

Research Article

Fatality, Malpractice, or Sabotage? Case on Craft Beer Poisoning in Minas Gerais, Brazil

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Abstract: In early January 2020, nineteen people got contaminated with the toxic substances' Mono and Diethylene Glycol, from drinking local craft beer at Minas Gerais, southeastern Brazil. Among the injured, four died. While Brazilian Police investigate the poisoning case, the Ministry of Agriculture suspended production and recalled all products from the brewery, as preventive measures. Three are the hypotheses investigated by the Federal Police: leakage, sabotage, or malpractice, through the misuse of a related chemical known as mono and diethylene glycol. There is no case solution this far. Key findings pointed out contamination raising suspicion among craft-beer consumers in Brazil. Some of them have replaced the contaminated beer brands with other craft beer labels. Others are suspicious of the quality of the overall craft beers produced in Brazil. Others Analysis and discussion compile the present study.

Keywords: Craft beer, brewing industry, Brazil.

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INTRODUCTION

The present article investigated a craft beer poisoning case, occurred in Minas Gerais, southeastern Brazil, as the unit of analysis (Yin, R. 1988).

Late December 2019, local authorities reported a fatal “mysterious disease”, in which death cause was unknown. In total, N=19 victims were detected, with four deaths.

The cases remained unsolved until January 10th, 2020, when investigation pointed out that all victims had in common the consumption of a local craft beer.

Further analysis evidenced significant traces of Monoethylene glycol (MEG) and Diethylene glycol (DEG), found in the victims' blood samples, as causes of four deaths.

After investigation, the craft beers *Belorizontina* and *Capixaba* - both produced by the local brewery *Backer*, were pointed out as causes for poisoning with MEG and DEG.

The local brewery was temporarily closed, and its products recalled for severe inspection, after four casualties and fifteen non-fatal cases of poisoning.

This study was primarily investigated following previous cases on craft beer in Brazil (Dias, M. D. O., & Teles, A. 2019; de Oliveira Dias, M., & Falconi, D. 2018; & Dias, M. D. O. 2018). The current poisoning case has had international repercussion (Reuters. 2020) and has been investigated by the Brazilian Police and Ministry of Agriculture. Data were collected from the Governmental archives such as the Ministry of Agriculture (MAPA 2020).

Beer is, by far and large, the most consumed alcoholic beverage in Brazil (see Figure 3) (Dias, M. D. O., & Teles, A. 2019; de Oliveira Dias, M., & Falconi, D. 2018).

Craft beer follows the trend for increased consumption of alcoholic drink in Brazil. The number of craft breweries in Brazil has grown enormously in the last decade, jumping from 356 to near 1,000 in the previous four years (Dias, M. D. O., & Teles, A. 2019), following an international trend, as illustrated in Figure 1:

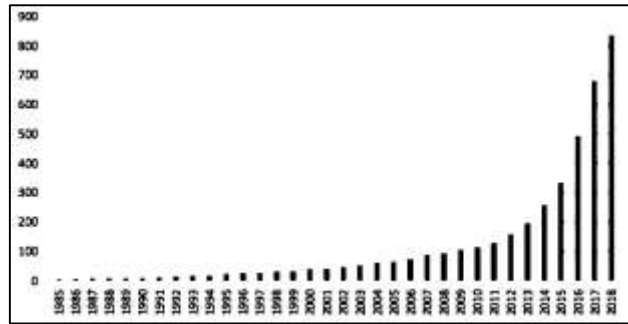


Figure 1. Craft beer industries in Brazil (1985 to 2018). Source: Ministry of Agriculture, Fishing and Supply, 2018.

Beer is also defined by the Brazilian Law N° 8.918/94, Chapter II, Section I, art. 64, as “the beverage obtained by the alcoholic fermentation of brewer's wort from barley malt and potable water, by the action of yeast, with the addition of hops (Brasil 1994).”

Brazilian beers are classified as (i) light beer; (ii) common beer; (iii) Extra beer; (iv) strong beer. Are also classified according to the color: (v) light beer, with a color corresponding to less than 20 EBC (European Brewery Convention) units; (vi) dark beer, the color of which corresponds to twenty or more EBC (European Brewery Convention) units (Brasil 1994).

Brazilian beers are also classified according to alcoholic strength as (vii) non-alcoholic beer; (viii) beer with alcohol, when its alcohol content is equal to or greater than one-half percent by volume; according Law

N° 8.918/94, item IV (Brasil 1994) - for the proportion of barley malt in (ix) pure malt beer, one containing one hundred percent malt of barley by weight on the original extract as a source of sugar; (x) beer having a proportion of barley malt greater than or equal to fifty percent by weight on the original extract as a source of sugar; (xi) beer bearing the name of the predominant vegetable, one having a proportion of barley malt greater than twenty-less than fifty percent by weight on the primitive extract as a source of sugar. Finally, beers in Brazil are also classified according to the fermentation levels: (xii) low fermentation; and (xiii) high fermentation (Brasil 1994).

Finally, beers in Brazil are known as *Pilsen, Lager, Export, Dortmunder, Bock, Weissbier, Malzbier, Ale, Porter* [7, Art. 67]. Figure 2 illustrates the Brazilian brewing industry market share.

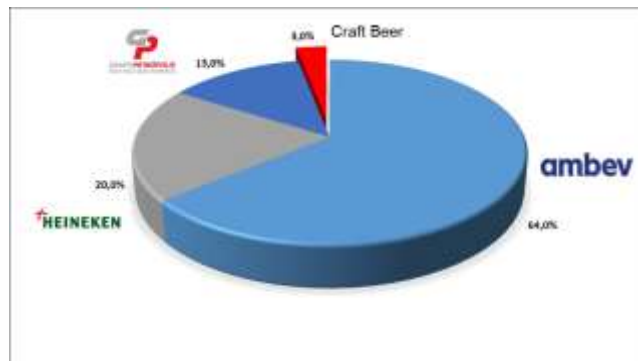


Figure 2. Brazilian Beer market. Source: Euromonitor, 2018, and Dias & Falconi (2018). Reprinted under permission.

Observe in Figure 2 that craft beer industries represent three percent of the total. Note that *Ambev* (64 percent), *Heineken* (20 percent), and *Grupo Petropolis* (13 percent), are the major players in the Brazilian

brewing industry. Finally, beer is also the most consumed alcoholic beverage in Brazil, as depicted in the following Figure 3:

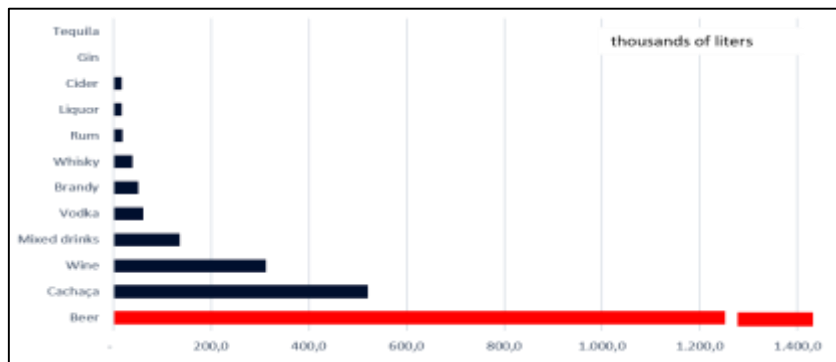


Figure 3. Brazilian consumption per type of beverage. Source: Euromonitor, 2018.

Observe in Figure 3 that beer is consumed 28 times more than *cachaça*, the second most consumed alcoholic beverage in Brazil (Euromonitor International, 2018).

MONO AND DIETHYLENE GLYCOL

Diethylene glycol (DEG) is an organic compound, which the formula is $C_4H_{10}O_3$, practically odorless, poisonous, colorless, hygroscopic liquid, miscible in water, alcohol, ether, acetone, and ethylene

glycol [12]. Diethylene glycol is derived as a co-product with mono ethylene glycol (MEG). DEG is found as a byproduct of MEG. It is used as (i) solvent (e.g. for oil); (ii) humectant (e.g. tobacco, glue); (iii) component for lubricants; (iv) antifreeze (e.g. wine and beer industries, for instance, to slow down the fermentation process), among others (Schep, L. J. *et al.*, 2009). DEG structure is illustrated in the following Figure 4:

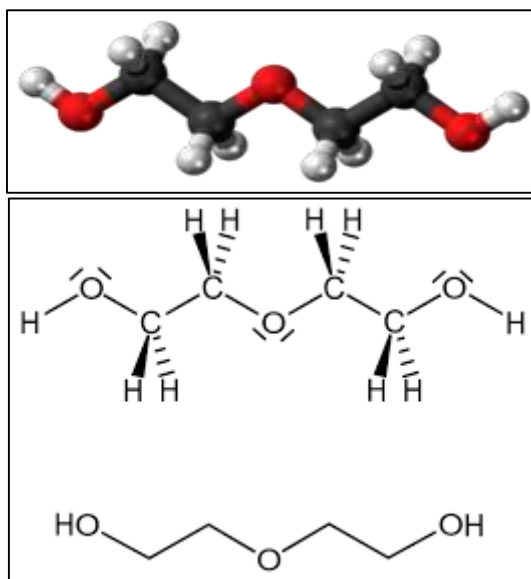


Figure 4. Diethylene glycol. Source: Schep *et al.*, (2009).

Both MEG and DEG are poisonous and can lead to death if ingested.

PREVIOUS CONTAMINATION CASES

MEG and DEG poisoning first case occurred in 1937 within 15 states of the USA (105 casualties); in 1990, for instance, Nigerian government identified MEG and DEG in paracetamol syrup, responsible for 47 children dead. Cases were also detected in Argentina, India, Haiti, and Bangladesh (this one with

336 casualties from 1990 to 1992, due to paracetamol syrup consumption). Regarding alcoholic beverages contamination, only one case was registered, in 1989 in Austria, where MEG and DEG was found in wines, with no casualties (Schep, L. J. *et al.*, 2009).

RESEARCH METHODS & LIMITATIONS

The present descriptive case study is a qualitative, inductive, interpretive study, employing multiple methods study, involving archival research, and a single case study, which unit of analysis (Yin, R.

1988) is the Backer craft beer contamination case in Brazil. Figure 5 depicts the brand *Belorizontina*, craft-brewed by the local industry Backer, from Belo Horizonte, Minas Gerais, southeastern Brazil (Backer. 2020).



Figure 5. Backer's Pilsen *Belorizontina* craft beer. Source: Reuters 2020.

This research is limited to the Minas Gerais craft beer market, in which N=1 brewing industry was investigated, Backer excluded other countries and beverages, such as cachaça, and wine, for instance. This work is also restricted to the Brazilian Beverage Law Nº 8.918, from July 14, 1994 (Brasil 1994).

BACKER BREWERY: OFFSPRINGS

Brazilian family business, the Backer Brewing industry, was created by the brothers Halim and Munir Lebbos in 1999, in the Western Region of Belo Horizonte (Minas Gerais State), located in the Olhos D'água neighborhood. Backer is registered as the first craft beer brewed in Minas Gerais (Backer. 2020).

The beer *Belorizontina* was created in December 2017 to honor the 120 years of the Minas Gerais' capital, *Belo Horizonte*, according to the founders (Backer. 2020).

Backer has been awarded 55 times from 2014 to 2018, both national and international awards. The most significant awards were (i) the 2nd best brewery in Latin America (2015), (ii) World Beer Awards in London – four prizes (2017), and (iii), Mondial de la Bière in Rio de Janeiro (2017), among others (Backer. 2020).

CONTAMINATION: MYSTERIOUS DISEASE

From December 19th, 2019, to January 5th, 2020, eight people were admitted to Minas Gerais' hospitals, without even a clue about the cause of the severe symptoms of intoxication reported (in total,

N=19 people were contaminated, in which four died). The case attracted media and social network attention. A "Mysterious disease causes death in Minas Gerais," published *Revista Veja*, on January 9th (Veja 2019), for instance:

Patients have gastrointestinal problems - such as nausea, vomiting and abdominal pain -, acute renal failure and neurological changes - with paralysis and difficulties in vision. For these characteristics, the syndrome has been called "nephro-neural". However, the cause is still unknown (Veja 2019)

At that moment, the possible hypotheses discussed amongst doctors were infection or intoxication (Veja 2019). The average number of days between symptom onset and hospitalization was 2.5 days (Veja 2019).

All of them had acute renal failure with rapid evolution (up to 72 hours) and central and peripheral neurological disorders. As the cause of the disease is not yet known, it is not yet possible to make an effective treatment or a prognosis of the patients' health status (Veja 2019).

Minas Gerais health authorities, as the Center for Strategic Information in Health Surveillance (CIEVS Minas) had received the first notification on December 30, according to an official note:

Several hypotheses about the probable origin of the cases of 'nephro-neural syndrome' are circulating on social networks. SES-MG clarifies, however, that none

of these were proven by the investigations (Braziliense, Correio; Braziliense, Correio 8 de janeiro de 2020).

FIRST DEATH

On Tuesday, January 8th, the *Correio Braziliense* headlined: “Patient who was hospitalized with mysterious disease dies in Minas Gerais” (Braziliense, Correio; Braziliense, Correio 8 de janeiro de 2020).

The first patient to die from the “mysterious disease” was Paschoal Dermatini Filho, 55 years old, who was hospitalized at *Santa Casa de Misericórdia* in Juiz de Fora (Minas Gerais). His daughter, Camila Dermatini, who is a pharmaceutical professional, decided to investigate the matter, contacting the other patients through social networks (Veja 2019), (Braziliense, Correio; Braziliense, Correio 8 de janeiro de 2020). After research, it was found that all the patients had drunk Backer’s *Belorizontina* beer. The suspicion was then referred to the Ministry of Agriculture – MAPA (Ministério da Agricultura, Pecuária e Abastecimento), who started investigations.

MINISTRY OF AGRICULTURE INVESTIGATES THE MYSTERIOUS DISEASE

Meanwhile, according to the Ministry of Agriculture Report *Apurações Administrativas Cervejaria Backer* (MAPA 2020), Federal government official ministry responsible for the control of craft breweries in Brazil, from January 2020, the following sequence of events took place:

On January 7th, MAPA performs inspection at the Backer brewery, collecting three lots of beer and raw materials (*Belorizontina* and *Capixaba* beers), also investigating the acquisition of raw materials (MAPA 2020).

Three days later, on January 10th, MAPA decided to close Backer as a measure of prevention and ordered a massive product recall (MAPA 2020). Three days later, on January 10th, MAPA decided to close Backer as a measure of prevention, and ordered a massive product recall (MAPA 2020).

RESULTS AND ANALYSIS

On January 14th, traces of mono and diethylene glycol were found in the victims’ blood test, according to the following Figure 6:

Brand	Lot	diethylene glycol	monoethylene glycol
Belorizontina	L2 1354	present	present
Belorizontina	L2 1348	present	present
Capixaba	L2 1348	present	present
Belorizontina	L2 1197	present	present
Belorizontina	L2 1604	present	absent
Belorizontina	L2 1455	present	absent
Belorizontina	L2 1464	present	absent

Figure 6. Backer’s lots analysis results. Source: MAPA (2020).

Observe in Figure 5 that diethylene glycol was found in seven lots investigated, while mono ethylene glycol was found in four over seven lots investigated (57 percent).

Evidence pointed out by MAPA suggests: (i) mono ethylene glycol buying acquisition notes indicated a high consumption of the substance in the brewery, which is normally used in a closed cycle in brewing processes; (ii) refrigeration without justifying

such consumption. Evidence indicated that the contamination (iii) occurred on the premises of the company; (iv) the residual water found in the plate cooler showed a positive result positive for both mono and diethylene glycol; (v) the presence of both mono and diethylene in a beer tank in elaboration was found and attested by the MAPA report (MAPA 2020).

The contamination, after analysis, is illustrated in the following Figure 7, as follows:

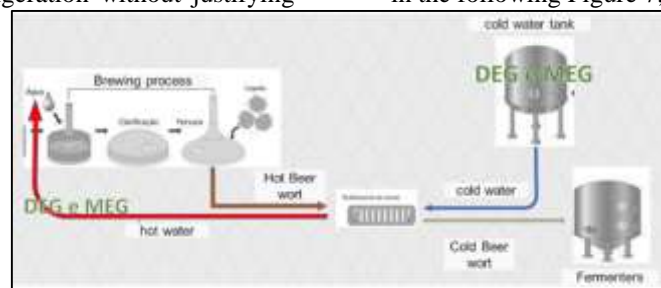


Figure 7. Contamination process. Source: MAPA (2020).

As a result of the MAPA intervention, 139,000 l of bottled beer, and 8,480 l of draft beer were apprehended (MAPA 2020). MAPA has also decided that Backer will remain closed until it proves safe conditions for operations (MAPA 2020).

DISCUSSION

The investigation evidenced that traces of both mono and diethylene glycol were found in all N=19 (See Figure 6). All products were recalled from the market, as a preventive measure to avoid further contaminations. Craft beer consumption has, therefore, decreased since the contamination occurred.

Police investigates the case based on three hypotheses: (i) sabotage, (ii) leakage, or (iii) malpractice, with no conclusion while this article is written.

One implication regards the seasonality of beer consumption in Brazil: from December to March it is summertime in southern hemisphere, when the beer is the most consumed alcoholic beverage in Brazil, especially on New year's celebration and Carnival (in 2020, from February 21 to 23), when traditionally, beer consumption spikes are usually recorded.

One possible outcome is the consumers shifting into other brands, even the more traditional beers, disregarding the craft ones, at least temporarily.

The implications of the contamination for the company proved to be a disaster. Despite the best efforts of the brewery owners to assist victims, the police investigation and the consequent opening of legal proceedings may result in high penalties for both technical and administrative brewery managers. If condemned, it may represent the definitive closure of the first craft beer industry from Minas Gerais, and one of the most awarded in the recent Brazilian history.

Finally, future research is encouraged to visit the case, following up on the current victims' current status.

Also, the impact on the craft beer industry of the potential decrease of consumption in the Brazilian craft brewing industry.

Further studies are also encouraged to determine best practices to avoid contamination by mono, diethylene glycol, or other toxic substances of the brewing process.

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