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Contents lists available at ScienceDirect

International Journal of Gastronomy and Food Science

journal homepage: www.elsevier.com/locate/ijgfs

Trends in alcohol consumption in relation to the COVID-19 pandemic: A cross-country analysis

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ARTICLE INFO

Keywords

Alcoholic beverages
 Consumer
 COVID-19
 e-commerce
 Premiumization
 Home-based experiences
 Quarantine cocktails

ABSTRACT

During the first sequence of lockdowns implemented in many countries around the world in early 2020 as a result of the emerging COVID-19 pandemic, there was widespread concern amongst many health professionals regarding a predicted rise in alcohol consumption. However, studies have reported diverse findings, with some consumer groups exhibiting an increase and others a decrease in their alcohol purchase and consumption patterns. Although the long-lasting changes in alcohol consumption, if any, are still unknown, the current situation has effectively accelerated a number of pre-existing trends which will likely continue in the future. E-commerce is growing steadily, mainly because of the restrictions within the on-trade channel and concerns around catching COVID-19 amongst consumers, thus lifting traditional barriers to the adoption of digital channels. Premiumization has also grown significantly during the pandemic, especially in the spirits category, due, in part, to the fact that consumers have been increasingly trying to recreate bar and restaurant quality gastronomic experiences in the privacy of their own homes. The trend toward homemade experiences is multi-stakeholder as consumers, retailers, restaurateurs, bar owners, and brands all try to help facilitate at-home consumption experiences. Larger size purchases seem to reflect not only the stockpiling phenomena that occurred during the initial phases of the pandemic but also convenience for consumers (e.g., avoiding queues). Additionally, the growing home mixology movement has been observed to result in consumers buying larger amounts of alcohol in order to facilitate cocktail making experimentation at home. It is important to stress, though, that this review was specially focused on available data from the first three quarters of 2020, as an effort to identify and understand the initial impacts the COVID-19 was creating amongst alcohol consumers. It currently remains uncertain how these trends will evolve, and whether or not they will continue post COVID-19 (whenever that might be). Key similarities and differences across national markets are highlighted.

1. Introduction

The emergence of the COVID-19 pandemic in early 2020 drastically changed various aspects of everyday life in many countries around the globe. Traditional patterns of alcohol consumption is one of the areas that has been severely affected by the multiple changes that COVID-19 has brought about, and by the various different measures that have been adopted by national governments in order to try and control it (e.g., Chodkiewicz et al., 2020; Kim et al., 2020). This new global situation has affected the consumers' relationship with alcohol as well. This includes everything from changes in individual consumption habits, sales

and distribution channels, socializing, drinking preferences, as well as the consumers' perspectives on future patterns of alcohol consumption, all have been significantly affected by the emergence of COVID 19. However, it is still unclear how the different trends will evolve in the months and years ahead. It would seem likely that certain of these trends will consolidate while other of our behaviors will revert to pre-lockdown patterns of behavior. Predicting the future is thus an especially important issue for the drinks industry given the increased uncertainty when it comes to factors affecting alcohol consumption.

This review presents some of the current alcohol consumption trends in European, American, and Asian countries. Based on the available

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Received 27 May 2021; Received in revised form 12 July 2021; Accepted 13 July 2021

Available online 16 August 2021

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information obtained from a number of major markets, we highlight trends that have been documented such as the faster growth of e-commerce, premiumization, at-home drinking activities, and the preference for purchasing larger sizes. At the outset, though, it is important to mention that the availability of data tends to be somewhat patchy, and for that reason, making cross-country comparisons is by no means necessarily a straightforward task. As such, we present some key findings that generalize to the different markets.

2. COVID-19 pandemic restrictions, alcohol sales, and consumption behavior

Since 2012, the global market revenue for alcoholic beverages had grown steadily. In 2019, however, this trend changed, possibly, at least in part, in relationship to COVID-19. Worldwide alcohol sales in 2019 were over 1.49 trillion U.S. dollars, but in 2020, the yearly revenue dropped by around 200 billion (Statista, 2021). Once most of the restrictions in some countries and measures (including lockdowns) had been implemented by governments in March–April 2020 in order to try and slow/stop the spread of contagion (Blavatnik School of Government, 2020), a temporary boom in off-premise alcohol sales was documented in a number of countries. Purchase and consumption data from multiple sources initially revealed a significant increase in alcohol sales in the US, United Kingdom, Australia, and Mexico, amongst others (see Table 1). However, once consolidated data became available, and more in-depth research was conducted, it appeared that sales and consumption have, in fact, both decreased.

The data revealed sales growth within the off-trade, as compared to sales made through all retail outlets such as hypermarkets, supermarkets, convenience stores, mini markets, kiosks, and wines and spirits shops (Hartziotis, 2020). This growth was to be expected given all the on-trade market, which includes sales through outlets such as bars and clubs have virtually been closed around the world (Hartziotis, 2020). For example, in the US, during the week ending April 11th, off-trade sales grew by an estimated 27%, while the on-trade decreased by 68% (Nielsen, 2020). Meanwhile, in the UK, off-trade sales grew by 20% and on-trade decreased by 40% during the first lockdown measures (IWSR, 2020a).

Numerous surveys, polls, and research studies that have been conducted during the initial lockdowns, as well as subsequently, have also shown how, for most of the population, the consumption of alcohol has either been maintained or else decreased (see Table 2). At the same time, however, an increase in binge drinking has also been reported amongst smaller groups of consumers, raising some important questions concerning how to tackle this problem from a public health perspective (Kim et al., 2020). It has also been reported that the rate of alcohol-related liver diseases in the pandemic (April to June 2020)

Table 1

Alcohol sales growth per country. Data for the US, from Statista (2020), for Mexico from Forbes (2020), for France from You (2020), for Australia from Colbert et al. (2020) for the UK from Finlay and Gilmore (2020). This table compares data from different sources, with different information gathering methodologies, and measures different reported time frames. Nevertheless, a general tendency toward a growth in consumption in each country is revealed by comparing the same timeframes analyzed in each country in 2019 and 2020.

Country	Change in sales
US	+55%
Mexico	+67%
France	-3%
UK	+67%
Australia	+28%

Table 2

Individual alcohol consumption during lockdown as compared to similar periods in 2019. Data for the US from Piacenza (2020), for Mexico from Instituto Nacional de Salud Pública (2020), for France from Santé Publique France (2020), for Australia from Alcohol and Drug Foundation (2020), and for the UK from Alcohol Change UK (2020). The percentages shown in this table highlight different answers about alcohol consumption from citizens in different countries, where 2020 lockdown periods were compared to similar periods in 2019.

Country	Increased	Stable	Decreased
UK	21%	55%	9%
US	16%	55%	19%
Australia	12%	64%	24%
France	11%	65%	24%
Mexico	12%	49%	39%

increased 1.2 times as compared with the pre-outbreak period (July 2018 to March 2020; Itoshima et al., 2020), though the exact link to the pandemic requires further research.

Although Table 2 includes results from different polls, and therefore different data sources, between 64% and 89% of all of those who were interviewed reported a stable pattern of consumption, reduced consumption, or even quitting altogether during and after the initial lockdowns. For instance, at a national level, according to the Business Research Company (2020), the US alcohol market is expected to shrink by 4%, from 552 billion USD to 528 billion USD while global alcohol consumption is also expected to decrease (IWSR, 2020b).

Individual-level changes in alcohol consumption have also been investigated (e.g., Charles et al., 2021; Chodkiewicz et al., 2020; Grossman et al., 2020; Killgore et al., 2021; Pollard et al., 2020; Sallie et al., 2020). In some countries (e.g., US, Spain, France), alcohol consumption increased during the pandemic compared with before (Marty et al., 2021; Pollard et al., 2020; Sánchez-Sánchez et al., 2020; but see Mitchell et al., 2020). For example, according to cross-sectional surveys conducted in France (n = 938, April 2020) and Spain (n = 1,073, May 2020), respondents reported a greater consumption of alcohol during the pandemic than was the case before (Marty et al., 2021; Sánchez-Sánchez et al., 2020). Moreover, in a US panel survey (n = 1,540, 1st wave: April–June 2019, 2nd wave: May–June 2020), alcohol consumption was shown to have increased during the pandemic as compared with before (Pollard et al., 2020). Similar findings were observed in a sample of US college students, such that those surveyed in spring 2020 reported more alcohol use than in fall 2019 (Charles et al., 2021). It should be noted that the degree of alcohol use in the fall of 2020 had returned to a similar level as before the pandemic in fall 2019. Another cross-sectional survey conducted in the US (between April and September 2020) has highlighted how the effects of the pandemic on alcoholic consumption are dependent of the severity of the lock-down status (Killgore et al., 2021). The results indicate a significant increase in high-risk alcohol use for those who reported living under lockdown restrictions but not those who were not.

In some countries (e.g., UK, Poland, China, Italy), alcohol consumption has decreased overall during the pandemic when compared with the situation beforehand (Sallie et al., 2020; Scarmozzino and Visioli, 2020; Szajnoga et al., 2021; Wang et al., 2020; Zipursky et al., 2021), though sub-groups reported a higher frequency of alcohol consumption, highlighting the importance of segmentation in alcohol consumption analyses. In a cross-sectional survey conducted in China (n = 2,229, between May and August 2020), Wang et al. found that alcohol consumption had decreased slightly overall in the pandemic when compared to the situation before. According to the results of a survey conducted in the UK (n = 1346), patterns of alcohol consumption during the pandemic differed among individuals (Sallie et al., 2020). People were asked to report on drinking behaviors within a typical week in November (i.e., before the pandemic) and within the last week (i.e., during the pandemic, May 2020). Self-reported alcohol consumption decreased overall during the pandemic as compared with before.

However, some people (e.g., older individuals, essential workers, individuals with children, those with higher depression) reported an increase in their consumption of alcohol.

Meanwhile, in a survey conducted in Poland ($n = 4,072$, conducted between 8 and 18 April 2020), sub-groups (men, young adults, inhabitants of big cities, and remote workers) reported a higher frequency of alcohol consumption during the pandemic lockdown, though the consumption of alcohol was decreased overall during the pandemic period. In a cross-sectional survey in Norway ($n = 25,708$, between April 15 and April 30), [Alpers et al. \(2021\)](#) measured which sub-groups had increased their alcohol consumption by using self-assessed change in alcohol consumption before and during the pandemic. The results revealed that those reporting economic worries, those in quarantine, and those working or studying from home exhibited a higher frequency of alcohol consumption during the pandemic lockdown as compared to before. Taken together, the current findings of individual-level changes in alcohol use therefore suggest that the effects of COVID-19 on alcohol consumption differ as a function of the country as well as between individuals.

Determining the exact global tendency of alcohol consumption associated with the pandemic, i.e., whether it has increased, stayed stable, or decreased, will require meta-analyses that control for a number of factors. In particular, such analyses may look, for instance, for drink types, measure types, country-specific pandemic on-set, as well as consumer segmentation, in order to derive accurate global variations in consumption.

3. E-commerce growing even in on-premise retailers

During the 2015–2019 period, alcohol e-commerce grew 15% per year in key markets around the globe ([IWSR, 2020c](#)); beer sales through this channel increased by 14%, wine by 18%, and spirits by 15% during the same period ([ISWR, 2020c](#)). However, after the start of the COVID-19 pandemic, this trend accelerated. In the US, online alcohol sales during March 2020 grew by 234% as compared to the same month in the preceding year ([Nielsen, 2020](#)). For example, Drizly, the largest alcohol e-commerce delivery marketplace in the US and Canada, and operating in 235 counties ([Doering, 2020](#)), reported a 400% increase in sales in May 2020, as compared to the same month in the preceding year ([Drizly, 2020](#)).

In México, different online retailers reported a growth of between 300% and 900% in March 2020 as compared to March 2019 ([Expansión, 2020](#)). Reports from Australia highlight an increase of over 500% in online sales after the onset of COVID-19 relative to a similar period in the preceding year ([Colbert et al., 2020](#)). Meanwhile, in the UK, a growth of more than 50% in online sales was reported during the first week after lockdown, as compared to the same week in 2019 ([Carruthers, 2020](#)).

Causes of the acceleration of this already growing trend could mainly be attributed to the restrictions imposed in several countries enforcing the closure of pubs, bars, restaurants, and many other venues where people might normally drink in public ([Globaldata, 2020](#)) as well as the fear of attending those places/venues where it may be difficult to maintain physical distance ([Grover, 2020](#)). Notably, though, this trend could grow even further, as there is a segment of consumers who have yet to purchase online. In the US alone, this group could represent up to 22% of alcohol consumers ([IZEA, 2020](#)). Online alcohol buying shows no signs of letting up. In the UK, for example, two in every five people expect to keep buying online rather than going back to physical stores ([Hillier, 2020](#)). It should be stressed, however, that expected behaviors do not always match-up with the reality of the situation.

Even on-premises channels would appear to be seizing this opportunity, as a growing number of bars, restaurants, pubs, and nightclubs develop new strategies to maintain and attract new consumers through e-commerce channels ([House, 2020](#)). Despite all of the market and consumption shifts that have been caused by coronavirus, nothing seems

to indicate that e-commerce will stop growing. However, the question remains as to the extent and rate of this growth, given that the pandemic has accelerated the trend.

4. Premiumization as a consequence of on-premises lockdown

Over the past two decades, many consumers have switched their consumption preferences towards premium alcoholic beverages, that is, beverages that have a higher quality and price ([BevAlc, 2020](#)). Due to various influences — among them increasing wealth in some segments, broader options for high-quality products and categories, and a consumer interest in, and appreciation of, production methods and origin — consumers are increasingly willing to spend more on higher-quality products across the wine, spirits, and beer categories ([BevAlc, 2020](#); see also [Pombo and Velasco, in press](#)). However, it has been suggested that current events may have accelerated this trend ([PR Newswire, 2020](#)).

Various conditions can be seen as propelling premiumization: First, luxury goods, including premium alcohol, appear, at least historically, to be more resistant to crises ([IWSR, 2020d](#)). Second, in the case of premium alcohol, some of the bestselling products in the category, such as spirits, are more frequently bought through virtual channels (apps, websites) and fine wine retail stores than in restaurants and bars ([IWSR, 2020b](#)). Considering that on-premises channels are still recovering from lockdown measures, the off-premises and online channels have become an increasingly dominant format through which costumers can buy alcohol, absorbing those customers used to on-premises purchasing and in this way facilitating the connection between premium products and this kind of customer.

Third, the restrictions imposed on restaurants, bars, and on-premises vendors when combined with the fear of those places/venues where it becomes difficult to maintain an appropriate social distance (as mentioned already, see also [Rodrigues et al., 2020](#)), is apparently pushing many consumers to explore other ways to socialize and to replicate at home the experiences that they had in bars and restaurants, including alcoholic drinking experiences (as explained below). As the prices of purchasing premium alcohol for at home consumption are typically much lower than through on-premises channels, customers seem to be intent on spending their alcohol budget on premium alcohol brands ([BevAlc, 2020](#)). In the US, whisk(e)ys above 30 USD experienced a 9% growth between March and April of 2020, which was when 32 of 50 states in the US imposed lockdown measures ([Higham, 2020](#)), compared to the same months in 2019; wine bottles priced from 20 to 25 USD, increased sales as well and bottles of gin also showed a 6% increase in sales ([BevAlc, 2020](#)).

As more consumers are staying home rather than going to on-premises locations, having more of a budget to pay for premium alcohol and trying to replicate some of the experiences that they may formerly have had in bars and restaurants (and which they may be missing under lockdown), premium categories which are growing are especially those more related to enabling those “lost experiences” such as mixology (i.e., creating home-made cocktails). The growth of spirits, for instance, could also be related to this trend, as premium alcoholic beverages are often associated with high-end, or premium, cocktails ([BevAlc, 2020](#)). In the UK, in the four weeks ending March 22nd, online sales of spirits grew by 23% as compared to 2019 through online stores and 25% in stores, gin and malt whisk(e)y performing especially strongly ([Carruthers, 2020](#)). It is expected that premium spirits will increase their share of the global market by as much as 13% by 2024, despite the COVID-19 crisis, as consumers continue to favor the premiumization trend, including cocktails and high-end sipping spirits ([IWSR, 2020d](#)). What is more, there has been a discussion in the alcohol industry around what some have coined “quarantini”, or quarantine cocktails (i.e., those cocktails that people can prepare and enjoy at home; [Hubbard, 2020](#); [Hargreaves, 2020](#); [Spence, 2020](#)).

5. Home-based alcohol experiences

As many bars, restaurants, and nightclubs have had to close temporarily or else had severe restrictions placed upon their operations because of the COVID-19 pandemic, consumers have been exploring other ways in which to replicate similar experiences at home. Meanwhile, those working in on-premises and off-premises channels have also been trying to develop strategies to enable this emerging trend. In this respect, home mixology seems to be experiencing a growth in part because of the desire to have social experiences online while at the same time maintaining social distancing (Rizo, 2020).

Indeed, the COVID-19 pandemic has qualitatively influenced the quality/kind of gastronomic experiences that consumers have at home. For example, craft cocktails have been growing in the US, where a number of states are changing their laws in order to permit home cocktail deliveries (Spence et al., 2021). As suggested by Spence and colleagues, this seems to happen as meal boxes and high-end gastronomic experiences to be enjoyed at home have been emerging through the COVID-19 pandemic. This has also become an opportunity for food and beverage business to develop novel pairing experiences, such as, for example, introduced by the collaboration between chef James Ramsden of Pidgin and Wychwood Brewery in 2020. Following the increasing interest in insect foods, they offered a bug and beer Halloween tasting menu, which the brewery also delivered in the form of kits for people at home (My Beer Notes, 2020).

A survey of 1500 people in the US, revealed that more than half of the interviewees reported having prepared themselves cocktails during the past months and 54% stated that they intended to keep this habit up (Drizly, 2020). The same survey, from US retailer Grizly, reported an exponential growth of sales of liqueurs, cordials, schnapps, and mixers (of between 600% and 1000%) with sales of vermouth growing by 1200% (Captain, 2020). In the UK, during the week ending April 5th, the retailer The Whisky Exchange, stated that tonic water, whisk(e)ys, and liqueurs were among the best-selling products during the week of 23–29 March of 2020 (Carruthers, 2020).

However, strategies developed by producers, distributors, and bars are also aimed at replicating elements of the overall multisensory drinking experience in the home environment, delivering their products directly into the home. For instance, premixed cocktail kits have seen substantial growth in the US (Nielsen, 2020), as have some other more creative initiatives around the world. So, for example, in Australia, pubs developed marketing strategies in order to recreate the entire pub experience at home, sending their clients a box of craft beer, appetizers, glasses, pub snacks, music playlists, or even vinyl records while having an online chat with owners and clients (Mazzeo, 2020). In France, some bars have been offering their customers bottles of take-away cocktails for six people at a reduced price (Spiritshunters, 2020).

In the UK, wholesalers have developed innovative and environmental packaging to send samples to their clients (e.g., flat bottles that can fit through the mailbox). Others, meanwhile, are using Zoom and other apps in order to conduct virtual tastings of their products (Nicklin, 2021). Finally, not only are crafting or mixing experiences on the rise, but ready-made beverages are also becoming increasingly popular. In fact, the so-called Ready-to-Drink (RTD) market, which is a trend that was already growing, has seen a 12% increase in the volume of sales globally compared with 2018 and 2019 sales (GlobalData, 2020). RTD seems to be a category that is especially strong amongst the ongoing COVID-19 pandemic crisis, as consumers look to replicate the overall experience of having a cocktail at home, but without having to spend too much time or money as would be required to prepare a cocktail at home from scratch (Schiesl, 2020).

The trend of home experiences appears to have been driven, or at the very least accelerated, by the pandemic, as it was not necessarily driven by consumer demand *per se* but consumer demand strongly linked to external causes. As such, it is uncertain whether the trend will continue to grow in a post COVID-19 world, or at the very least maintain some of

its stronger components, such as consuming RTD cocktails at home, or even continuing with home mixology, given the already existing interest in these, at least in some consumers, even before the pandemic took hold.

Consistent with global trends associated with social distancing, the drinking situation has mainly moved from face-to-face drinking parties (e.g., at the pub or bar) to at home consumption. An online survey (n = 502, July 2020) shows that almost half of the respondents (51.6%) had not joined a face-to-face drinking party at all (Supaliv, 2020). Japanese consumers have experienced alternative ways of drinking alcoholic beverages with others. Aligned with the global home-based alcohol experiences trend, an online survey (n = 10,186, June 2020) shows that 18.3% of Japanese adults have taken part in online drinking parties using Zoom during the pandemic (see Hot pepper gourmet gaisyoku souken, 2020). Most popular social companions during online drinking parties were friends (48.3%). The proportion of online drinking parties with co-workers was smaller (22.5%) than with friends. Interestingly, among those consumers who had experienced an online drinking party more than half (58.3%) expressed a desire to repeat the experience.

6. Social distancing through multipacks and larger volume alcohol sales

Another global trend is related to stockpiling and buying larger sizes of alcohol. Some of the reasons behind this behavior, include the fact that people are shopping less frequently, given restrictions on movement and concerns over contagion and because of a desire to avoid queues while waiting to buy goods which is stimulating more larger-size alcohol and multipacks sales (Byington, 2020). For example, in Australia, 1.75 l bottles of spirits showed the largest increase in March 2020, while 375 ml bottles showed the smallest increase (Micallef, 2020). Some other off-premise channels and online beer stores have experienced the same phenomenon with the 24-pack category increasing by 24% (Nielsen, 2020). In the US, comparing the year ended February 29th to the seven week COVID-19 impacted period ended April 18th, sales grew up to 10 times for boxed wine and 23 times for 1.75 l bottles of spirits; beers as well have increased larger pack sales: 30-packs have been up to 21% while 24-packs up to 20% (Nielsen, 2020).

7. Conclusions

Due to the COVID-19 pandemic, alcohol consumption around the world has changed in a number of meaningful ways. Most of these changes have varied according to the specific political, social, economic, and/or cultural context of each country. For instance, consumer behavior could have been affected depending on the severity of measures adopted by national governments to control the epidemic (see Nadkarni et al., 2020 for forced alcohol abstinence in India), as well as sociocultural factors (e.g., De Mooij and Hofstede, 2011, for a review). From an economic perspective, for example, developed countries might have also resisted better in economic terms, mostly because of the provision of state aid handouts and high-income salaries of the population concerned. But in developing countries, the economic consequences probably had a stronger impact, as income is lower and public financial capacity is weaker (Rodela et al., 2020), and this could have had a major impact on alcohol consumers' purchasing behavior. However, there have been a few trends which are noticeable, and which have been shown to have taken place in several countries spanning different continents.

Online commerce was already growing, but the conditions that have been created by COVID-19 (lockdowns, social distancing, etc.) would seem to have facilitated its adoption, boosting it even further. We predict that this trend will continue to grow, perhaps at a faster pace than before, given the acceleration of e-commerce that has resulted from the pandemic. Premiumization has been a growing trend in recent decades and COVID-19 has certainly not slowed it down. Whether the pandemic

will transform it long-term or not remains to be seen but it is, perhaps expected, that once lockdowns stop and places like bars and restaurants reopen, this may return to the way it was before the pandemic. Home-based experiences are currently one of the key growth areas when it comes to alcohol drinking behaviors. Either for the need to replicate bar and restaurant experiences at home, or because the latter have developed strategies to sell their products direct to the customer's home. As home drinking increases, so too has the interest in mixology, and sales of premixed and RTD beverages in a number of markets. We anticipate that this trend will continue to grow as the market develops.

As home-based experiences are strongly related to high quality alcohol ingredients, and premiumization seems to keep growing, a decrease in alcohol sales could also be predicted. This could be a result of the decision of consumers to spend more on better (i.e., more expensive) alcohol, which will refocus the budget spent in alcohol into lesser occasions but with a more rewarding overall experience.

Larger pack sales grew as people found themselves shopping less frequently, given concerns around catching COVID-19, and because of a desire amongst consumers to avoid queues. Mixology could also be influencing this trend as consumers will undoubtedly need a greater number of different types of alcohol to experiment with at home.

Despite the evidence showing how the analyzed trends are occurring simultaneously in various markets around the world, it remains to be seen whether they will remain post-COVID-19. It could be possible for those trends that are more related to the intrinsic dynamics of the alcohol culture (such as premiumization and e-commerce) to continue to grow, as they were already doing before the pandemic started. On the other hand, the future of home experiences and larger purchase sizes remains more uncertain, as these trends were undoubtedly boosted by an external force, namely the COVID-19 pandemic.

As the situation of the pandemic continues to affect many countries around the world, there should be an effort to conduct longitudinal and cross-country research to better understand how these trends evolve and others may appear. In addition, to further expand and develop our understanding of the changes in consumption as new data is revealed. At present, the availability of data tends to be a little patchy. It will also be important to further evaluate the specific characteristics of the audiences of each of the trends reported here.

Although behavioral patterns of consumption could have remained relatively unchanged for a while, the impact could drastically change in the mid- and long-term, as restrictions and other consequences created by the COVID-19 pandemic affect societies and their individuals in a wide variety of ways. Additionally, other factors may show up as being influential to behavioral changes, such as stress (Cummings et al., 2021) and should be analyzed within the causes of consumer changes. This should be performed to better understand how an event like a pandemic, and the conditions that it creates for consumers, can affect the relation between society and alcohol in the long term.

Funding

This research was funded by a grant to C.V. from Asahi Breweries.

Author contributions

AP, KM, & CS: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Roles/Writing - original draft; Writing - review & editing. CV: Conceptualization; Data curation; Formal analysis; Funding acquisition; Investigation; Methodology; Project administration; Resources; Supervision; Validation; Roles/Writing - original draft; Writing - review & editing.

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