

Non-alcoholic beer in the European Union and UK: Availability and apparent consumption

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Abstract

Introduction. Market research indicates an increasing interest in low- and no-alcohol drinks in Europe, but there is no systematic overview of their availability and consumption. In this article, we present data on the availability and apparent consumption of non-alcoholic beer in the European Union and the UK. **Methods.** We use Sold production, exports and imports by PRODCOM list (NACE Rev. 2) dataset, available in Eurostat, to extract the available data on sold production, exports and imports of non-alcoholic beer in the EU-27 (total and country-level) and the UK between 2013 and 2019, and additionally calculate the apparent consumption. **Results.** Between 2013 and 2019, the sold production volume in the EU increased from 0.59 to 1.38 billion litres, the value from 0.42 to 1.28 billion EUR and value per litre from 0.72 to 0.93 EUR/L. In 2019, the share of non-alcoholic beer represented 3.8% of all beer volume and 4.1% of all beer value produced. Five countries accounted for 80.8% of sold production volume: Germany, the Netherlands, Spain, Poland and Czechia. The Netherlands and Germany were the largest exporters, while importing was distributed more equally. Per capita, average apparent consumption (2017–2019) was highest in Czechia, followed by the Netherlands, Spain, Luxembourg and Germany. **Discussion and Conclusions.** Our results show the increasing availability of non-alcoholic beer in the EU-27, although overall changes seem to be driven by a small number of countries. More research is needed at the country-level on no- and low-alcohol consumption trends and drivers, and their impact on alcohol-related harm reduction. [Kokole D, Jané Llopis E, Anderson P. Non-alcoholic beer in the European Union and UK: Availability and apparent consumption. *Drug Alcohol Rev* 2022;41:550–560]

Key words: alcohol policy, non-alcoholic beer, PRODCOM, public health, European Union.

Introduction

The World Health Organization European Region, including the European Union (EU), has the highest levels of per capita alcohol consumption in the world, with, as of 2019 World Health Organization report, little overall change between 2010 and 2016 [1]. Alcohol use as a risk factor contributes to 5.2% of all deaths and 6.5% disability-adjusted life years in the EU [2]. Given the monotonic dose–response relationship between alcohol consumption and most of the related negative outcomes [3], a recently increasingly considered approach to reduce alcohol-related harm is reformulation of the existing alcohol products to contain less or no alcohol [4]. An increase in the availability of no- and low-alcohol

products could contribute to reduction of harmful alcohol use in two ways: by current drinkers replacing the alcoholic beverages consumed with similar beverages of lower strength; or by switching to non-alcoholic alternatives for part of their time; in both cases reducing the average amount of alcohol consumed [4]. In a recently published overview of the literature on production, consumption and impact of low and no-alcohol drinks [5], we found very little research on this topic coming from a public health perspective (e.g. on labelling [6–8] and marketing [9]) and almost no research focusing on whether low- and no-alcohol products can contribute to reduction in overall ethanol consumption, although at least one innovative trial attempting to answer this question with reduced alcohol beer is

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currently in progress [10], and another small study found that reduction in wine alcohol content did not lead to increase of wine consumed [11]. Thus at this point, it is too early to make conclusions about this approach as a public health measure aimed at reducing alcohol-related harm. However, to have an informed discussion about the merits of no- and low-alcohol products, it is also necessary to have reliable information on current trends in consumption and consumer interest.

Despite some market research reports pointing to an increased market share of no- and low-alcohol products in Europe in general [12,13] and non-alcoholic beer in certain EU countries (Germany, Poland, the Netherlands and Spain) [14–16], little is known about overall trends in their availability and consumption. Most of the data come from the UK; for example, for the time period 2015 to 2018 and the first half of 2020, out of the volume of all beer purchased, 4.9% had an *alcohol by volume* (ABV) $> 0.0\%$ and $\leq 3.5\%$, and 1.5% had an ABV of 0.0% [17]. In addition, it has also been shown that the introduction of new lower strength beers (mainly 3.5% ABV), and the reformulation of beer products to contain less alcohol, resulted in British households purchasing less alcohol [18,19], with such changes promoted by pricing policy, for example, the setting of a minimum unit price for the sale of alcohol [17]. Little is known about the drivers for low- and no-alcohol products; market research reports consider increased health consciousness as one important reason for the growth in consumer interest in non-alcoholic beer [12,20]. Results of surveys from UK and the Netherlands show that low- and no-alcoholic products are consumed when it would be inappropriate to consume a higher strength product (e.g. when driving afterwards); because of the taste and as a replacement for the alcoholic beverages [21,22].

To date, no systematic overview of the availability and consumption of low- and no-alcohol drinks has been undertaken in the EU. To address this gap, we examine existing data available through Eurostat, the statistical office of the European Union [23]. We focus on the available data through PRODCOM [24], which provides information on the EU supply of industrial products, and includes data on sold production, exports and imports of non-alcoholic beer, which allows also for calculation of the apparent consumption.

In this article, we thus aim to answer the following questions: what is the EU-27 + UK sold production of non-alcoholic beer (defined as beer with an ABV $\leq 0.5\%$); what is EU-27 + UK import and export of such beer; and what is the EU-27 + UK apparent consumption of such beer.

Methods

Data source and indicators

Our data source is PRODCOM, combined with COMTEXT data in the dataset *Sold production, exports and imports by PRODCOM list (NACE Rev. 2)* [23]. PRODCOM, a community scheme based on COUNCIL REGULATION (EEC) No 3924/91 [25], is used to produce detailed product output information at the EU level, with the primary purpose of providing information on the EU supply of industrial products [24], and is collected on yearly bases through national-level enterprise surveys (see Appendix for details on PRODCOM data collection process). The dataset includes the following indicators: physical volume and value of sold production; and the extra- and intra-EU exports and imports (see Table 1 for definitions). In addition, from this data, it is possible to estimate apparent consumption by summing production and imports and subtracting exports [24].

Data sample and extraction

We extracted data for PRODCOM code 11.05.10.10: Non-alcoholic beer and beer containing $\leq 0.5\%$ alcohol (from here on referred to as ‘non-alcoholic beer’) and data for PRODCOM code 11.05.10.00: Beer made from malt (excluding non-alcoholic beer, beer containing $\leq 0.5\%$ by volume of alcohol, alcohol duty) (from here on referred to as ‘beer’) from the dataset *Sold production, exports and imports by PRODCOM list (NACE Rev. 2)* [23]. The sample included total EU-27 estimates, as well as individual EU-27 countries and the UK. Extracted raw data included sold production, export and import for both quantity (volume in litres) and value (in EUR). Data for non-alcoholic beer was available for years 2013–2019 (sold production) and 2017–2019 (exports and imports); therefore, we limited the extraction to this period. The last data update in the available dataset was 15 July 2021. Data were extracted in February and March 2021, with an update in November 2021.

Data analysis

For sold production, we calculated the value of non-alcoholic beer and regular beer per 1 L by dividing value with volume. We calculated the percentage of non-alcoholic beer volume and value as a proportion of all beer by taking non-alcoholic beer sold production volume/value and dividing it by the sum of non-alcoholic beer and other beer volume/value. At country

Table 1. Indicator definitions

Indicator	Definition
Sold production	Sold production is the production carried out at any time and within the economic territory of each country under the primary or secondary activities of the enterprise, which has been sold (invoiced) during the reference period. It includes production sold (invoiced) between different kind-of-activity units belonging to the same enterprise [26], and refers to: (i) the physical volume of production sold during the survey period; and (ii) the value of production sold during the survey period [24].
Export	All physical movements of goods which subtract from the stock of material resources of a Member State by leaving the statistical territory of this Member State to a destination in the statistical territory of another Member State or a non-member country [26]. Extra EU-exports include goods leaving the statistical territory of the European Union from a non-EU country, and Intra-EU exports in a given Member State include goods destined for another Member State were placed, in another Member State, under the customs procedures for inward processing, or, until April 2016, for processing under customs control [23].
Import	All physical movements of goods which add to the stock of material resources of a Member State by entering the statistical territory of this Member State from the statistical territory of another Member State or from a non-member country [26]. Extra EU-imports include goods entering the statistical territory of the European Union from a non-EU country and Intra-EU imports(exports) in a given Member State include goods entering which were placed, in another Member State, under the customs procedures for inward processing, or, until April 2016, for processing under customs control [23].
Apparent consumption	Represents an estimation of consumption based on the sold production, export and import data and is calculated by summing up production and imports and subtracting the exports [24]. As this is a derivative indicator that does not account for changes in stocks, we averaged the apparent consumption for the 3 years in which the data were available (see Limitations for further discussion).

level, we also calculated the percent of volume and value as the proportion of total EU-27 volume and value. For some countries, individual data were not publicly available due to confidentiality of the estimates, but only included in the aggregated EU-27 totals.

For exports and imports, we performed additional calculations based on the following assumption: as for individual countries, the trade with all parties, both intra and extra EU, is aggregated to provide the total external trade for the country; for EU totals, only extra parties are aggregated, so that trade with the rest of the world is reported. Thus, our assumption is that if we sum up the external trade of individual countries, and subtract the EU totals, we obtain information on overall intra-EU trade.

Finally, apparent consumption was calculated by adding the volume sold production and imports, and subtracting the volume of the exports—at country level and with EU-27 totals, at as an average of the data available for 2017–2019 (sum of all years divided by number of years) to take into account possible temporal delays between production, sale and export. At country level, only results for countries for which data in all three categories were available are presented (21 EU countries + UK). For this sample (countries with available data and EU-27 totals), we also calculated per capita consumption by dividing the apparent consumption with the population on 1 January 2019 as obtained in Eurostat [23]. Finally, we estimated the proportion of non-

alcoholic beer apparent consumption of total beer apparent consumption by taking non-alcoholic beer volume and dividing it by the sum of non-alcoholic beer and other beer volume. To keep the results succinct, the main results section is focused on presentation of the most recent data (2019), with the full data (2013–2019) available as Supporting Information.

Ethics

No ethics committee approval was necessary as the study does not involve human subjects.

Results

Sold production

EU-level. In 2019, approximately 1.38 billion litres of non-alcoholic beer were produced in EU-27, valued at 1.28 billion EUR, with the average value of 0.93 EUR per litre, Table 2. The share of non-alcoholic beer represented 3.8% of all beer volume and 4.1% of all beer value produced in the EU. Compared with 2013, the sold production volume increased from 0.59 to 1.38 billion litres in 2019, the value from 0.42 billion to 1.28 billion EUR, and the value per litre from 0.72 to 0.93 EUR/L. Over the same time period, the volume of beer sold production increased from 31.68 to 34.68

Table 2. EU-27 sold production of non-alcoholic beer and beer in volume and value, 2013–2019

	Non-alcoholic beer ^a			Beer (excl. non-alcoholic beer) ^b			%	
	Volume (L)	Value EUR	Value per 1 L (in EUR)	Volume (L)	Value (EUR)	Value per 1 L (EUR)	% Volume of all beer ^c	% Value of all beer ^c
2013	585 649 458	423 349 408	0.72	31 675 167 000	25 576 115 677	0.81	1.8	1.6
2014	638 011 858	500 969 825	0.79	32 609 971 000	25 374 502 555	0.78	1.9	1.9
2015	770 827 596	616 309 901	0.80	33 202 924 000	25 768 218 891	0.78	2.3	2.3
2016	838 718 354	677 663 127	0.81	33 867 701 000	27 371 419 681	0.81	2.4	2.4
2017	952 273 226	818 638 293	0.86	34 292 258 000	27 321 685 469	0.80	2.7	2.9
2018	1 111 861 285	1 017 384 808	0.92	34 959 556 281	28 990 970 276	0.83	3.1	3.4
2019	1 377 207 032	1 276 125 097	0.93	34 681 938 925	29 505 228 213	0.85	3.8	4.1

^aNon-alcoholic beer and beer containing $\leq 0.5\%$ by volume of alcohol (PRODCOM code 11.05.10.10). ^bBeer made from malt (excluding non-alcoholic beer, beer containing $\leq 0.5\%$ by volume of alcohol, alcohol duty) (PRODCOM code 11.05.10.00). ^cCalculated as non-alcoholic beer sold production volume/value divided by the sum of non-alcoholic beer and other beer volume/value.

billion, its value from 25.58 to 29.50 billion EUR and the value per litre from 0.81 to 0.85 EUR/L. Non-alcoholic beer's volume as a share of all beer volume increased from 1.8% of all beer in 2013 to 3.8% in 2019, and non-alcoholic beer's value as a share of all beer value increased from 1.6% of all beer produced in 2013 to 4.1% of all beer produced in 2019.

Country level. Table 3 presents the volume and value-related indicators for sold production of non-alcoholic beer per country (EU-27 + UK) for the year 2019. Five countries account for 80.8% of the sold production volume: Germany (30.5%), Spain (16.8%), the Netherlands (14.4%), Poland (12.0%) and Czechia (7.1%). The same five countries, plus France, also account for the majority of the sold production value, 88.3%. The landscape changed slightly from 2013, when only four countries accounted for a similar amount of the sold production volume (Table S2, Supporting Information); the Netherlands in that year reported zero sold production of non-alcoholic beer.

Seven countries account for the remaining 11.8% of sold production volume and 10.8% of value—Romania, Austria, Portugal, Hungary, Slovakia, Denmark and Lithuania. The relative percentages remained similar between 2013 and 2019 (Table S2). Six countries have zero sold production: Bulgaria, Croatia, Cyprus, Greece, Luxembourg and Malta. 1.6% of the total volume and 1.4% of the total value remain unaccounted for due to confidential data (for Belgium, Italy, Ireland, Latvia, Slovenia and Sweden).

The top five countries by percentage of non-alcoholic beer sold production volume as a share of all beer sold production are the Netherlands (6.8%), Spain (5.7%),

Germany (5.0%), Slovakia (5.0%) and Austria (4.9%). The top five countries by percentage of non-alcoholic beer sold production value as a share of all beer sold production are Spain (6.9%), the Netherlands (6.7%), Slovakia (6.4%), Hungary (6.1%) and Czechia (6.0%). From the data, it can be seen that the UK has low sold production volume, both in absolute terms (just over 10 million litres) and as a percentage of total beer sold production volume (0.2% compared to 3.8% EU-27 average). On the other hand, it has a higher value per litre than any EU-27 country (2.48 EUR compared to 0.93 EUR EU-27 average).

Full information for all indicators for all countries, including EU-27 totals, between years 2013 and 2019, is available in Tables S1–S4.

Export and import

EU-level. In 2019, there were just over 200 million litres of non-alcoholic beer exported outside EU-27, and 10.41 million litres were imported (Table 4). Considering that the total sum of exports by volume in all EU-27 countries was almost 400 million litres (see Table S5), this implies that 49.0% of non-alcoholic beer was exported within EU-27 (from one EU country to another), and 51.0% outside the EU-27. The total sum of imports of all EU-27 countries by volume was just above 195 million litres, meaning that 94.7% was imported from within EU-27, and 5.3% from outside the EU-27.

Country level. At country level, the largest exporters in 2019 in terms of volume were the Netherlands and Germany (28.5% and 24.3% of all exported volume,

Table 3. Volume and value-related indicators for non-alcoholic beer in 2019, EU-27 + UK

	Volume (L)	Value (EUR)	Value per 1 L (EUR)	% Within all EU-27 countries ^a		% Of non-alcoholic beer within all beer	
				Volume	Value	Volume	Value
Austria	42 281 628	32 990 575	0.78	3.1	2.6	4.9	3.6
Belgium	:C	:C					
Bulgaria	0	0		0.0	0.0	0.0	0.0
Croatia	0	0		0.0	0.0	0.0	0.0
Cyprus	0	0		0.0	0.0		
Czechia	97 440 900	72 214 336	0.74	7.1	5.7	4.8	6.0
Denmark	1 010 619	963 689	0.95	0.1	0.1	0.3	0.3
Estonia	0	0		0.0	0.0	0.0	0.0
Finland	33 146	79 278	2.39	0.0	0.0	0.0	0.0
France	81 012 800	118 632 131	1.46	5.9	9.3	3.8	4.1
Germany	419 781 500	360 508 400	0.86	30.5	28.3	5.0	5.8
Greece	0	0		0.0	0.0	0.0	0.0
Hungary	23 671 000	19 704 749	0.83	1.7	1.5	4.0	6.1
Ireland	:C	:C					
Italy	:C	:C					
Latvia	:C	:C					
Lithuania	555 739	529 550	0.95	0.0	0.0	0.2	0.2
Luxembourg	0	0		0.0	0.0		
Malta	0	0		0.0	0.0		
The Netherlands	198 749 000	174 414 000	0.88	14.4	13.7	6.8	6.7
Poland	164 797 900	107 404 714	0.65	12.0	8.4	4.0	5.2
Portugal	28 723 887	24 475 000	0.85	2.1	1.9	3.7	3.6
Romania	57 520 800	50 682 716	0.88	4.2	4.0	3.2	4.6
Slovakia	8 474 984	8 891 366	1.05	0.6	0.7	5.0	6.4
Slovenia	:C	:C					
Spain	231 728 000	285 625 746	1.23	16.8	22.4	5.7	6.9
Sweden	:C	:C					
UK ^b	10 030 000	24 923 385	2.48	—	—	0.2	0.6
EU-27	1 377 207 032	1 276 125 097	0.93	100.0	100.0	3.8	4.1

^a'C' data is confidential. ^bNot included in EU-27 calculations.

respectively), followed by Spain (9.3%) and Poland (9.0%)—all together they represent 71.1% of exported litres (Table 4). Importing is more evenly distributed, with the Netherlands, France and Hungary being the largest importers (12.5%, 10.7% and 8.0%, respectively). The UK is a larger importer in absolute terms of both volume and value than any other EU-27 country. Unlike for the EU-27 totals, no distinction between intra-EU and extra-EU trade can be made at the country level. Full information on exports and imports for the years 2017–2019 is available in Tables S5 and S6.

Apparent consumption

Table 5 shows apparent consumption by absolute volume, volume per capita and as percentage of all beer apparent consumption, averaged for years 2017–2019.

In absolute volume, the top five countries in the EU are almost the same as for the sold production: Germany, Spain, Poland, France and Czechia. Looking at average volume per capita, the top five consumer countries are Czechia (7.7 L), the Netherlands (4.7 L), Spain (4.2 L), Luxembourg (3.6 L) and Germany (3.5 l), whereas by percent of apparent consumption of all beer, the proportion is largest in Luxembourg (9.2%), followed by Cyprus (6.2%), the Netherlands (5.5%), Czechia (5.4%), Spain (4.8%) and Hungary (4.7%) There is missing data for six countries (Belgium, Ireland, Italy, Latvia, Slovenia and Sweden).

Discussion

This study analysed PRODCOM data to determine sold production, exports, imports and apparent

Table 4. Export and import of non-alcoholic beer, 2019

	Export				Import			
	Volume (L)	Value (EUR)	Volume (% among EU-27)	Value (% among EU-27)	Volume (L)	Value (EUR)	Volume (% among EU-27)	Value (% among EU-27)
Austria	16 126 753	7 555 500	3.8	3.9	4 043 881	3 852 970	10.7	9.4
Belgium	18 568 097	24 000 590	4.1	2.5	9 654 294	6 364 960	2.1	2.9
Bulgaria	4 946 333	8 884 930	4.7	7.9	6 152 191	9 158 540	4.9	4.8
Croatia	266 847	77 910	1.3	2.9	2 983 792	909 870	3.2	6.9
Cyprus	10 808	5920	0.1	0.0	279 316	329 750	1.5	0.7
Czechia	8 465 999	5 299 590	0.0	0.0	6 879 332	2 772 490	0.1	0.2
Denmark	2 311 097	1 972 170	2.1	1.7	3 917 430	2 689 030	3.5	2.1
Estonia	1 858 215	1 016 050	0.6	0.6	1 956 901	1 312 990	2.0	2.0
Finland	12 816	34 300	0.5	0.3	5 700 336	5 483 160	1.0	1.0
France	15 091 743	11 779 910	0.0	0.0	20 882 657	12 624 190	2.9	4.1
Germany	95 688 693	84 300 720	24.3	27.6	11 310 451	10 053 150	5.8	7.5
Greece	147 764	157 970	0.0	0.1	1 676 969	1 183 550	0.9	0.9
Hungary	2 119 284	429 060	0.5	0.1	15 537 287	6 237 530	8.0	4.7
Ireland	187 235	209 330	0.0	0.1	1 747 469	2 129 940	0.9	1.6
Italy	1 677 454	3 078 540	0.4	1.0	12 682 746	6 542 700	6.5	4.9
Latvia	1 130 088	871 990	0.3	0.3	2 356 566	1 522 820	1.2	1.1
Lithuania	3 302 152	1 892 150	0.8	0.6	4 072 137	2 798 480	2.1	2.1
Luxemburg	32 800	54 790	0.0	0.0	2 666 394	3 318 030	1.4	2.5
Malta	60	110	0.0	0.0	208 699	330 150	0.1	0.2
The Netherlands	112 475 542	98 879 650	28.5	32.4	24 440 655	16 602 130	12.5	12.4
Poland	35 403 903	15 479 480	9.0	5.1	7 593 781	4 686 380	3.9	3.5
Portugal	19 587 523	12 233 850	5.0	4.0	2 133 513	1 120 220	1.1	0.8
Romania	1 178 387	690 330	0.3	0.2	10 347 938	5 065 840	5.3	3.8
Slovakia	13 525 982	5 860 800	3.4	1.9	12 707 074	5 253 810	6.5	3.9
Slovenia	3 257 821	2 365 620	0.8	0.8	4 998 025	3 555 740	2.6	2.7
Spain	36 502 651	16 726 020	9.3	5.5	14 667 444	10 780 180	7.5	8.1
Sweden	267 271	1 073 090	0.1	0.4	3 679 245	6 971 190	1.9	5.2
UK ^a	6 936 155	9 542 630			53 280 530	44 460 960		
EU-27 (Extra-EU-27)	201 555 983	177 295 111			10 412 824	10 773 560		
Intra-EU-27^b	193 063 614	128 046 800			184 906 116	122 966 980		
%Intra-EU trade	48.9	41.9			94.7	91.9		
%Extra-EU trade	51.1	58.1			5.3	8.1		

^aNot included in EU-27 totals. ^bSum total all countries minus EU-27.

consumption of non-alcoholic beer (ABV \leq 0.5%) in the EU-27 and UK. As far as we are aware, this is the first study looking into trends and country distributions in the volume and value of the produced non-alcoholic beer. As there has been very little peer-reviewed literature published on this topic, and none for the EU setting, we tried to place our results also in the context of other available grey literature—market research and national reports.

In 2019, approximately 1.38 billion litres of non-alcoholic beer were produced and sold within EU according to the Eurostat data, valued at 1.34 billion EUR; this is less than 4.1 billion litres [15] and 4 billion USD [12] estimated in some of the market research reports. While those reports likely

encompassed more than just EU members under their definition of Europe, the discrepancy is too big to be only explained by this reason, but we are not able to judge the quality and reliability of the paywalled reports' methodology. Another finding from our analyses was that the growth of sold production of non-alcoholic beer in 2013 and 2019 in EU-27 was much steeper than that of regular beer. This is aligned with much of the market research, which has recognised the growth of non-alcoholic beer market compared to the 'stagnating' beer market [13,20]. From the current data, we are not able to tell the extent to which non-alcoholic beer replaced or added to the sold production of regular beer. Elsewhere, at least in the British market, evidence from market research-based

Table 5. Apparent consumption (in litres) by country (EU-27 + UK), averaged for years 2017–2019

	Average apparent consumption	Average per capita consumption	Average % non-alcoholic beer as % total beer
Austria	29 653 202	3.3	3.5%
Belgium ^a			
Bulgaria	1 917 408	0.3	0.4%
Croatia	1 734 572	0.4	0.5%
Cyprus	836 519	1.0	6.2%
Czechia	81 854 051	7.7	5.4%
Denmark	1 311 348	0.2	1.3%
Estonia	692 740	0.5	0.7%
Finland	5 537 388	1.0	1.3%
France	86 063 012	1.3	3.7%
Germany	292 465 250	3.5	3.9%
Greece	954 858	0.1	0.2%
Hungary	32 990 049	3.4	4.7%
Ireland ^a			
Italy ^a			
Latvia ^a			
Lithuania ^b			
Luxembourg	2 204 834	3.6	9.2%
Malta	141 796	0.3	2.8%
The Netherlands ^c	80 827 523	4.7	5.5%
Poland	93 403 898	2.5	2.5%
Portugal	11 514 349	1.1	1.8%
Romania	54 362 313	2.8	3.0%
Slovakia	10 122 454	1.9	2.8%
Slovenia			
Spain	197 097 959	4.2	4.8%
Sweden			
UK ^c	41 179 915	0.6	0.8%
EU-27	1 003 281 706	2.2	3.1%

^aContains the confidential estimates for either non-alcoholic or alcoholic beer; all those estimates have been treated as missing data; therefore the amount is not calculated in those countries. ^bExports larger than imports and sold production. ^cData available for average calculation only for 2018 and 2019, UK not included in EU-27 calculations.

household purchase data evidence suggests that newly introduced no- and low-alcohol beers replace rather than add to purchases of higher strength beer [19], although the overall market share is still very low [21]. Overall, Pareto distribution of sold production among EU-27 member states can be observed: five countries accounted for just over four-fifths of the sold production volume and value: Germany, the Netherlands, Spain, Poland and Czechia. Most of these countries have been singled out in market research reports (e.g. Germany, Spain, Poland, the Netherlands) [14–16]. But in some other commonly mentioned countries, such as the UK and Ireland [16], sold production and apparent consumption were not high at all, indicating the market research reports tend to focus on relative rather than the absolute increase in interest and consumption. Finally, considering the apparent consumption, when looking at per-capita data or non-alcoholic beer as percentage of total beer consumption,

the following countries stand out as being in top five in both of the categories: Czechia, the Netherlands, Spain and Luxembourg. In Czechia, high per-capita non-alcoholic beer apparent consumption reflects the high overall beer per capita consumption [27], whereas Luxembourg and the Netherlands are ranked in the middle of the EU-27 countries [27], which could explain the higher proportion of non-alcoholic beer as percentage of all beer in these two countries.

Limitations

The PRODCOM data are continually being updated and revised based on the information received from the countries, the exact numbers might still change, especially for 2019—our paper reflects the data available as of November 2021. In addition, not all data

were available due to confidentiality, however, this was also because the numbers were likely too small to be revealed, meaning they do not significantly change our results. Finally, calculating apparent consumption is not recommended in PRODCOM [24], although only a few of the listed reasons were relevant in the case of non-alcoholic beer as a single product rather than component of the other products. The first mentioned issue is that the value of the export cannot always be compared directly with that of sold production; for this reason, we only considered volume and not value of the apparent consumption. Second, the coverage of production statistics is not necessarily in line with that of trade statistics and the thresholds above which businesses are represented in these statistics can be different. In the case for non-alcoholic beer, export and import data were available for all countries regardless of the amounts, whereas production data for some countries was confidential as it could identify individual company data (this represented 1.6% of all sold production volume). For this reason, the countries with confidential sold production data were excluded from apparent consumption calculation. Third, the PRODCOM guidelines mention that the presented data relate to a given year and there are temporal delays between the various operations (such as production, sale and export) to be taken into account. Part of these delays are explained by storage, but they disappear when data are considered over several years. For this reason, we have averaged the apparent consumption for the three available years (2017–2019) and are explicit about focusing on apparent consumption rather than real consumption (which would have to be adjusted for changes in inventories and stock levels). This also means that for apparent consumption, we can focus only on differences between countries rather than within-country temporal trends.

Implications for practice and research

Analysis of this data was possible because there is the non-alcoholic beer category in the used nomenclatures. We should note that this is not the same as zero alcohol beer with an ABV of 0.0%, but rather beer with an ABV less than or equal to 0.5%. Standardised nomenclatures are not available for other no- and lower strength alcohol products (e.g. light beer, no-alcohol wine, no-alcohol spirits). While at present, this is likely due to rather low production of these products, as the market develops, the nomenclature categories should be revised to reflect this and enable monitoring production of other no- and low alcohol drink categories. This holds true not only for the

PRODCOM data, but also for other EU-wide measurement nomenclatures, such as COICOP used in the Household Budget Surveys), which would allow us to measure consumption rather than the production. In addition, other public health alcohol consumption measurers will have to consider changing landscape of (no and low) alcoholic drinks in their quantification efforts. As shown in this paper, and also according to other reports (e.g. [21]), low-and no-alcohol drinks are on the rise, and the measurement instruments should keep up to detect and reflect these changes. The Netherlands has already included question on low and no-alcohol alternatives in their national Lifestyle monitor survey [28] and Youth risk behaviour survey [29] .

In addition, more research is needed to understand the correlates and drivers of no- and low-alcohol products consumption and the role of their availability on changes in overall alcohol consumption, how differing country contexts in EU facilitate and impede these transitions, and what might be unintended consequences or second-order effects. Two issues should be prioritised: labelling and marketing. Labelling wise, the terminology on what can be labelled as alcohol-free, non-alcoholic or low-alcohol depends on (and differs by) the country and in the future, ideally, the terminology should be harmonised at least within the EU countries, so consumers can clearly understand what they are consuming. Marketing-wise, alcohol industry using low- and no-alcohol products to market the alcoholic brands to young people has been raised as a concern by researchers and civil society alike [30,31] but not enough data are available to determine if the concern is substantiated. Thus, more research is needed, especially in countries with higher levels of apparent consumption. Available research looking into how low- and no-alcohol drinks are marketed [9,22] shows that marketing focuses them being healthier than alcohol, suggests occasions for consumption (e.g. sports, before driving), focuses on alcohol content and emphasises newness. A survey of representative Dutch sample [22] explored attitudes toward the marketing of low- and no-alcohol drinks and showed that larger percentage (58% of total sample and 66% of young people) thought it can encourage drinkers to drink alcohol-free alternatives instead of alcoholic beverages than thinking marketing would stimulate non-drinkers to start drinking alcoholic beverages (25% of total sample, 35% of young people).

Another relevant implication is to situate the non-alcoholic beer consumption in general trends toward drinking less alcohol. Increased availability of low- and no-alcohol drinks reflects the industry following the consumer interest—and might be thus related to broader trend of declining alcohol consumption in the Western countries [1,32]. This would imply that non-

alcoholic beer consumption would be higher in countries with declining alcohol consumption. To examine whether this might be the case, we looked at the changes in the alcohol consumption between 2010 and 2019 for the top five non-alcoholic beer consuming EU countries (as available in the Global Information System on Alcohol and Health). No common trend could be identified however: in this period, there was a minimal increase in alcohol consumption in Czechia (1%), large increase in Spain (25%), minimal decrease in Luxembourg and Germany (1%) and a small, but noticeable decrease in the Netherlands (6%) [27]. Non-alcoholic beer consumption thus does not seem to be on the rise only in the countries with decreasing alcohol consumption.

What is more likely is that there are certain population segments across the countries that are driving non-alcoholic beer consumption. The emerging evidence from the UK and the Netherlands points that no- and low-alcohol beer consumers tend to be young, better educated and wealthier [33,34], and a hypothesis worth investigating is that availability of low and no-alcohol products might at this point be helpful means to reduce alcohol consumption in the well-off part of the population that is overall embracing healthier lifestyle and trying to reduce their alcohol consumption, but will not have an impact in lower socio economic environment or with heavier drinkers. Thus, any public health focus on low- and no-alcohol products should not overshadow other interventions and policies aimed at decrease of alcohol consumption in the general and heavy drinking populations.

Conclusion

In 2019, approximately 1.38 billion litres of non-alcoholic beer (including beer containing up to $\leq 0.5\%$ alcohol) were produced in the EU-27, valued at 1.28 billion EUR, with an average value of 0.93 EUR per litre. The share of non-alcoholic beer represented 3.8% of all beer volume and 4.1% of all beer value produced in the EU. Despite the rather low overall share, the growth of non-alcoholic beer sold production volume and value between 2013 and 2019 was larger compared to regular beer. Five countries accounted for 80.8% of sold production volume: Germany, the Netherlands, Spain, Poland and Czechia. The total sum of exports by volume in all EU-27 countries was almost 400 million litres (51.1% extra-EU), and just above 195 million litres were imported (5.3% extra-EU). The Netherlands and Germany were the largest exporters. Per capita,

apparent consumption was highest in Czechia, followed by the Netherlands, Spain, Luxembourg and Germany.

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Data availability statement

The data used in this paper are publicly available through Eurostat (European Statistical Office) on <https://ec.europa.eu/eurostat/web/prodcom/data/> database (dataset Sold production, exports and imports by PRODCOM list (NACE Rev. 2).

Conflicts of Interest

PA declares that within the previous 5 years he has received financial reimbursement from the AB InBev Foundation. No other competing interest declared.

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Appendix

PRODCOM survey background and data collection

PRODCOM, a community scheme based on COUNCIL REGULATION (EEC) No 3924/91 [25], is used to produce detailed product output information at the EU level, with the primary purpose of providing information on the EU supply of industrial products [24].

It is based on a list of products called the PRODCOM list that currently comprises about 4000 headings relating to industrial products and some industrial services, detailed at an eight-digit level. The first four digits refer to the equivalent class within the *Statistical classification of economic activities in the European Community* (NACE), and the next two refer to subcategories within the *Statistical classification of products by activity*. Most PRODCOM headings correspond to one or more *Combined nomenclature* codes [23]. PRODCOM data are obtained by the National Statistical Institutes. The National Statistical Institute in each reporting country carries out a survey of industrial production in that country, collates the results and transmits them to Eurostat. Eurostat calculates EU totals and publishes the national and EU data together with the related external trade data. In each member state, there is one PRODCOM coordinator in charge of transmission of these data. To collect the data, a survey questionnaire is used (conformed to the requirements of the regulation). Other sources of information to supplement the survey can also be used [24]. PRODCOM statistics are compiled from the enterprises that cover at least 90% of the national production per NACE class and employ at least 20 people (different thresholds may nonetheless be adopted by countries in exceptional cases). The territory covered in each country refers to the specifications of the Nomenclature of Countries and Territories for the External Trade Statistics of the Community and Statistics of Trade between Member States. Generally, all countries provide this data on regular basis. If only a

small number of enterprises produce a product in the reporting country, there is a risk that information regarding an individual enterprise might be revealed. If the enterprise does not agree to this the reporting country declares the production figures confidential. They are transmitted to Eurostat but not published on country level, only as part of EU aggregates [24]. In addition, the external data used in PRODCOM are extracted from COMTEXT. COMEXT is an EU database for statistics on international trade in goods, containing information on both imports and exports intra and extra-EU. COMEXT is collected from traders on the basis of Customs (extra-EU) and Intrastat (intra-EU) declarations. Products are disseminated according to the Combined Nomenclature (CN8) [24]. Eight-digit codes from both databases can be matched to obtain information on sold production, imports and exports for selected product.

Supporting Information

Additional Supporting Information may be found in the online version of this article at the publisher's website:

Table S1. Non-alcoholic beer sold production quantity (volume in litres) and value (in EUR), per country and EU total, 2013–2019.

Table S2. Percentage of non-alcoholic beer produced by country as share of EU-27 total, 2013–2019.

Table S3. Percentage of non-alcoholic beer within all beer sold production within the country, 2013–2019.

Table S4. Value per litre of sold production of non-alcoholic beer in EU countries, 2013–2019.

Table S5. Import and export of non-alcoholic beer in terms of quantity and value per country, 2017–2019.

Table S6. Percentage of non-alcoholic beer imported and exported by country as share of all countries, 2017–2019.