries. The discovery of the Ebla tablets in Syria further illuminates the prevalence of beer production, revealing a diverse array of beers crafted in the city around 2500 BCE (Dumper & Stanley, 2007). The beer culture of Sumer eventually permeated into Egypt, influencing brewing practices and consumption patterns.

Beer in ancient Egypt: a cultural and medical tradition

The earliest evidence of beer in Egypt dates back to approximately 3500 BCE (Maksoud, 1994). Excavations conducted at two pre-dynastic sites, Abydos and Hierakonpolis, unveiled large, fixed vats supported by distinctive firebricks, be-

lieved to be remnants of ancient breweries (Geller, 1992). Hieroglyphic inscriptions indicate that beer held significant cultural importance in early Dynastic Egypt, evolving into a refined art form mastered by the Egyptians (Turner & Berry, 1973). Medical papyri document the brewing of at least seventeen distinct types of beer by the Egyptians. Unger (2004) suggests that the diverse array of Egyptian beers arose from the varying quantities of grain and malt, as well as the types of malt used. Over time, beer transitioned into the everyday beverage of choice for the Egyptian populace. The Greek historian Herodotus credited the Egyptians with creating the first true beer, highlighting its importance in ancient Egyptian society. Additionally, there is evidence to suggest that beer served medicinal purposes during this period:

> "An ancient Egyptian medical manual, of about the same date as the Book of the Dead, contains frequent mention of the use of Egyptian beer in medicine, and at a period about 1,000 years later, the papyri afford conclusive evidence of the existence even in that early age, of a burning liquor question in Egypt, for it is recorded that intoxication had become so common that many of the beer shops had to be suppressed" (Bickerdyke, 1889, p. 25).

In an article published in the American Journal of Physical Anthropology, Nelson et al. (2010) speculate that ancient Egyptians and Jordanians used beer not only for the treatment of gum disease but also for other medical conditions. Furthermore, they suggest that these ancient societies fermented antibiotics. It is posited that in ancient times, the intricate process of fermenting antibiotics was probably widespread and passed down through generations.

Beer in ancient Greece and Rome: from Minoan fermentation to Roman brewing

It appears highly likely that the Minoans, the pre-Greek inhabitants of Crete, engaged in the fermentation of barley and possibly other substances. Recent archaeological discoveries support the notion that they consumed some form of beer. For instance, at an early Minoan settlement in southern Crete, two storage jars dating back to around 2200 BCE were unearthed, with analyses suggesting they may have contained beer. Similarly, at Apodoulou in Crete, a cooking pot dating to around 1700 BCE was found, exhibiting traces of phosphoric acid and dimethyl oxalate indicative of beer brewing (Tzedakis & Holley, 1999). In ancient Greece, beer held a lower status compared to wine and was associated with barbarian cultures, such as the Thracians, Paeonians, and Phrygians. Classical writers typically mentioned beer only in relation to its medicinal properties or when

comparing it unfavourably to wine (Curtis, 2001). Xenophon, a Greek general and writer, did not hold beer in high regard. In *Anabasis*, on his march to Persia, he comments on what he saw in one of the villages:

> "There were stores within of wheat and barley and vegetables, and wine made from barley in great big bowls; the grains of barley malt lay floating in the beverage up to the lip of the vessel, and reeds lay in them, some longer, some shorter, without joints; when you were thirsty you must take one of these into your mouth, and suck" (Xenophon, 2022, September 16, Book 4, Ch. 5).

By the time of the Roman Empire, beer had gained widespread popularity and was commonly consumed in the northwest regions, including Roman Britain. It was brewed and enjoyed throughout the empire by non-Roman peoples or Romans and Romanized individuals when wine was unavailable. In the southern part of Roman Britain, it is believed that wheat formed the primary base of beer. Evidence suggests that spelt wheat was the principal grain used in the malting process (Cool, 2006). However, despite its prevalence, beer was not held in high regard by most physicians and medical authors during the Roman Empire. Both ancient Greeks and Romans viewed beer as inferior to wine and believed it could lead to negative health effects (Nelson, 2005). Greek physician, pharmacologist and botanist Pedanius Dioscorides (1906-14) described *zýthos* beer as a diuretic drink with harmful effects on the kidneys and tendons, suggesting that it was not used in medicine and could even cause conditions like elephantiasis. Similarly, Dioscorides (1906-14) mentioned that *koúrmi* beer could cause headaches, disrupt humoral balance, and harm tendons.

Oribasius, a fourth-century Greek medical writer and personal physician to the Roman emperor Julian, also expressed disapproval of beer. While he acknowledged barley beer as having comparable strength to wine, he noted that beer's properties were inferior and that it passed through the body more slowly (Oribasius).

Brewing among the Celts: domestic traditions and professional practices

In Celtic societies, brewing was primarily a domestic activity managed by women, although, in certain regions of their territories, there may have existed groups of professional beer makers, as observed in Roman Gaul (Unger, 2004). The Gauls distinguished between two main types of beer: a barley beer called *korma*, considered inferior, and a wheat beer known as *cervesia* (Nelson, 2003).

The evidence is derived from Marcellus Empiricus, a Gallic medical author from the fifth century CE. In discussing a remedy for coughs, he mentions adding salt "into a drink of *cervesa* or *curmi*", likely referring to wheat beer and barley beer, respectively (Empiricus, 1889). In present-day Germany, excavations at Eberding-en-Hochdorf uncovered a 2550-year-old Celtic settlement where beer was brewed in specially constructed ditches. The brew was flavoured with spices such as mug wort, carrot seeds, or henbane (Stika, 2011).

The Picts and Celts who inhabited the British Isles were known to brew fermented beverages containing heather (L. *Calluna vulgaris*). Among the Picts, those who brewed heather ale for ceremonial purposes were held in high esteem within Pictish society (Buhner, 1998, p. 28). It was believed that the Picts crafted exceptional ale solely from heather, without the addition of malt or any other sweetener, relying solely on the heather blooms and their nectar for flavour and to facilitate the fermentation process. Heather possesses mild narcotic and sedative properties and has been traditionally used in herbal medicine to alleviate urinary and kidney ailments, as well as to relieve rheumatic and arthritic pains. In the Highlands, an infusion of heather tops was used to treat coughs, consumption (pulmonary tuberculosis), and to calm the nerves. Thomas Pennant (1776, p. 262), a Welsh naturalist and travel writer who extensively explored Scotland and other parts of Britain during the late eighteenth century, in his account from his tour in Scotland wrote that:

> "Ale is frequently made in this island [of Islay] of the young tops of heath, mixing two-thirds of that plant with one of malt, sometimes adding hops. Boethius relates that this liquor was much used among the Picts, but when that nation was extirpated by the Scots the secret of making it perished with them."

Scandinavian and Germanic ale traditions: medicinal uses and linguistic evolution

The Danes and Anglo-Saxons not only consumed ale but also used it for various medicinal purposes, including treating coughs, shortness of breath, curing hiccups, and even rubbing it onto the knees to alleviate aches and pains (Bamfort, 2004). The Scandinavian word *bjórr* evolved into *beer* in the Anglo-Saxon culture (Zoëga, 2016). Additionally, b*jórr* can also be interpreted as 'strong ale.' Another Nordic term, *ǫl,* should be translated as 'ale' (Zoëga, 2016). While their distinction often hinges on alcoholic content, with *ǫl* considered to have less alcohol and *bjórr*

being stronger, both terms refer to a beverage derived from the fermentation of malted cereals.

In the Viking era, mead and beer constituted the primary alcoholic beverages among the Norse people. Beer, crafted from barley, held a prominent status and was consumed abundantly within Viking communities. During festive occasions, Vikings partook in farmhouse ales, resembling the Nordic and Baltic Farmhouse ales prevalent today. While low-alcohol ale likely featured in their daily routines, feasting gatherings saw the consumption of stronger, more intoxicating ales. Notably, both beer and mead were customarily presented in drinking horns made from cattle, a practice that necessitated swift consumption or communal passing due to the inability to set down the horn while still containing liquid. For occasions where sipping and intermittent drinking were preferred, Vikings used wooden cups as a practical alternative to drinking horns (Graham-Cambell, 2013; Wolf, 2004).

Exploring gruit: traditional herbal flavourings in ale brewing

For many centuries, ale was brewed without the use of hops; instead, a specific herb or combination of herbs known as gruit, or grut, was employed for flavouring. Gruit ale was brewed in various regions, including the Low Countries, the lower Rhine Valley, Scandinavia, and Northern France. However, the exact origins of gruit remain unknown. Gruit imparted specific taste, aroma, and resistance to spoilage to ale (Unger, 2004), a role later fulfilled by hops. Gruit, however, was not the sole ingredient in ales. In fact, brewers added a variety of plants, primarily herbs, which could influence the health of the drinker. In Germany, for instance, ginger, aniseed, cumin, laurel, marjoram, mint, sage, and even acorns were used in brewing (Schulte, 1908).

Brewing dynamics in the Medieval era: household traditions and monastic innovations

In the early Middle Ages, the production of ales remained primarily within the domain of the household, where women played a central role in their brewing. However, ale production also expanded on a larger scale in monasteries, which began to emerge more prominently in the eighth and ninth centuries with the spread of Christianity. Monks soon became key figures in the art of brewing, and by the twelfth century, they were responsible for producing virtually all high-quality ale (Cherrington, 1925-30). Monastic brewers were instrumental in advancing brewing techniques and technology during this period. One notable innovation

was the invention of the double-bottomed vat, which enabled two successive infusions of mash. The second infusion yielded what was known as *cervisa sedilis*, or small beer. This technique, referred to as parti-gyle brewing, became widespread in later centuries. It involved using the same mash at least three times to produce beer, ranging from the strongest to the weakest (Strong, 2011).

Brewing was a widespread practice in the Frankish kingdom, with large monasteries often serving as centres of brewing activity. However, the monastic production of beer was not confined to the borders of the Carolingian Empire; it spread to the British Isles, various parts of Germany, and even farther north to Scandinavia. Brewing in convents was also a common practice. Dom Philiber Schmitz (1942, as cited in Toussaint-Samat, 2009, p. 165) noted that "brewing was one of the leading monastic industries. Except in the south of France, almost all monasteries had breweries, called *cambae*, even, curiously enough, in cider-making areas." For many monasteries, brewing became a significant source of income. Monks were known to produce a variety of medicinal ales, drawing upon their knowledge of herbs and secret recipes. This expertise allowed them to craft ales with purported medicinal properties, catering to both internal consumption and external markets.

The emergence of hops: transforming brewing practices in medieval Europe

Around the tenth century, the widespread adoption of cultivated hops, in contrast to the traditional gruit, began in Germany, eventually spreading to the rest of Europe. While it is commonly believed that the first hops-flavoured beers were introduced into England by the Dutch during the fifteenth century (Boulton & Quain, 2001), the export of beer from Holland and Zeeland to England had commenced much earlier (Unger, 2004). In thirteenth-century England, the regulation of ale production and sale was established by the *Assize of Bread and Ale* (L. *Assisa panis et cervisiae*), a statute usually attributed to Act 51 Hen. III, dated around 1266–1267. This law marked the first instance of good regulation in British history. Similar to regulations for bread, the quantity of ale that could be sold for a fixed price was determined based on the price of barley or oats. For instance, if a quarter of barley cost the brewer 20d, they were permitted to sell a 2-gallon quantity for 1d. A larger quantity could be sold for the same price outside of urban areas (Ross, 1956).

In Germany, the ingredients permitted for the production of beer were regulated by the *Reinheitsgebot*, referred to as the 'purity order', or the 'German Beer Purity Law' in English. The law was promulgated by Albert IV, Duke of Bavaria, in

1487, specifying three ingredients – water, malt, and hops – for brewing beer. The original text of the decree, dated 23 April 1516, states that "beer should only be brewed from water, barley, and hops." Interestingly, the decree does not explicitly mention malt, nor does it reference yeast, whose effects were not fully understood at that time (Hornsey, 2003).

The significance of hops in medieval and modern brewing

During the Middle Ages, sweet gale (L. *Myrica gale*) and hops (L. *Humulus lupulus*) were widely used throughout Europe (Behre, 1999). Sweet gale, also known as myrica gale, was often combined with other preservative herbs, while hops were predominantly used either alone or as a primary ingredient for medicinal beers, with additional botanicals added for health benefits rather than flavour. *Humulus lupulus*, commonly known as the 'wolf of the woods' in Latin, is a climbing vine belonging to the hemp family, which also includes cannabis. It has grown wild since ancient times in Europe, Asia, and America. In early antiquity, its young shoots were consumed as a vegetable, while its dried cones were used for their slightly narcotic effect to alleviate conditions such as mania, toothache, earache, and neuralgia. Nicholas Culpeper (1995, p. 135), an English botanist, herbalist, and physician, noted that hops are under the dominion of Mars and act to "open obstructions of the liver and spleen, cleanse the blood, loosen the bowels, cleanse the kidneys from gravel, and induce urination. [...] By all these testimonies, beer appears to be better than ale".

Hops contribute rich aroma and flavour to beer, in addition to possessing a wide range of biological activities, including sedative and hypnotic nerve effects. Hops contain various chemical components, including resins, flavonoids, polyphenols, fructose and lupulin, a naturally occurring substance that contributes significantly to the plant's characteristic scents and flavours (Ayers, 2000). Lupulin, found within hop cones, contains humulones and lupulones, which are used in the brewing industry to impart desirable bitter flavour and aroma to beer while also aiding in beer preservation due to their antibiotic properties. Dried hop cones contain 4-14 % polyphenols, mainly phenolic acids, prenylated chalcones, flavonoids, catechins, and proanthocyanidins. Moreover, hops provide a resin containing monoacyl phloroglucides, which are converted to hop bitter acids during the brewing process (Gerhäuser, 2005). Scientific research has revealed that hops contain significant quantities of estrogenic and soporific compounds, contributing to its sedative and sleep-inducing effects. These chemical constituents not only enhance the sensory experience of beer but also offer potential health benefits and contribute to its preservation.

Fragmentary hop cones dating back to an early period have been found in several archaeological sites, suggesting their historical use in brewing. Although findings from the Neolithic, Iron Age and Roman periods are scarce, numerous medieval sites across central and northern Europe have yielded evidence of hops utilization. Some notable sites include Develier in Switzerland (6-8th century), Serris-Les Ruelles in France (7-9th century), Mikulčice in Czech Republic (8-9th century), Wolin in Poland (early Middle Ages), Lübeck in Germany (13th century), Ribe in Denmark (8th century), and Viborg Søndersø in Denmark (11th century) (Behre,1999; Sloth et al., 2012). Significantly, the diversity of these sites indicates that the use of hops in brewing was not solely confined to monasteries, as previously believed (Behre, 1999). However, it was within monastic institutions that the earliest documented evidence of hops utilization in brewing was recorded. Monasteries were also at the forefront of pioneering taxation methods, particularly regarding beer, with several of their practices subsequently adopted as fiscal measures by emerging towns (Hornsey, 2003).

Records indicate that hops were cultivated as a crop as early as 736 CE in the garden of a Wendish prisoner at Greisenfeld, located in the Hallertau region of Bavaria, Germany (Hornsey, 2003, p. 304). It is believed that the Benedictine monks from Hochstift Monastery in Freising were among the first to cultivate hops. Records from the years 859-875 CE mention hop gardens (*humularia*) alongside orchards and fields (Behre, 1999; Hornsey, 2003). The earliest written evidence of hops being used for brewing dates back to the twelfth century. Abbess Hildegard from Bingen, Germany, in her work *Physica sacra* (c. 1158 CE), describes hops as a plant excellent for physical health from a humoral perspective and for the preservation of all sorts of drinks (Garret, 2011, p. 438):

> "It is warm and dry, and has a moderate moisture, and is not very useful in benefiting man, Hops (*hoppho*) is a hot and dry herb, with a bit of moisture. It is not much use for a human being, since it causes his melancholy to increase, gives him a sad mind, and makes his intestines heavy. Nevertheless, its bitterness inhibits some spoilage in beverages to which it is added, making them last longer" (Throop, 1998).

Brewing traditions and transitions: the ale vs. Hopped beer controversies

The introduction of hopped beer into England faced resistance from ale brewers, who perceived it as a threat to their traditional brewing practices. In an effort to protect foreign brewers from harassment by their English counterparts, King

Henry VI issued an ordinance in June of 1436. The ordinance characterized the actions taken by English brewers against their foreign counterparts as "malevolent" and directed the Sheriffs of London to ensure the safety of foreign brewers, allowing them to continue producing hopped beer (Sharpe, 1911). Nearly a century later, in 1531, hops were mentioned among various misuses in the household of King Henry VIII, indicating their growing popularity. The Royal brewer was instructed "not to put any hops or brimstone into the ale" (Way, 1843), suggesting a desire among ale brewers to incorporate hops into their brewing practices despite previous resistance.

Andrew Boorde made distinctions between ale and beer, asserting that "ale is made of malte and water" and, in his opinion, it is "a naturall drynke" for an Englishman, while beer was deemed more suitable for a Dutchman. Historical pharmacopoeias noted the sleep-inducing and anaphrodisiac properties of hops. The *National Standard Dispensatory* mentioned hops' potential benefits in treating "priapism and seminal emissions" (Ludovivi, 1915, p. 217). Thomas Cogan (1589), a sixteenth-century medical writer, emphasized the prevalence of ale in Britain, especially in the northern regions where beer-making was less common outside cities, towns, and the houses of the affluent. Accounts from the late sixteenth century, such as Paul Hentzer's, suggest a transition from ale to beer in England, though he remarked on its potency. In 1598, he wrote: "The general drink is beer, which is prepared from barley and is excellently well tasted but strong and what soon fuddles" (Hentzer, 1757, p. 87).

Sir Thomas Elyot (1541, pp. 34r-34v), an English humanist and author of *The Castel of Helth*, a popular treatise on medicine in English, categorizes ale and beer together, referring to them as "necessary and convenient drinks" when brewed using good quality grain and clear water:

> If the corne be good, the water holsome and cleane, and the ale or biere welle and perfytelye brewed and clensed, and by the space of syx dayes or more, settled and defecate, it must nedes be a necessary & conuenient drynk, as well in syknes as in helth: consyderinge that barleye corne, wherof it is made, is commended, and vsed in medicine, in all partes of the world, & accompted to be of a singular efficacy, in reducynge the body into good temper, specially which is in a distemperature of heate.

Elyot adds that hops in beer make it "colder in operation", which is a positive aspect since alcohol is humorally hot and dry.

The conflict between those who opted for using gruit in ale and those who favoured hops lasted, in its most furious forms, for about two centuries. Gruit

was used to flavour ale and give it a specific taste of bitterness and smell, as well as some preservative qualities since, without it, ale had a very limited lifetime. The power to control the sale of gruit was, in effect, a right to levy a tax on ale production. Initially, the right of ale taxation resided with monasteries, the Church, and local rulers. It soon became an important element in the revenue for bishops, city councils, and also lay rulers. In the Low Countries, brewers were obliged to use gruit in the brewing process, and its distribution was organised as a monopoly. It provided a tax base on brewing and was an early form of taxation. For instance, the supply of gruit to brewers was a right held by the counts of Holland and Flanders in the Low Countries, in Westphalia, the Rhineland, as well as by the bishops of Liege and Utrecht in the lower Rhine region (Unger, 2004). The gruit monopoly brought considerable wealth and prestige to its owners, and simultaneously, the existing regulations and monopolies slowed the spread of hopped brewing (Papin, 2004). Around 1500, hopped beers evidently came to dominate the beer markets in North-Western Europe. In Germany, the aforementioned Reinheitsgebot specified that hops are one of the necessary ingredients for beer (Van Tongeren, 2011). The result was the end of a many thousand-year tradition of herbal beer making in Europe. Gruit disappeared from European commercial brewing by 1750.

Hops revolutionized brewing as well as the beer trade. They gave beer greater durability and protection against various bacteria. Thomas Tusser (1878, p. 121) supported the value of hops as a preservative by stating:

> "The hop for his profit I thus doo exalt,
> it strengtheneth drinke, and it fauoreth malt.
> And being well brewed, long kept it will last,
> and drawing abide, if ye drawe not too fast".

Hops were found to be effective at preventing beer from souring and thus greatly extended its keeping power. This, in turn, enabled beer to be transported over significant distances, and brewers could, therefore, operate on a much larger scale. According to Unger (2004, p. 55), "Not all export beer was necessarily made with hops, but hopped beer was more likely to survive transportation over any distance". The use of hops not only preserved the beer but also made it more viable for export markets.

Exploring herbal additions in brewing: from gruit to botanical brews

The gruit content still remains a mystery. According to Unger, it may have been a combination of dried herbs, including sweet gale (L. *Myrica gale*), yarrow

(L. *Achillea millefolium*), and wild rosemary (L. *Ledum palustre*), also known as marsh rosemary or Marsh Labrador tea (Unger, 2004, p. 31). These three herbs all had the reputation of being highly inebriating, sexually stimulating, and mildly psychotropic. Brewing historian Odd Nordland (1969, as cited in Hornsey, 2003) adds to this speculation, noting that "[Sweet gale] was said locally that when one drank much of it, it was strongly intoxicating, with unpleasant after effects.".

Writing about wild rosemary, Maude Grieve (2021) remarks that

> "The leaves are reputed to be more powerful than those of *L. latifolium* [Labrador tea], and to have in addition some narcotic properties, being used in Germany to make beer more intoxicating. The leaves contain a volatile oil, including *ledum camphor*, a stearopten, with valeric and volatile acids, ericolin, and ericinol".

In 1653, Nicolas Culpeper (1995, p. 280) commented on yarrow in his *Complete Herbal*:

> "It is under the influence of Venus, inwardly taken it helps the retentive faculty of the stomach: it helps the gonorrhea in men, and the whites in women, and helps such as cannot hold their water".

Numerous rural and monastic brewers enriched the flavour and medicinal attributes of ale by incorporating a variety of plants during production. The adjunct herbs (and spices) used included ginger (L. *Zingiber officinale*), aniseed (L. *Pimpinella anisum*), sage (L. *Salvia officinalis*), laurel (L. *Laurus nobilis*), marjoram (L. *Origanum majorana*), mint (L. *Mentha*) and even acorns (Hallema & Emmens, 1968). Anglo-Saxon medical works also reference a wide range of botanicals, such as ground ivy (L. *Glechoma hederacea*), bog myrtle (L. *Myrica gale*), carline thistle (L. *Carlina vulgaris*), yarrow (L. *Achillea millefolium*), rosemary (L. *Salvia rosmarinus*), heather (L. *Calluna vulgaris*), alecost (L. *Tanacetum balsamita*), wormwood (L. *Artemisia absinthium*) and leaves of the ash tree (L. *Fraxinus excelsior*), among others (Hagen, 1995; Garret, 2011). In northern and north-eastern Europe common juniper (L. *Juniperus communis*) was also commonly used in brewing.

Ground ivy, a herb whose leaves were frequently added to medieval ales for flavouring, also served the purpose of clarifying and preserving ale. Additionally, alecost, or costmary, emerged as one of the most favoured herbs among medieval brewers. Its leaves were typically added to the wort towards the end of the brewing process to enhance flavour, clarity, and preservation, as well as to improve the ale's body and head. Beyond its brewing applications, alecost was valued as a medicinal herb by medieval people, who used it to alleviate intermittent fever and chest

pains. These medicinal properties likely influenced the perceived health benefits of alecost-infused ale (Stevenson, 2011).

Wormwood has maintained pharmaceutical and botanical importance throughout history, traditionally utilized to manage various disorders of the digestive system, including liver disorders, gastritis, jaundice, splenomegaly, dyspepsia, indigestion, flatulence, and gastric pain, as well as for wound healing, anaemia, and anorexia (Batiha & Olatunde, 2020). Its diverse array of medicinal properties includes antioxidant, antifungal, antimicrobial, anthelmintic, anti-ulcer, anticarcinogenic, hepatoprotective, neuroprotective, antidepressant, analgesic, immunomodulatory, and cytotoxic activities. In addition to its pharmaceutical uses, wormwood has a long-standing tradition in brewing. Nicholas Culpeper (1995, p. 276), a notable herbalist, lists the herb's medicinal properties, attributing its favourable humoral characteristic to its association with Mars, suggesting positive effects on human health:

> "It is hot and dry in the first degree, viz. just as hot as your blood, and no hotter.… It cleanses the body of choler… It provokes urine, helps surfeits, or swellings in the belly: it causes appetite to meat…".

In Anglo-Saxon times, feverish patients were advised to "drink during a period of thirty days an infusion of clear ale and wormwood, githrife, betony, bishop-wort, marrubium, fen mint, rosemary and other herbs." (Bickerdyke, 1889, p. 409). Wormwood's medicinal use persisted through the centuries and found its way into traditional English drinks like purl, a centuries-old typical English beverage mentioned in works by Shakespeare and Pepys. Purl was essentially a strong pale ale infused with certain bitter aromatics, commonly including orange peel and wormwood (Hornsey, 2003). Even in Dickens's times, purl remained popular, sometimes known as 'Dog's Nose', a variation obtained by mixing beer with gin and served warm with various flavourings.

Sage ale was widely consumed throughout the Middle Ages and was esteemed for its medicinal properties. As noted by Culpeper (1995, p. 228): "A decoction of the leaves and branches of Sage made and drank, saith Dioscorides, provokes urine, brings down women's courses…stays the bleeding of wounds, and cleanses foul ulcers". Sage was revered for its diverse medicinal attributes, which likely contributed to the popularity of sage ale during this period. According to English botanist and herbalist John Gerard (1597, Ch. 266),

> "Sage is singular good for the head and brain; it quickeneth the senses and memory, strengtheneth the sinews, restoreth health to those that have the palsy upon a moist cause, takes away shaking or trembling of the members;

> and being put up into the nostrils, it draweth thin phlegm out of the head. [….] No man needs to doubt of the wholesomeness of Sage Ale, being brewed as it should be, with Sage, Scabious, Betony, Spikenard, Squinancy, and Fennel seeds".

Juniper berries have served as versatile ingredients, finding applications in medicine, cuisine, and brewing traditions across various cultures. In folk medicine in Poland, Germany, Denmark, and other Scandinavian countries, juniper has been prized for its therapeutic properties being used to address gastrointestinal problems, respiratory disorders, urinary ailments, and menstrual irregularities (Paluch, 1984; Brøndegaard, 1987; Moerman, 1998). Moreover, juniper's aromatic and flavour-enhancing qualities have made it a popular addition to European beer brewing practices. Juniper was commonly used in the brewing of Sahti in Finland (Behre, 1999; Nordland, 1979; Salomonsson, 1979). In the Nordic countries, juniper branches and twigs were even utilized as natural filters during the mashing process, owing to their antiseptic properties (Garret, 2011). These diverse applications underscore the cultural significance and versatility of juniper throughout history.

Henbane, mandrake, and darnel ales and beers were once popular, prized for their hallucinatory and inebriating effects. Henbane (L. *Hyoscyamus niger*) was known by various names in middle Europe, such as, *bilsa*, *pilsen*, and *pilsenkrut*. Despite its primarily narcotic, anodyne, and antispasmodic properties, henbane was also used in traditional medicine for treating pain, asthma, bronchitis, and muscle spasms. However, caution was necessary, as evidenced by a magico-medical text from the late tenth or early eleventh century CE, which provided a recipe for a soporific containing radish, hemlock, wormwood, and henbane infused in ale, cautioning against improper quantities that could result in a fatal concoction rather than a sleep-inducing remedy (Cockayne, 1866). Henbane might have also been an ingredient in gruit. According to Rätsch (1994. p. 285),

> "In low doses, beer brewed with henbane has an inebriating effect, in moderate doses, it is an aphrodisiac. (Henbane is the only beverage that makes you more thirsty the more you drink! This is due to the dehydrating effects of the tropane alkaloids.) In high doses, it leads to delirious, 'demented' states, confusion, disturbances of memory, and mad behaviors having no apparent cause".

The recipe for henbane ale includes 40 g dried chopped henbane herbage, 5 g bayberry, 23 l water, 1 l brewing malt, 900 g honey, 5 g dried yeast, and brown sugar (Rätsch, 2005).

Mandrake boasts a long history of medicinal use, renowned for its hallucinogenic and narcotic properties. Documented in ancient Egypt and mentioned in the Ebers papyrus, mandrake was believed to enhance fertility and serve as an aphrodisiac. However, mandrake's medicinal use extended beyond fertility rituals, finding application as an anaesthetic during surgery due to its sleep-inducing qualities (Sutcliffe, 2008). Moreover, mandrake was employed in the treatment of melancholy, convulsions, and mania, reflecting its diverse therapeutic potential. However, caution was warranted, as large doses could induce madness (Grieve, 2021). Notably, ancient Egyptians incorporated ginger and mandrake root to flavour their beers, reflecting the cultural significance of these ingredients in brewing practices (Andrews, 2021).

Darnel (L. *Lolium temulentum*) possesses a rich and varied history, characterized by its entheogenic, medicinal, and symbolic significance across cultures. Recognized as a rare example of a poisonous grass, darnel's toxic properties have been documented since ancient times. This almost-forgotten species combines the characteristics of a weed, a pasture grass, a cereal, a medicinal herb, a hallucinogen, as well as a religious symbol (Thomas, 2019). Excavations of Egyptian remains from the Predynastic period (over 3,400 BCE) reveal traces of darnel, known as the *tekh*-plant, suggesting its consumption alongside beer, possibly in ritual contexts. Darnel, long believed to be the sole poisonous grass, is now understood as a host for the ergot fungus, which contributes to its inebriating qualities. Ancient cultures used it for both medicinal and brewing purposes, with its presence in the hormetic treatment for a range of conditions. Probably the most renowned example of traditional medication containing darnel is mithridate, a preparation credited with cure-all properties, especially cancelling or expelling poison (Goyon, 1992). Named after King Mithridates of Pontus (first century BCE), mithridate was reputed to possess cure-all properties, including the ability to counteract poisoning through a process known as mithridatism, wherein the individual gradually increased their immunity to toxins through self-administration of progressively stronger doses. Pliny (1938, pp. 24-25), in his *Natural History*, showed scepticism towards theriacs such as mithridatum:

> "The Mithridatic antidote is composed of fifty-four ingredients, no two of them having the same weight, while of some is prescribed one sixtieth part of one denarius. Which of the gods, in the name of Truth, fixed these absurd proportions? No human brain could have been sharp enough. It is plainly a showy parade of the art, and a colossal boast of science".

Darnel, historically mixed with beer to enhance its intoxicating properties, has left a mark on brewing practices since ancient times. Ethnographic studies reveal

that Slovenian ethnic groups residing in western Hungary reportedly combined darnel seeds with barley to heighten the narcotic effects of beer (Eliáš et al., 2010). Observations from the nineteenth century shed light on the cultivation of darnel for brewing purposes, with reports of its cultivation in Battersea fields for this purpose (Johnson, 1827). However, the use of darnel in beer came with potential risks, as it was believed to cause headaches and harm to sinews among consumers (Lieber, 1970).

Ginger stands as one of the oldest recorded spices, with a history spanning over 5,000 years. Originating in Southeast Asia, it was revered as a tonic root and panacea remedy by ancient Indian and Chinese civilizations before being brought to the attention of the Western world by Arab traders in the first century CE. Mediterranean writers such as Dioscorides and Pliny the Elder documented ginger's properties after its introduction. During the Middle Ages, ginger became a coveted commodity in Europe. In fourteenth-century England, the cost of a pound of ginger was as much as that of a sheep (Prance & Nesbitt, 2005).

Ginger's rich history extends into traditional and alternative medicine, being referenced in Anglo-Saxon *Leechdoms* and frequently recommended in recipes from the thirteenth and fourteenth centuries (Cockayne, 1866; Bonser, 1963). Like other spices, ginger was believed to possess beneficial humoral qualities, being hot in the third degree and either dry in the second degree (dry ginger) or moist in the first degree (green ginger). According to Culpeper, ginger "helps digestion, warms the stomach, clears the sight, and is profitable for old men: heats the joints and therefore is profitable against the gout, expels wind." (Culpeper, 1995).

The origins and craft of ginger beer in 18th century England

Ginger beer was already known in England in the 1700s during the colonial spice trade. Thomas Sprat's writings mention the practice "of brewing beer with Ginger instead of Hops" (Sprat, 1702), shedding light on the early existence of ginger beer in English culture. Typically crafted by mixing ginger, sugar, water, and optionally lemon and/or cream of tartar, ginger beer was left to sit and ferment, resulting in a mildly alcoholic and effervescent beverage. The ginger beer quickly gained popularity among diverse segments of English society, offering a refreshing alternative to traditional ale and beer. Its appeal lay not only in its distinctive flavour but also in its perceived health benefits, as ginger was believed to aid digestion and provide a warming sensation during colder months.

The following original recipe for ginger beer comes from *The Cook and Housekeeper's Dictionary* by Mary Eaton (1823, p. 148):

> "GINGER BEER. To every gallon of spring water add one ounce of sliced white ginger, one pound of lump sugar, and two ounces of lemon juice. Boil the mixture nearly an hour, and take off the scum; then run it through a hair sieve into a tub, and when cool, add yeast in the proportion of half a pint to nine gallons. Keep it in a temperate situation two days, during which it may be stirred six or eight times. Then put it into a cask, which must be kept full, and the yeast taken off at the bunghole with a spoon. In a fortnight, add half a pint of fining to nine gallons of the liquor, which will clear it by ascent, if it has been properly fermented. The cask must still be kept full, and the rising particles taken off at the bunghole. When fine, which may be expected in twenty-four hours, bottle and cork it well; and in summer it will be ripe and fit to drink in a fortnight".

Ales and beers in nourishment and medicine

In older times, ales and beers served as foundational components of nutritive drinks prepared for the ill and convalescents, reflecting the historical belief in their healthful properties. These beverages were often enriched with ingredients believed to be humorally wholesome, adding to their nutritional value and perceived medicinal benefits. As can be seen in the recipes below, one of the ingredients that positively affected human health was butter. According to humoral theory, butter possessed the most favourable qualities, being hot and moist in the second degree.

In an anonymous sixteenth-century cookbook, *The Good Huswifes Handmaide for the Kitchin*, a recipe entitled "To make Buttered Beere" exemplifies this tradition of crafting nourishing drinks using ale and beer as a base:

> "Take three pintes of Beere, put fiue yolkes of Egges to it, straine them together, and set it in a pewter pot to the fyre, and put to it halfe a pound of Sugar, one penniworth of Nutmegs beaten, one penniworth of Cloues beaten, and a halfepenniworth of Ginger beaten, and when it is all in, take another pewter pot and brewe them together, and set it to the fire againe, and when it is readie to boyle, take it from the fire, and put a dish of sweet butter into it, and brewe them together out of one pot into an other (Anon, 1594, p. 53a)".

A similar recipe is found in Robert May's *The Accomplisht Cook* (1685, p. 378), published almost a hundred years later:

> "Buttered Beer.
>
> Take beer or ale and boil it, then scum it, and put to it some liquorish and anniseeds, boil them well together; then have in a clean flaggon or quart pot some yolks of eggs well beaten with some of the foresaid beer, and some good butter; strain your butter'd beer, put it in the flaggon, and brew it with the butter and eggs".

R. V. French confirms that buttered ale was indeed frequently consumed, indicating that recipes such as those presented above were commonly used. According to French (1884, p. 224):

> "At this time [seventeenth century] people frequently ate no supper but took "buttered ale" composed of sugar, cinnamon, butter and beer brewed without hops. It was put into a cup, set before the fire to heat, and drunk hot".

Finally, Kenelm Digby (1910, p. 147), in his collection of recipes, particularly for beverages, included instructions on how to prepare "cock ale".

> To make Cock-Ale
>
> Take eight gallons of Ale, take a Cock and boil him well; then take four pounds of Raisins of the Sun well stoned, two or three Nutmegs, three or four flakes of Mace, half a pound of Dates; beat these all in a Mortar, and put to them two quarts of the best Sack: and when the Ale hath done working, put these in, and stop it close six or seven days, and then bottle it, and a month after you may drink it (Digby, 1910, p. 147).

Culinary role of ale: exploring its use in historical cookery

Ale was used not only as an ingredient in beverages, like those presented above but also added to a variety of dishes. An analysis of cookery books from the fifteenth and sixteenth centuries presents some interesting results. In *Liber cure cocorum*, ale is an ingredient in 17 recipes, constituting 12% of all recipes in the book. A similar value can be found in the recipes gathered in *Two Fifteenth-Century Cookery Books* from 1450, in which ale was added to 57 recipes (11%). A sixteenth-century *A Proper Newe Booke of Cokerye* (1550) contains only 4 (12%) out of 50 recipes in which ale is one of the ingredients.

Exploring medical literature in the sixteenth and seventeenth centuries

The sixteenth and seventeenth centuries witnessed a surge in the publication of various works, including medical treatises and health manuals, all grounded in ancient authorities. In addition to medical books written in Latin and vernacular languages for professionals, there was a plethora of popular literature available to the general public. These included recipe books, guides on maintaining health and caring for the sick, phlebotomies, herbals, and manuals on conducting urinary analysis and diagnosing illnesses based on colour and sediments. Almanacs were also prevalent, offering advice on bloodletting, identifying auspicious or inauspicious days for medical treatment, and predicting prevalent illnesses during specific seasons of the year. Many of these almanacs, recurring annually, were authored by surgeons and physicians and were grounded in astral medicine, making them particularly useful for medical practitioners.

Scholarly pursuits in beer and brewing during the early modern period

In the early modern period, beer and brewing became popular subject of study, with publications dating back to the early sixteenth century. Like Renaissance writers, scholars of this era often referenced ancient authors such as Galen, Aristotle, Dioscorides, and Pliny the Elder in their works. These references can be categorized into three main groups: medical treatizes and health manuals, economic guides, and specialist brewing literature. One of the earliest books in this genre was published in 1530 under the title, *An Excellent Little Book of the Making of Wine and Beer so that they may be Useful and Wholesome to Man*, printed at Erfurt by Melchior Sachssen at Noah's Ark. In 1549, a German scholar, physician and pedagogue Johann Brettschneider, also known as Johann Placotomus, authored *Über Natur und Kräfte der Biere*, which was later published in Latin as *De natura et viribus cerevisiarum et mulsarum opusculum* in 1551 in Wittenberg. Placotomus's work provided insights into the historical background, nature, and effects of beer on the human body.

The first comprehensive study of beer and beer methods appeared in 1575 in Erfurt. More significant than these two works is *Fünff Bücher Von der Göttlichen und Edlen Gabe der Philosophischen, hochthewren und wunderbaren Kunst, Bier zu brawen* by Heinrich Knaust, a German pedagogue and Roman Catholic theologian. Knaust's treatise includes extensive quotations from Placotomus and Abraham Werner, whose work was published in Wittenberg in 1567. The value of Knaust's

book lies not only in historical deductions but also in its review, based on the author's personal knowledge of the facts regarding beer during his time.

Characteristic of the Renaissance, the title of the book provides a comprehensive summary of its contents, covering various aspects of beer brewing. Titled *Five Books of the Divine and Noble Gift of the Philosophical, Precious and Admirable Art of Beer Brewing. Also of the names of the most Admirable Beers in all Germany, and of their Natures, Temperaments, Qualities, Individual Characters, Wholesomeness, and Unwholesomeness, whether wheat or barley, white or red beer, spiced or not spiced. Newly revised and much Fuller and More Perfect than the former edition. By Master Heinrich Knaust, Doctor of Law and of Medicine*, the book was published in Erfurt by George Baumann in 1575.

In 1584, English physician Thomas Cogan published *The Haven of Health*, a manual "made to comfort of Students". Similar to ancient beliefs, Cogan viewed beer and ale as common beverages associated with drunkards and beggars. He argues that

> "for it is worse to bee drunke of Ale than of Wine, and the drunkennesse endureth longer; by reason that the fumes and vapours of Ale that ascend to the head, are more grosse, and therefore cannot be so soone resolved as those that rise by Wine" (Cogan, 1589, p. 250-51).

However, Cogan acknowledged that ale and beer, if not too strong, are nourishing for the body due to the corn from which they are made, and they possess health benefits from the hops content. Beer "provoketh urine, and expelleth some choller by siege" (Cogan, 1589, p. 251). Moreover, it does not harm tendons or cause joint pain as wine does. Cogan explained the medicinal properties of ale and beer from the perspective of humoral theory, emphasizing their content. For instance, ale and beer have cooling properties when they are made of barley malt, while wheat malt "enclineth more to heat" as wheat is humorally hot (Cogan, 1589). Cogan's critique of beer was part of a broader discourse among scholars of English medicine. Some, like Cogan, preferred old English ale, while others argued that beer was the more healthful and economical beverage.

Tadeáš Hájek, a Czech naturalist and personal physician of the Holy Roman Emperor Rudolph II, published *De cervisia elusque conficiendi ratione, natura, viribus et facultatibus* in 1585, which stands as one of the most comprehensive interpretations of the art of brewing of that period. Another significant figure, Jacobus Theodorus (Jacob Diether), also known as Tabernaemontanus, was a German physician, early botanist, and herbalist. His illustrated work *Neuw Kreuterbuch* (1588) resulted from a lifetime of botanizing and medical practice. Tab-

ernaemontanus's book contains a wealth of information on beer, likely influenced by the works of Placotomus, Werner, and possibly by Knaust.

In the1600s, additional works on beer and its production were published. Among the authors should be mentioned Johann Coller who wrote *Oeconomia oder Hausbuch* (1608), Salome Sartorio, *Koge Bog: Indeholdendis et hundrede fornødene stycker, Som ere, om Brygning, Bagning, Kogen, Brændevijn oc Miød at bere-de, saare nytteligt vdi Husz holdning. Som tilforn icke paa vort Danske Sprock vdi Tryck er vdgaaen* (1616), Martinus Schoockius or Schoock, *Liber de cerevisia, quo omnia ad illam pertinentia plenissime discutiuntur* (1661), Joannes Meibon, *De cerevisiis potibusque et ebriaminibus extra vinum aliis* (1688), and Johann Jacob Agricola, *Schauplatz der Allgemeinen Haus-Halten* (1677).

Conclusion

Ale and beer brewing have been integral parts of human civilization since ancient times. Babylonians possessed approximately 20 beer recipes, while Egyptian Pharaohs were entombed with vast quantities of this cherished beverage. Even the labourers who constructed the pyramids received their payment in ale. By the close of the Middle Ages, beer had emerged as a ubiquitous European drink, enjoyed daily across all social classes. The brewing process played a pivotal role in eliminating disease-causing bacteria from ale and beer. Additionally, the fermentation of grains imbued these beverages with the transformative power revered as sacred by many cultures. What is more, not only the process of fermentation but also brewing contributes to the healthful properties of beer. The addition of sacred and medicinal plants enhances the nutritional and medicinal properties of beer. In conclusion, we can say that drinking ales and beers not only quenches thirst but can also improve mood and restore health.

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SAŽETAK

Pravljenje i pijenje ale piva i običnog piva dio je ljudskog iskustva očito od postanka civilizacije. Pivo je jedno od najkonzumiranijih alkoholnih pića diljem svijeta. Bogato je hranjivim tvarima poput ugljikohidrata, aminokiselina, minerala, vitamina i drugih spojeva. Povijesno gledano, ale i pivo služili su kao izvori iznimno hranjive hrane, a korišteni su i zbog svojih ljekovitih svojstava. Vjerovalo se da se fermentacijom jednostavni sastojci poput žitarica i vode pretvaraju u sveti proizvod, a uvođenje ljekovitih biljaka pojačava njegova svojstva. Najraniji zapisi pokazuju da je u Sumeru pivo služilo u medicinske svrhe još 2000. godine prije Krista. U ranome srednjem vijeku ale pivo postalo je omiljeno među Keltima, Nijemcima i Skandinavcima, koji su bili njegovi veliki ljubitelji. Ale se pravio bez hmelja, umjesto toga za aromu se uzimala biljka ili kombinacija biljaka nazvana gruit. Smatralo se da ale i pivo imaju i magičnu i ljekovitu moć te su se često propisivali u medicinske svrhe. Uvođenje hmelja unaprijedilo je pivarstvo i trgovinu pivom. Hmelj je poboljšao kvalitetu piva, produžio mu trajnost i zaštitio ga od bakterija. Cilj je rada prikazati povijest ale piva i običnog piva koji se koriste zbog svojih ljekovitih svojstava.

Ključne riječi: *ale, pivo, gruit, hmelj, začinsko bilje, recepti*