No. 121/22, 53–66
ISSN 2657-6988 (online)
ISSN 2657-5841 (printed)
DOI: 10.26408/121.05

Submitted: 31.01.2022
Accepted: 18.02.2022
Published: 31.03.2022

ECONOMIC AND QUALITY DETERMINANTS OF YERBA MATE, TEA AND COFFEE CONSUMPTION

Natalia Kłopotek[1*], Przemysław Dmowski[2]

[1] Gdynia Maritime University, Morska 81-87, 81-225 Gdynia, Poland, Faculty of Management and Quality Science, e-mail: n.klopotek@au.umg.edu.pl, ORCID 0000-0003-2546-4090
[2] Gdynia Maritime University, Morska 81-87, 81-225 Gdynia, Poland, Faculty of Management and Quality Science, e-mail: p.dmowski@wznj.umg.edu.pl, ORCID 0000-0002-7774-3692
* Corresponding author

Abstract: Yerba Mate, coffee and tea consumption varies depending on the country, region and cultural background. The highest quantity of tea is consumed in Turkey, coffee in Finland and Yerba Mate in Argentina. The purpose of this paper is to present the economic and qualitative factors that determine the consumption of Yerba Mate, coffee and tea. The determinants and factors influencing the volume of production and consumption were analysed. A comparison of selected qualitative parameters, such as polyphenols, antioxidising effects and caffeine, was drawn. The discussed parameters determine, to a great extent, the demand for these products. The analysis made it possible to conclude that the analysed products can function as substitutes for each other, both in terms of economics and sensory and health-promoting properties.

Keywords: coffee, consumption, market, production, tea, Yerba Mate.

1. INTRODUCTION

Yerba Mate, tea and coffee are products that are consumed on a daily basis. Consumption depends on the country, region and cultural background. The highest quantity of tea is consumed in Turkey, coffee in Finland and Yerba Mate in Argentina. Under the FAO classification (Food and Agriculture Organization of the United Nations), these products fall within a group of stimulant crops [FAO 2021]. The commercial availability and health-related benefits resulting from the consumption of these products affect the continuous increase in their consumption in Poland. Their retail sale can be observed in both online and brick-and-mortar shops. For both global and domestic connoisseurs, there are also places that provide only selected and high-quality products and accessories indispensable to preparing and consuming these products. The economic aspects, sensory and bioactive characteristics of Yerba Mate, coffee and tea have proven that these products can function as substitutes for each other.

Yerba Mate (*Ilex paraguariensis A. St.-Hil.*) is an infused drink made of leaves and stems of an evergreen tree – Paraguay tea from the family *Aquifoliaceae* – which can endemically be found only between the Atlantic Ocean and the Paraguay river in Argentina, southern Brazil and Paraguay. The production of Yerba Mate takes place in several stages, depending on the area of origin, each of which significantly affects the final quality of the product [Burris et al. 2012]. Considering the country of origin, we can differentiate four main types of Yerba Mate: Argentinian, Brazilian, Paraguayan and Uruguayan.

Another criterion for the division, significant from the economic perspective, involves the stem content. By analysing the commercial offer, we can distinguish Yerba Mate con palo (elaborada) – containing ca. 30% stems, and sin palo (despalada) – with no stems or up to 10% stems. The first type, Yerba Mate (elaborada), due to the content of stems, which fail to constitute a full-value product, is relatively less expensive than Mate (despalada). Another differentiating criterion that significantly affects the commercial value of Yerba Mate is the content of flavourings, which is important from the perspective of the consumers' evaluation of the quality. The market offer includes Yerba Mate containing 100% Paraguay tea, and Yerba Mate with added aromas, fruits or herbs.

The forerunners of the consumption of infused Paraguay tea were the indigenous inhabitants of South America – the Guarani. Today, the consumption of Yerba Mate plays its social and almost ritual role in South American society [Bracesco et al. 2011; Samoggia, Landuzzi and Vicién 2021]. The product originates in South America and is still most popular in this region. However, modern consumers are more frequently looking for products characterised by sophisticated organoleptic features and specific health-promoting properties, which has lead to regularly increasing sales of Yerba Mate around the world, including in Poland. Furthermore, an undisputed advantage emphasising the attractiveness of Yerba Mate consumption involves the method of preparing and drinking this infusion. The infused tea is often consumed in specially designed vessels, such as a gourd (*porongo* and *calabaza*) or matero made of *palo santo*. The selection of the vessel depends on the region and preferences. The indispensable accessories also include a *bombilla* – a metal straw with perforated surface that protects against undesired consumption of leaves [Burris et al. 2012].

The Yerba Mate market prices are very diversified and depend on many factors. The most expensive include the properly selected Green Yerba Mate by The Real Tea Company (68.32 USD per 500g of Yerba) [www.tea-direct.co.uk], Yacuy Relax Detox (23 USD per 500g of Yerba), Yacuy Medium Cut (19 USD per 500g of Yerba) [circleofdrink.com], originating mainly from small, very often ecological plantations manufacturing so-called craft products of exceptional sensory and qualitative features.

Another product that is equally popular or perhaps even more popular in terms of the volume of consumption is tea, defined in the Compendium of Guidelines for

TEA (*Camellia sinensis*) as "only the delicate buds and leaves from different varieties of *Camellia sinensis (Linneaus) O. Kuntze*, processed under the established methods of production and appropriate for the preparation of an infusion suitable for consumption". It is produced in a variety of countries, mainly Asian ones (China, India, Sri Lanka, Indonesia). Africa also produces very good quality tea, where the main countries of origin include Kenya, Malawi, Uganda, and Tanzania [Bhagat et al. 2016]. The tea market value depends mainly on the order of leaf collection, time of harvest, country of origin, and in particular the botanic garden, which is reflected in the commercial grading system applicable in its international trade.

By analysing the grading system, we can differentiate e.g., *Special Finest Tippy Golden Flowery Orange* – tea composed of undeveloped buds plucked from the upper part of the plant and the first youngest leaves. This is one of the best types of tea in the commodity trade and is known as so-called flowery tea. The average price of this tea on the market totals ca. 100 EUR per 1 kg. It is followed in the grading system by *Orange Pekoe*, tea obtained from the first and second leaf (from the top), *Pekoe* from the second and third leaf and *Pekoe Souchong* from the third to sixth, followed by *Souchong*. Taking into account the leaf size, the trade also differentiates leaf tea, broken tea, fine (particles up to 1mm), the so-called fannings and tea dust – Dust [Nierzwicki 2010]. The tea grading criterion also includes the plant botanical species, which determines the Chinese tea, *Camellia sinensis var. Sinensis*, and *Camellia sinensis var. assamica* originating in India [PN-ISO 6078:1996; UNCTAD 2016].

Tea can also be divided by the level of leaf fermentation. Thereby, we can differentiate fermented tea – black, half-fermented tea – oolong, and non-fermented tea – green and white tea [Nierzwicki 2010; UNCTAD 2016]. This criterion determines that white and green tea is better in quality and relatively more expensive than the black tea. The most expensive tea on the global market includes Da Hong Pao Tea (1.2 million USD per 1 kilogram), Pandas Dung Tea (70,000 USD per 1 kilogram), PG Tips Diamond Tea Bag (15,000 USD per 1 kilogram), Narcissus Wuyi Oolong Tea Box (6,500 USD per 1 kilogram) and Tieguanyin tea (3,000 USD per 1 kilogram) [www.teabloom.com].

The third, and most popular among the products analysed in this article, is coffee, defined as the fruit and seeds of the coffee tree from the family *Coffea* [Nierzwicki 2010]. Although there are over 70 well-known botanical varieties of coffee, only two are used for the majority of production: *Coffea arabica L.* and *Coffea canephora var. robusta*, widely known as Arabica and Robusta. There are two methods for processing the coffee beans: dry and wet methods. Coffee processed under the wet method is the most valued in the world, but the production process is more expensive [Subedi 2011]. Before roasting, coffee is called green coffee, and can be stored for many years with no deterioration in the properties of the final product [Nierzwicki 2010].

Coffee is classified as per the country of origin: South American (originating from Brazil, Columbia and Peru), Central American (originating from Guatemala, Costa Rica and Mexico), East Indian (India, Indonesia), Arabic, African (Ethiopia, Kenya, Uganda), and other. Instant coffee is also well known; it was launched in 1938 by the Swiss company Nestle. The world's most expensive coffee includes those produced in special conditions: Black Ivory Coffee (over 500 USD per 1 pound), Hacienda La Esmeralda (over 500 USD per 1 pound), Finca El Injerto Coffee (ca. 500 USD per 1 pound), Kopi Luwak (ca. 160 USD per 1 pound) and Saint Helena Coffee (ca. 79 USD per 1 pound) [www.financesonline.com].

The purpose of this paper is to present the economic and qualitative factors that determine the consumption of Yerba Mate, coffee and tea. A comparison of selected qualitative parameters, such as polyphenols, antioxidising effects and caffeine, was drawn. The discussed parameters determine, to a great extent, the demand for these products.

2. ECONOMIC CONDITIONS OF YERBA MATE, TEA AND COFFEE PRODUCTION AND CONSUMPTION

Bearing in mind the properties of the analysed products, including their sensory and health-promoting qualities, we can observe the continuous increase in their consumption on the global market. The recent period related mainly to the consequences of the global pandemic is an exception. In 2018, the Yerba Mate global market was valued at ca. 1.3 billion USD. The largest share in revenue included crops from Latin America – ca. 82% of total revenue on the Yerba Mate global market. According to Institutio Nacional de la Yerba Mate (INYM), Argentina is the world leading producer and exporter of Yerba Mate. The specialists' analyses and estimates indicate a significant increase in the sale of Yerba Mate between 2019 and 2027. As for the revenue in the forecast period (from 2019 to 2027), the CAGR (Compound Annual Growth Rate) is estimated to increase by 3.1%. According to the Yerba Mate Market Report, it is forecast that up to 2027, the Yerba Mate global market will reach a value of ca. 1.6 billion USD [Global Yerba Mate Market to Report 2019].

Yerba Mate is a product consumed mainly as an infused drink. In 2018, as much as approx. 70% of Yerba Mate global consumption referred to Yerba consumed as an infused hot drink. However, it is becoming more widely used, e.g., in the food industry as an additive to confectionery, beverages, diet supplements, cosmetics and body care products as well as functional food products. The increasing demand and popularity of Yerba Mate consumption may be contributing to the increase in the segment of Yerba Mate-based food and beverages. The statistical data presented by INYM reveals that in 2020, nearly 813 million kilograms of green Mate leaves were processed. By comparing the volume of production from 2017 (ca. 690 million kg), 2018 (ca. 809 million kg) and 2019 (over 837 million kg), we can observe an upward

trend. A slight decrease was recorded in 2020, which was undoubtedly related to the global pandemic. However, by analysing the data from January 2021 (ca. 20 million kg) compared to January in the previous years, the analysts forecast a return to growth in consumption [Informe del Sector Yerbatero, Enero de 2021].

Tea is produced in more than 30 countries, although the global market is dominated mainly by the Asian countries. The area of crops around the world totals ca. 3.5 million hectares. In 2016, tea production totalled 5.73 million tons, with over 50% destined to become black tea [UNCTAD 2016]. The largest tea producers include China (2.35 million tons in 2016) and India (1.24 million tons in 2016), which combined constitute in total ca. 65% of global production. The amount of tea originating from African countries is also increasing (Kenya, Malawi, Uganda, Tanzania, Rwanda, Zimbabwe). Since 2013, the level of tea production in Africa has reached ca. 700,000 tons annually, which constitutes nearly 13% of global production. The leading country in African tea production is Kenya (474,000 tons in 2016) [FAO 2018].

At the same time, as a result of ongoing climate changes, we can observe a decrease in the volume of production in Sri Lanka, Indonesia and Vietnam [Bhagat et al. 2016]. The structure of tea cultivation has also been changing for a number of years. Tea from small, organic crops which are limited in total production is becoming increasingly popular; however, most of this tea is unique and by virtue of its properties, desirable to consumers. The FAO data proves that the share of small gardens in total tea production in 2013 totalled ca. 30%, indicating an upward trend [Chang and Brattlof 2015].

In the case of coffee, nearly 60% of global production refers to *Coffea arabica L.*, known as Arabica, and the other 40% refers to *Coffea canephora var. Robusta*, known as Robusta. The largest coffee producing country in 2020 was Brazil. The total crops of Arabica and Robusta from this country constituted ca. 40% of the global crops (69 million 60-kg bags)[1]. Apart from Brazil, the world leaders in C. arabica production include Columbia (14.3 million bags – ca. 8% of global production), Ethiopia (7.4 million bags – ca. 4%), Honduras (6.1 million bags – ca. 3.5%) and Peru (3.8 million bags – ca. 2%). While for C. robusta, the main crops are located, apart from Brazil, in Vietnam (29 million bags – ca. 16.5% of total global production), Indonesia 12.4 million bags – ca. 7%), Uganda (5.6 million bags – 3.2%) and India (5.7 million bags – ca. 3%). These countries account for more than 50% of the total Robusta quantity cultivation [Coffee Development Report 2020].

From an economic perspective, Robusta is regarded as the easiest and least expensive produce. The fruit is produced faster, and the yield is higher per one tree than Arabica. Arabica grows at higher altitudes and compared to Robusta, it is characterised by a lower yield and lower resistance to unfavourable weather

[1] One bag refers to one 60-kg bag of coffee – this is an international unit defining the volume of global crops and export.

conditions, pests and diseases. Therefore, despite significant differences, the prices of Arabica are approximately twice as high as the prices of Robusta.

Yerba Mate, tea and coffee are the most popular commercial products. For a number of countries, the export of these products constitutes the main pillar of economic growth, which significantly affects maintaining and increasing employment, thereby reducing poverty.

Detailed data on the export of Yerba Mate, tea and coffee is presented in Table 1.

Table 1. Volume and directions of the global export of Yerba Mate, tea and coffee in 2019

Exported product	Exporting country	Main export destination	Exported product	Exporting country	Main export destination	Exported product	Exporting country	Main export destination
Yerba Mate	Argentina	Syria	Tea	China	Hong Kong	Coffee	Brazil	USA
	44% – 83.1m USD	71.9% – 59.8m USD		23.8% – 1.77bn USD	18.7% – 330m USD		15.7% – 4.72bn USD	20.7% – 976m USD
		Chile 10.4% – 8.65m USD			Morocco 12.7% – 226m USD			Germany 16.8% – 792m USD
	Brazil 42.9% – 81m USD	Uruguay 83.6% – 67.8m USD			Vietnam 7.37% – 131m USD			Italy 10% – 474m USD
		Germany 3.17% – 2.57m USD		Kenya 15.2% – 1.13bn USD	Pakistan 37.9% – 429m USD		Vietnam 7.97% – 2.39bn USD	Germany 15% – 358m USD
	Paraguay 3.81% – 7.2m USD	Argentina 36.5% – 2.63m USD			Egypt 15% – 169m USD			USA 10.8% – 257m USD
		Spain 14.5% – 1.04m USD			Great Britain 10.7% – 121m USD			Spain 9.25% – 221m USD
		Bolivia 12.2% – 876,000 USD		Indie 11.4% – 848m USD	Iran 26.7% – 227m USD		Columbia 7.93% – 2.38bn USD	USA 44.4% – 1.05bn USD
		Poland 5.96% – 429,000 USD			Russia 12.6% – 107m USD			Germany 8.11% – 193m USD
		The Netherlands 5.95% – 428,000 USD			USA 6.1% – 51.7m USD			Japan 7.77% – 185m USD
	Germany 1.29% – 2.43m USD	Poland 39.9% – 970,000 USD		Sri Lanka 10.9% – 811m USD	Russia 15.9% – 129m USD		Germany 7.9% – 2.37bn USD	Poland 14.6% – 345m USD
		France 12.6% – 306,000 USD			China 7.62% – 61.7m USD			France 13% – 308m USD
	France 1.22% – 2.3m USD	Spain 81.6% – 1.88m USD			USA 5.98% – 48.5m USD			USA 10.8% – 256m USD
	Poland	France		Poland	France		Switzerland	France
	0.18% – 341,000 USD	40.1% – 137,000 USD		3.28% – 244m USD	15.6% – 38m USD		7.88% – 2.36bn USD	22% – 520m USD
		Brazil			Great Britain			USA
		25.6% – 87,200 USD			9.55% – 23.3m USD			15.3% – 361m USD

	USA 8.2% – 20m USD		Germany 7.74% – 183m USD
	Australia 6.44% – 15.7m USD	Poland 1.1% – 329m USD	Netherlands 18.9% – 62.2m USD Germany 17.6% – 57.8 62.2m USD Ukraine 10.8% – 35.7 62.2m USD

Source: own elaboration based on data from 2019, available at OEC (The Observatory of Economic Complexity).

By analysing the structure and volume of export, according to the Observatory of Economic Complexity (OEC) data from 2019, Yerba Mate ranked 1144th. The main exporters of Yerba Mate included Argentina, Brazil, Paraguay as well as Germany and France, which both re-exported the product. Between 2018 and 2019, Yerba Mate exports dropped by 6.87 billion USD, from 203 million USD to 189 million USD. In these statistics, Poland takes 5th place in Europe in terms of Yerba Mate re-exportation [The Observatory of Economic Complexity].

In contrast, according to the OEC data from 2019, tea ranked 393rd as regards products most frequently sold worldwide, with a total turnover of 7.44 billion USD. Between 2018 and 2019, tea exports dropped by 6.33%, from 7.94 billion USD to 7.44 billion USD. The tea trade constitutes 0.041% of total global trade. In 2019, the tea largest exporters included China, Kenya, India, Sri Lanka and the United Arab Emirates.

The re-exportation of tea from Poland constituted 3.28% of global exports, which accounted for 244 billion USD. Poland was the second European country in terms of the volume of tea re-exportation, after Germany (3.29% of global exports) [The Observatory of Economic Complexity].

Finally, according to the OEC data from 2019, in terms of products most frequently sold worldwide, coffee took the highest place among the products analysed in this article at 122nd place. The total value of turnover amounted to 30 billion USD and was lower by 2.7% than in 2018. The coffee market accounted for 0.17% of total global trade. In 2019, the largest coffee exporters included the following countries: Brazil, Vietnam, Columbia, Germany and Switzerland [The Observatory of Economic Complexity].

By analysing the data on the global import and consumption of Yerba Mate, tea and coffee it can be seen that the main importers of Yerba Mate in 2019 included Uruguay, Syria, Chile, the USA and Spain.

Detailed data on the import of Yerba Mate, tea and coffee is presented in Table 2.

Table 2. Volume and directions of the global import of Yerba Mate, tea and coffee in 2019

Imported product	Importing country	Main import destination	Imported product	Importing country	Main source of importation	Imported product	Importing country	Main source of importation
Yerba Mate	Uruguay	Brazil	Tea	Pakistan	Kenya	Coffee	USA	Columbia
	35.9% – 67.8m USD	99.9% – 67.8m USD		8.08% – 601m USD	71.3% – 429m USD		18.4% – 5.53bn USD	19.1% – 1.05bn USD
	Syria 31.7% – 59.9m USD	Argentina 99.9% – 59.9m USD			Vietnam 13% – 78.2m USD			Brazil 17.7% – 976m USD
	Chile 6.02% – 11.4m USD	Argentina 76.2% – 8.65m USD		USA 6.57% – 489m USD	China 14.9% – 73m USD			Canada 8.55% – 472m USD
		Brazil			Japan		Germany	Brazil
		20.5% – 2.33m USD			12.4% – 60.5m USD		10.5% – 3.15bn USD	25.2% – 792m USD
	USA 3.76% – 7.1m USD	Brazil 36.7% – 2.61m USD			Argentina 12.4% – 60.4m USD			Vietnam 11.4% – 358m USD
		Argentina 33.5% – 2.38m USD		Russia 5.5% – 410m USD	Sri Lanka 31.4% – 129m USD			Italy 7.57% – 238m USD
		Ecuador 19.4% – 1.38m USD			Indie 26% – 107m USD		France 6.46% – 1.93bn USD	Switzerland 26.9% – 520m USD
	Spain 3.28% – 6.19m USD	France 30.3% – 1.88m USD			China 10.7% – 43.8m USD			Germany 15.9% – 308m USD
		Argentina 22.2% – 1.38m USD		Hong Kong 5.03% – 374m USD	China 88.2% – 330m USD			the Netherlands 11.7% – 226m USD
	Poland 1.1% – 2.08m USD	Germany 46.5% – 970,000 USD			Sri Lanka 4.99% – 18.7m USD		Italy 5.7% – 1.71bn USD	Brazil 27.8% – 474m USD
		Paraguay		Great Britain	Kenya			Vietnam
		20.6% – 429,000 USD		4.36% – 324m USD	37.3% – 121m USD			12.7% – 216m USD
		Argentina 20.1% – 418,000 USD			India			France
					14.3% – 46.2m USD			9.74% – 166m USD
					Malawi 7.53% – 24.4m USD		Belgium 4.98% – 1.49bn USD	Brazil 20% – 299m USD
					Poland 7.19% – 23.3m USD			France 8.5% – 127m USD
				Poland 1.62% – 121m USD	India 14.5% – 17.5m USD			Columbia 8.15% – 122m USD
					Sri Lanka 13.6% – 16.4m USD		Poland 2.11% – 632m USD	Germany 54.6% – 345m USD
					Kenya 12.5% – 15.1m USD			Italy 11.2% – 70.6m USD
								Vietnam 6.27% – 39.6m USD

Source: own elaboration based on data from 2019, available at OEC (The Observatory of Economic Complexity).

In terms of Yerba Mate imports, Poland takes the fourth place in Europe. The main import directions to Poland include mainly: Paraguay, Argentina, Brazil and Germany, who re-export the majority of Yerba Mate imported to Poland from Brazil (57.8%) and Argentina (21.1%). The Yerba Mate market has constantly been developing.

In contrast, the main tea importers include Pakistan, the USA, Russia, Hong Kong and Great Britain. Poland ranks 6th among the European countries in terms of the volume of tea imports. Tea is imported to Poland mainly from India, Sri Lanka and Kenya. In 2019, we could observe an increase in tea import to Poland by 0.092% compared to 2018.

The main coffee importing countries in 2019, according to the OEC, included the USA, Germany, France, Italy and Belgium. The Polish import of coffee constitutes 2.11% of the global import, which accounts for 632 million USD. Poland imports coffee mainly from the Netherlands, Germany, Ukraine and the Czech Republic. Poland ranks 8th regarding the volume of coffee imports in Europe. In 2019, we could observe a decrease in the value of coffee imports to Poland by 4.67% compared to 2018.

The analysis of Yerba Mate, tea and coffee consumption reveals that the majority of Yerba Mate is consumed in Argentina – as much as 100 litres per capita annually. This product is most popular in South America, but it is becoming more and more accessible and popular worldwide, which is proven by the volume of import to e.g., European countries [INYM 2021; Samoggia, Landuzzi and Vicién 2021].

In terms of tea consumption, Turkey is the market leader with tea consumption of approx. 3.16 kg annually per capita, followed by Ireland (ca. 2.19 kg annually per capita), Great Britain (ca. 1.94 kg annually per capita) and Russia (ca. 1.38 kg annually per capita). As regards tea consumption, Poland ranks 8th worldwide, with ca. 1 kg per capita consumed annually [www.statista.com].

According to data from the International Coffee Organization (ICO) of 2018, the highest consumption of coffee per capita was in Finland (12 kg per capita annually), Norway (9.9 kg per capita annually), Iceland (9 kg per capita annually), Denmark (8.7 kg per capita annually) and the Netherlands (8.4 kg per capita annually). The ICO provides that calculated by kilograms, the coffee consumption in Poland totals 2.3 kg per capita annually [The Observatory of Economic Complexity].

Price is an important criterion for consumers when choosing the product. Differences in the price of Yerba Mate, tea and coffee result from various factors, which include: brand, composition, method and cost of production, atmospheric conditions, origin (plantation), costs of transport and type of packaging. In January 2021, the market of Yerba Mate available in Poland was analysed. The price analysis of Yerba Mate available on the domestic market revealed that the average price amounted to ca. 45 PLN per 1 kg of dried product. The data from 2015 published on the website Liczby.pl showed

that the average retail price of black loose tea in Poland totalled 4.02 PLN per 100 g (40.2 PLN per 1 kg), whereas in 2016 – 4.18 PLN per 100 g (41.8 PLN per 1 kg). The analysis of data from 2004 revealed yearly increase in tea prices. Over 11 years, the price of tea increased nearly twofold (from 2.20 PLN per 100 g in 2004) [www.markethub.pl/en/tea-market-in-poland/]. As for ground coffee, its retail price fluctuated between 1999 and 2015, from 4.55 PLN in 2003 to 7.46 PLN in 2012 per 250 g. In 2015, the retail price per 250 g of ground coffee totalled 6.81 PLN (27.24 PLN per 1 kg). Due to the increased prices of the majority of products on the market, we can definitively state that in 2021, the prices of these products are higher than in 2015.

Therefore, the average price of Yerba Mate is similar to the price of tea and slightly higher than the price of coffee. However, taking into account the Yerba Mate brewing method, the choice of this product may be well-grounded. Yerba Mate is a drink which can be infused multiple times. The number of infusions depends on the type of dried product, and the infusions are repeated until it loses its required sensory qualities. In the case of tea and coffee, the dried product is not usually used again after a single infusion.

3. HEALTH-PROMOTING PROPERTIES OF YERBA MATE, TEA AND COFFEE

An extremely important aspect of the Yerba Mate, tea and coffee consumption is the health-promoting qualities of these products. The number of biologically active compounds in these products depends on the country of origin, cultivation conditions, location of the shrubs (exposure to sunlight), time of harvest, method of processing, and method of preparation (duration of infusion, number of infusions – for Yerba Mate).

Selected health-promoting quality attributes of Yerba Mate, tea and coffee are presented in Table 3.

Table 3. Bioactive compounds and antioxidising properties of Yerba Mate, tea and coffee

Bioactive compounds	Yerba Mate	Tea	Coffee
Polyphenols	130–260 mg GAE/100 ml	62–205 mg GAE/100 ml	101–337 mg GAE/100 ml
Antioxidising effect	74–90.9%	37.5–95.6%	63–86%
Caffeine	41.2–82.4 mg/150 ml	11.83–51.57 mg/150 ml	42.27–120.89 mg /150 ml

Source: own elaboration based on: Bell, Wetzel and Grand 1996; Bastos et al. 2007; Heck and Gonzales de Mejia 2007; Chin et al. 2008; Gonzalez de Mejia et al. 2010; Dmowski, Śmiechowska and Prystupa 2011; Kruszewski et al. 2012; Worobiej and Tyszka 2012; Jabłońska-Ryś, Zalewska-Korona and Sławińska 2013; Miranda et al. 2017; EFSA 2021.

The dominant substances in Yerba Mate, tea and coffee include polyphenolic compounds. They are substances with antioxidant, anticarcinogenic, antimutagenic and antibacterial properties. The content of these compounds determines their antioxidising quality to a large extent. The compounds affecting the antioxidising effect of coffee to the largest extent include caffeine and chlorogenic acid [Chłopicka, Niedziela and Bartoń 2015]. The polyphenolic compounds that determine the antioxidising potential of tea include mainly catechins in green tea and theaflavins and thearubigins in black tea [Dmowski, Śmiechowska and Sagan 2014], whereas dry leaves of Yerba Mate contain, just like coffee beans, e.g., chlorogenic acid and its isomers, caffeic and quinic acid. Similar to tea, Yerba Mate also contains rutin, quercetin and kaempferol [Heck and Gonzales de Mejia 2007].

The content of polyphenols in the infusions may be different; however, analysis proves that the tested products contain similar amounts of bioactive compounds. Coffee includes slightly more of these; however, taking into account the antioxidising effect, all infusions are equally effective antioxidants [Gonzalez de Mejia 2010].

Consumption of the analysed products is also closely related to the stimulating properties resulting from the caffeine content. It is a compound that exists naturally in more than sixty plants. Caffeine belongs to the group of xanthines and is a substance that stimulates the central nervous system [Hassan 2020]. Traditionally, the caffeine in tea is called theine, and in Yerba Mate mateine; however, chemically the compounds do not differ from each other. According to data provided by the European Food Safety Authority (EFSA) the largest dose of caffeine, taking into account the analysed products, can be found in coffee (42.27–120.89 mg/150 millilitres of infusion). The caffeine content in Yerba Mate is similar to that in coffee and amounts to 41.2–82.4 mg/150 ml [Heck and Gonzales de Mejia 2007; Kruszewski et al. 2012], whereas the content of caffeine in tea totals 11.83–51.57 mg/150 ml [Chin 2008; EFSA 2021]. Although there is less caffeine in Yerba Mate and tea, it is released over a longer period, and therefore its effects are more long-lasting.

Another crucial parameter affecting the consumption of the analysed products is their sensory qualities. Most Polish consumers accept a given product based on its taste. As yet unpublished surveys of the authors prove that in the case of Yerba Mate, the taste-related attributes are important for approx. 60% of the respondents, in the case of tea the taste is important to more than 50% of the surveyed [Dmowski and Sieńkowska 2015], while in the case of coffee – 74% of the respondents [Przybysz, Widła and Dłużewska 2013]. In terms of sensory qualities, a common feature of Yerba Mate, tea and coffee includes, first of all, a bitter taste related to the caffeine content [Lenart and Sikora 2001]. There are also other common features, including: dark brown/brown appearance, tart flavour. Moreover, Yerba Mate and tea share additional common attributes such as the smell typical of tea and green colour [Dmowski and Kłopotek 2016].

4. SUMMARY

The paper presents the economic conditions of the production and consumption of Yerba Mate, tea and coffee, and compares their stimulating, antioxidative and sensory properties. It has been proven that in terms of the analysed parameters of their health-promoting quality, these products do not significantly differ in properties from each other. They have similar contents of antioxidants (although their structure differs), and comparable antioxidant potential and content of stimulating compounds, especially caffeine.

The common features of Yerba Mate and tea are undoubtedly the content of antioxidant compounds and similar taste, especially bitter taste, which is the common denominator of all of the products described in this article. In addition, the effect of caffeine contained in Yerba Mate tea infusions is analogous to that of coffee, and even more long-lasting.

In turn, the intensity of the attributes of appearance, smell and taste between the products analysed may vary, due in part to the method of production, length of brewing, country of origin and other factors, which affects the variety and richness of these products. However, there are types of Yerba Mate, such as Green Despalada, which resemble more intensely brewed tea in taste.

Analysing the qualitative attributes of the products and the average prices that the average consumer pays for them, one can venture to say that Yerba Mate, which is becoming increasingly popular in our country, may be an excellent substitute for tea and coffee.

REFERENCES

Bastos, D.H.M., Saldanha, L.A., Catharino, R.R., Sawaya, A.C.H.F., Cunha, I.B.S., Carvalho, P.O., Eberlin, M.N., 2007, *Phenolic Antioxidants Identified by ESI-MS from Yerba Mate (Ilex paraguariensis) and Green Tea (Camelia sinensis) Extracts*, Molecules, vol. 12, pp. 423–432.

Bell, L.N., Wetzel, C.R., Grand, A.N., 1996, *Caffeine Content in Coffee as Influenced by Grinding and Brewing Techniques*, Food Research International, vol. 29, no. 8, pp. 785–789.

Bracesco, N., Sanchez, A.G., Contreras, V., Menini, T., Gugliucci, A., 2011, *Recent Advances on Ilex paraguariensis Research: Minireview*, Journal of Ethnopharmacology, vol. 136, no. 3, pp. 378–384.

Burris, K.P., Harte, F.M., Davidson, M., Steward, C.N., Zivanovic, S., 2012, *Composition and Bioactive Properties of Yerba Mate (Ilex paraguariensis A. St.-Hil.): A Review*, Chilean Journal of Agricultural Research, vol. 72, no. 2, pp. 268–274.

Chin, J.M., Merves, M.L., Goldberger, B.A., Sampson-Cone, A., Cone, E.J., 2008, *Caffeine Content of Brewed Teas*, Journal of Analytical, vol. 32, pp. 702–704.

Chłopicka, J., Niedziela, A., Bartoń, H., 2015, *Aktywność antyoksydacyjna i całkowita zawartość polifenoli w naparach kawy w zależności od rodzaju kawy i sposobu jej przygotowania*, Bromatologia i Chemia Toksykologiczna, vol. 48, pp. 278–282.

Dmowski, P., Kłopotek, N., 2016, *Sensory Characterization of Ilex paraguariensis Beverages,* Food Quality Evaluation, Wyd. Politechniki Radomskiej, Radom, pp. 21–30.

Dmowski, P., Sieńkowska, S., 2015, *Konsumencka ocena jakości sensorycznej herbaty czarnej dostępnej na trójmiejskim rynku*, Handel Wewnętrzny, vol. 335, no. 2, pp. 101–114.

Dmowski, P., Śmiechowska, M., Prystupa, A., 2011, *Aktywność antyoksydacyjna wybranych naparów Ilex Paraguariensis dostępnych na rynku Trójmiasta,* Bromatologia i Chemia Toksykologiczna, vol. 44, no. 3, pp. 620–624.

Dmowski, P., Śmiechowska, M., Sagan, E., 2014, *Wpływ czasu parzenia i stopnia rozdrobnienia herbaty czarnej na barwę naparu i jego właściwości przeciwutleniające*, Żywność, Nauka. Technologia. Jakość, vol. 96, no. 5, pp. 206–216.

Gonzalez de Mejia, E., Soo Song, Y., Heck, C.I., Ramirez-Mares, M.V., 2010, *Yerba Mate Tea (Ilex paraguariensis): Phenolics, Antioxidant Capacity and in vitro Inhibition of Colon Cancer Cell Proliferation,* Journal of Functional Foods, no. 2, pp. 23–34.

Hassan, U., 2020, *Frequency and Awareness of Caffeine Consumption among the Medical Students*, The Professional Medical Journal, vol. 27, no. 12, pp. 2763–2768.

Heck, C.I., Gonzalez de Mejia, E., 2007, *Yerba Mate Tea (Ilex paraquariensis): A Comprehensive Review on Chemistry, Health, Implications, and Technological Considerations,* Journal of Food Science, vol. 72, no. 9, pp. 138–151.

Jabłońska-Ryś, E., Zalewska-Korona, M., Sławińska, A., 2013, *Zawartość polifenoli w wybranych kawach z gatunku Coffea arabica,* Towaroznawcze Problemy Jakości, no. 2, pp. 62–70.

Kruszewski, B., Jakóbiak, A., Jasiczek, A., Wieczorek, B., Niemczuk, D., 2012, *Wpływ parametrów parzenia na zawartość kofeiny w naparze Yerba Mate,* Bromatologia i Chemia Toksykologiczna, vol. 45, no. 3, pp. 1001–1005.

Lenart, B., Sikora, T., 2001, *Jakość sensoryczna wybranych kaw palonych i rozpuszczalnych*, Żywność, vol. 1, no. 26, pp. 127–144.

Miranda, A.M., Steluti, J., Fisberg, R.M., Marchioni, D.M., 2017, *Association between Coffee Consumption and Its Polyphenols with Cardiovascular Risk Factors: A Population-Based Study*, Nutrients, vol. 9, no. 3, pp. 276.

Nierzwicki, W., 2010, *Jakość żywności*, WSTiH, Fundacja Rozwoju Uniwersytetu Gdańskiego, Gdańsk.

PN-ISO 6078:1996, *Herbata czarna. Terminologia.*

Przybysz M.A., Widła, G., Dłużewska, E., 2013, *Preferencje konsumenckie picia kawy. Wpływ temperatury i czasu prażenia ziarna kawy na ocenę smaku i zapachu espresso*, Zeszyty Problemowe Postępów Nauk Rolniczych, vol. 572, pp. 65–79.

Samoggia, A., Landuzzi, P., Vicién, C.E., 2021, *Market Expansion of Caffeine-Containing Products: Italian and Argentinian Yerba Mate Consumer Behavior and Health Perception,* International Journal of Environmental Research and Public Health, vol. 18, no. 15.

Subedi, R.N., 2011, *Comparative Analysis of Dry and Wet Processing of Coffee with Respect to Quality and Cost in Kavre District, Nepal: A Case of Panchkhal Village*, International Research Journal of Applied and Basic Sciences, vol. 2, no. 5, pp. 181–193.

Worobiej, E., Tyszka, K., 2012, *Właściwości przeciwutleniające różnych rodzajów herbat czarnych*, Bromatologia i Chemia Toksykologiczna, vol. 45, no. 3, pp. 659–664.

Internet sources

Bhagat, R.M., Ahmed, K.Z., Gupta, N., Baruah, R.D., Wijeratne, M.A., Bore, J.K., Nyabundi, D.W., Wenyan, H., Xin, L., Peng, Y., Ahammed, G.J., 2016, *Report of the Working Group on Climate Change of the FAO Intergovernmental Group on Tea*, Food and Agriculture Organization of the United Nations, www.fao.org/documents/card/en (14.05.2021).

Chang, K., Brattlof, M., 2015, *Contribution of Tea Production and Exports to Food Security, Rural Development and Smallholder Welfare in Selected Producing Countries*, Market and Policy Analyses of Raw Materials, Horticulture and Tropical (RAMHOT) Products Team, Trade and Markets Division, Food And Agriculture Organization of The United Nations, www.fao.org/3/a-i4485e.pdf (14.05.2021).

Coffee Development Report, 2020, *A Flagship Report of the International Coffee Organization*, https://www.ico.org (14.05.2021).

EFSA, European Food Safety Authority, www.efsa.europa.eu/en (14.05.2021).

FAO, 2018, Raport CCP:TE 18/CRS1, *Current Market Situation and Medium Term Outlook*, Intergovernmental Group on Tea, www.fao.org//j5316e/j5316e.html (14.05.2021).

FAO, 2021, Food and Agriculture Organization of the United Nations, https://www.fao.org/markets-and-trade/commodities/en/ (14.05.2021).

Global Yerba Mate Market to Report, 2019, *Coherent Market Insights*, www.coherentmarketinsights.com/market-insight/yerba-mate-market-2744 (14.05.2021).

https://liczby.pl/ (14.05.2021).

Informe del Sector Yerbatero, Enero de 2021, Institutio Nacional de la Yerba Mate, https://inym.org.ar/descargar/publicaciones/estadisticas/2021 (14.05.2021).

INYM, 2021, Institutio Nacional de la Yerba Mate, https://inym.org.ar (14.05.2021).

Statista Research Department, 2016, *Annual per capita Tea Consumption Worldwide as of 2016, by Leading Countries*, www.statista.com/statistics/507950/global-per-capita-tea-consumption-by-country/ (14.05.2021).

The Observatory of Economic Complexity, https://oec.world/en (14.05.2021).

UNCTAD, 2016, United Nations Conference On Trade And Development, *Tea An INFOCOMM Commodity Profile*, UNCTAD Trust Fund on Market Information on Agricultural Commodities, New York and Geneva, https://pdf4pro.com/amp/view/tea-unctad-infocomm-14757b.html (14.05.2021).

www.circleofdrink.com (14.05.2021).

www.financesonline.com (14.05.2021).

www.markethub.pl/en/tea-market-in-poland/ (14.05.2021).

www. statista.com.

www.teabloom.com (14.05.2021).

www.tea-direct.co.uk (14.05.2021).