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Quality and Toxicity of Alcoholic Beverages in Russia: Interdisciplinary Approach

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Abstract

There is abundant literature about alcohol consumption and alcoholism in Russia. However, some papers operate mainly with truisms and generalities about health damage from alcohol. Practical realizations of such approach were indiscriminate social policies such as the anti-alcohol campaign (1985-1989). Later on, a questionable concept has been propagated that the quantity but not quality of consumed alcohol is important for health. This coincided with the quality decrease of beverages. Industrial alcohol-containing liquids were sold in vodka bottles causing severe poisonings. Following abolition of the state alcohol monopoly in 1992, the country was flooded by beverages of poor quality, sold through legally operating shops and kiosks, which caused severe poisonings. Thereafter, the quality has improved while the consumption tended to decrease. It should be stressed in conclusion that the government must care about weaker members of society, including those suffering of substance use disorders and alcohol-related dementia, because they can be poisoned by toxic beverages, abused and expropriated by criminals. In regard to the future research, poor quality beverages containing toxic admixtures are of particular importance. Addition of ethanol from non-edible sources to beverages should be prohibited or, at least, its presence must be clearly indicated on labels. An interdisciplinary approach is necessary to objectively elucidate the problem.

Introduction

There is abundant literature about alcohol consumption in Russia. Many publications operate with truisms and generalities about health damage from alcohol. A practical realization of such approach has been indiscriminate policies such as the anti-alcohol campaign (AAC) launched in 1985 and ended with a failure by 1988-1989. Later on, an unfounded concept has been propagated that the quantity but not quality of consumed alcohol is important for health [1]. This coincided with a considerable quality deterioration of beverages sold through legally operating shops. Industrial alcohol-containing liquids were sold in vodka bottles causing severe poisonings; details and references are here below and in the preceding paper [2]. Alcohol misuse is an issue that expands beyond its physical and psychological consequences [3]; therefore, it is attempted here to apply an interdisciplinary approach, discussing toxicological, social and psychological aspects of the problem.

Focused review

The AAC started 1985 was initially effective, but ended with a failure and was accompanied by increased consumption of home-made moonshine (samogon), technical liquids and eau-de-colognes. After 1987, the alcohol consumption was increasing, while vodka enhanced its share in the total. The production of beer and especially of wine decreased considerably [4]. Apparently, the AAC and its predictable failure were exploited for political and economic purposes. The AAC destabilized the Soviet society; widespread drunkenness in the 1990s acted like anesthesia during a surgery: workers and intelligentsia did not protest against privatization of the state property because of their drunkenness. During the AAC, many distilleries producing spirits from grain and potatoes were dismantled[4]. At the same time, technical ethanol met no demand from the stagnating industry. Official permissions to use alcohol from non-edible raw materials for production of beverages were issued during the 1990s[1]. Some permissions have later been revoked but, in conditions of disregard for laws and regulations, the use of technical ethanol has been continued. It is known from practice and animal experiments that alcohol produced by synthesis from acetylene or by hydrolysis and fermentation from sawdust/woodchips is more toxic than that from edible sources [5,6]. Later on, purified ethanol from non-edible raw materials was claimed to be compatible with requirements to beverage alcohol [1]. However, purification costs money; so that one can never be sure that it had been adequate. Bioassays may overestimate toxicity of alcohol produced from edible sources as animals are not adapted to it. Human consumption of alcohol predates recorded history and is theorized to have adaptive significance [7]. An evolutionary adaptation to by-products of natural fermentation can be reasonably assumed. Alcohol from non-edible raw materials has a different spectrum of admixtures: higher concentrations of butanol, butanone, methyl butyl ketone, crotonaldehyde, acetone, diethyl ether, acetaldehyde etc. [8]. Adaptation to some new by-products is lacking. This topic needs further research.

Claims that the quantity but not quality of alcohol is important for health[1] distract the public attention from toxicity of some legally sold beverages. Phrases like "Alcohol is the chief killer" in Russia [9,10] are suitable to disguise the shortages of public healthcare, shifting responsibility for the comparatively low life expectancy from authorities onto patients i.e., supposedly self-inflicted diseases due to excessive alcohol consumption. In addition to alcohol abuse, the inadequacies of the Russian health care system have contributed to the enhanced mortality [11]. Excessive alcohol consumption is a criminogenic factor [3]; however, the alcohol-related crime is exaggerated by some professional literature and the media. In this way the organized crime and corruption are obfuscated. Moreover, alcohol is often mentioned in the context of family violence and child

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abuse. Without denying the problem, it should be commented that it is easier to denounce a socially unprotected offender, in particular, if he or she suffers a substance use disorder. Otherwise, various tools are applied to prevent a disclosure of domestic violence: denial of facts, allegations of slander, threats and provocations, appeals to preserve honor of the family or an ethnic/confessional community.

After 1990, together with inflation and transition to the market economy, the prices and qualities of beverages diversified. New labels appeared and disappeared; names and qualities correlated poorly. Imported products had sometimes been good in the beginning but later were replaced by imitations. Well-known wines and spirits changed their taste or were replaced by surrogates containing technical ethanol with flavor and color additives [1,12-14]. The astringent taste of technical alcohol is known as it was regularlystolen from factories and scientific institutes, being often consumed during the AAC. The relative proportion of counterfeit beverages on sale is difficult to determine; apparently, it has been higher outside Moscow than in the Capital. The literature rightly discusses "the sale of illegal alcohol by legal retail outlets"[15]. The following data have been published: in the 1ate 1990s, ~60% of legally sold alcoholic beverages contained insufficiently purified ethanol produced by synthesis from acetylene or by hydrolysis of cellulose (sawdust) [12]. In 2007 about a half of all vodka originated from illegal sources; wine and cognac being often falsified as well [1].

After 1991, the consumption approached the level prior to the AAC[10]. Following abolition of the state alcohol monopoly in 1992, the country was flooded by drinks of poor quality, sold through shops and kiosks. For example, in Karelia, the incidence of lethal alcohol poisonings increased 3 times while the average blood ethanol concentration in such cases increased 1.4 times [1]. Simultaneously, the mortality from acute alcohol poisonings in the Arkhangelsk province increased by 234.6% [16]. For the whole Russian Federation (RF), the mortality rate from alcoholic poisonings increased from 1998 to 2004 by 58 % [17]. Among regions of RF, the highest mortality rates of alcohol poisonings in the period 2001-2010 were registered in Siberia [18], where vodka had been of low quality since decades. The following absolute figures of lethal poisonings with alcohol-containing fluids were reported: 1998 - 21,800, 1999 - 24,100, 2000 - 27,200[19]. Among causes of death and autopsy findings in such cases was intravascular coagulation, acute tubular necrosis with renal failure, pancreonecrosis, bleeding erosions and ulcers of stomach and esophagus[20]. Unrecorded figures were certainly higher as many cases, remaining unclear for lack of toxicological tests or other reasons, were diagnosed post mortem with cardio- and cerebro-vascular diseases.

Some legally sold beverages caused severe poisonings. It is acknowledged in the professional literature that vodka was manufactured from technical liquids and then sold through legally operating shops [21,22], generally with the knowledge of authorities. Numerous lethal intoxications after the intake of moderate doses were reported, while the blood ethanol concentration was relatively low [1,12,17,21,23]. A tendency of the quality improvement has been noticed since approximately 2010. Reportedly, 27% of all alcoholic beverages were counterfeit in 2021 [24]. The alcohol-related mortality in RF was decreasing in the period 2010-2019 (with the exception of the year 2018). Interestingly, the mortality was decreasing also in the areas with a temporary increase in alcohol consumption [25], which can be explained by the quality improvement of beverages and decline in heavy binge drinking. In general, the alcohol consumption tended to decline in Russia since approximately 2010 [26]. The current situation is difficult to evaluate due to questionable reliability of published statistics. It seems that today there are more inebriated people in Moscow streets than 5-10 years ago. Poor-quality beverages are on sale now as before.

In 2006, a mass poisoning with jaundice in different regions of RF was supposedly caused by disinfectant Extrasept-1 sold in vodka bottles, which contained, apart from ethanol, 0.08-0.15% of diethyl phthalate and 0.1-0.14 % polyhexamethylene guanidine hydrochloride (PHMG)[27]. The number of poisonings in the period August-November 2006 was 12,611 cases, among them 1189 lethal ones [28,29]; factual figures must have been higher. Histologically, "cholestatic hepatitis with a severe inflammatory component" was described [29]. Of note, PHMG is not particularly hepatotoxic; it is used worldwide for disinfection of swimming pools. The clinical picture with predominance of liver injury did not correspond to the toxicity profile of PGMG [30]. Reportedly, the mean lethal dose of Extrasept-1 in animal experiments is not much lower than that of purified ethanol: 9.7 vs. 12.3 mg/kg [31]. The median lethal dose (LD_{50}) of PHMG, administered orally, has been around 450 mg/kg for mice and 630 mg/kg for rats [32], while the animals died with signs of injury not of the liver but of the nervous system [33-36]. Lung lesions due to PHMG used in household humidifiers have been reported [37]. Experimentally, the substance showed lower toxicity when given via routes other than inhalation [38].

The proposal to develop global strategies learning from the Russian experience [39] is precarious because somestatistics from RF are of questionable reliability [40]. The data on the 2006 mass poisonings have been cited in the professional literature and could have influenced conclusions, which is potentially misleading for toxicity assessments of PHMG and the related substance polyhexamethylene biguanide (PHMB). The reported difference between LD_{50} estimates in rats for PHMG and PHMB by the same researchers in two consecutive studies was striking: 600 vs. 25.6 mg/kg[33,34]. Note that general toxicity of both substances is comparable with LD_{50} values 500-800 mg/kg in rats when administered orally [31,41]. The question is whether the figure 25.6 mg/kg[34] could have resulted from added precaution due to the information on mass poisonings in RF[29] cited by Asiedu-Gyekye et al. [34]. Recent papers on PHMB toxicity have also referred to the poisonings in RF, whereas the role of PHMG as a causative factor was not questioned [38,41]. The experimental study [38] revealed no hepatotoxicity. Further objective research is needed. As for diethyl phthalate, its acute toxicity to mammals is low [42,43]. Some phthalates induced liver injury in experiments; but it has not been confirmed when tested in primates [44].

Apart from PHMG, "chloride compounds" have been discussed as possible causative factorsof the mass poisonings [30,45]. There is a hypothesis that carbon tetrachloride, dichloroethane or other organochlorides, used in dry cleaning of clothes, caused the intoxications [46,47]. In some individuals, supposed to have died after drinking Extracept-1, carbon tetrachloride was found in tissues

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post mortem[31]. In many patients the onset of severe poisoning was related to the consumption of vodka purchased in a shop[30]. As discussed above, technical liquids were used for production of vodka, added to beer and wine. This has been veiled by certain writers creating impression that consumers deliberately bought surrogates for drinking: "This outbreak was caused by the consumption of antiseptics with chloride compounds due to the deficit of other non-beverage alcohol"[45]. This was also the standpoint of the Health Ministry [48]. In fact, there was not the "deficit of other non-beverage alcohol" [45]but a temporary deficit of vodka in 2006 caused by the elevation of excise duties[19]. The shortage was compensated by surrogates sold in vodka bottles[28].

Furthermore, 74 lethal cases were reported from Irkutsk in 2016. According to the published information, the poisoning was caused by the bath lotion Boyaryshnik (Hawthorn) containing up to 93% of ethyl alcohol[49,50]. The author has found no reliable information on Hawthorn bath lotion containing 93% of ethanol. Inscriptions on labels may be misleading and contradicting to organoleptic properties. Note that concentrated solutions are usually more expensive per unit of the solved substance. It has been suspected that the cause of the poisonings was the medicinal hawthorn (Crataegus) tincture containing 70% of ethanol [51]. The tincture is the pharmacy product consumed by some drinkers in Russia[52,53]. Such tinctures are relatively expensive these days; some consumers buy them because they hope for a higher quality of alcohol than vodka from the shop. The misinformation was probably intended to disguise the fact that methanol was used as a cheap substitute for medicinal ethanol.

According to the World Health Organization, "unrecorded alcohol… is produced, distributed and sold outside formal channels" [54]. The concept of unrecorded alcohol is not directly applicable to RF without a comment that ethanol from non-edible sources has been used for production of beverages sold through legal shops, generally with the knowledge of authorities[5,14,15,23]. Exaggeration by some writers of "unrecorded" alcohol is shifting responsibility for poisonings onto consumers, who allegedly prefer surrogates [55]. Overtly misleading statements can be found in the current literature: "The consumption of non-beverage alcohol is the most concerning type of alcohol consumption in Russia. This type of alcohol includes industrial surrogates such as medical alcohol, aftershaves, antifreeze, *tooth powders, glues, kerosene*[emphasis added], and brake fluid. It was easily accessible and widely consumed" [56]. In fact, most vodka and liquor has been purchased through legally functioning retail stores and supermarkets [57]. Apart from parochial sales of samogon (moonshine) mainly in rural areas, "most vodka and liquor consumed by the population is purchased in the official retail stores". The Internet trade has been "typically for bulk orders only"[58]. Without opening the bottle, consumers are usually unable to distinguish between branded and falsified vodka as it is sold at the same shops and looks identical. In the 1990s, slanting labels and lax closures were known as attributes of falsified vodka. Today, bottles with counterfeit beverages are "in good accordance with the original products" [58].

It is known that excessive alcohol consumption is associated with enhanced suicide rate [59].Remarkably, the rate of suicides without measurable blood alcohol concentration (BAC) slightly increased in Belarus after the start of the AAC (1985 ~6.25; 1988~6.6 per 100.000 of residents), then decreased to 6.1 after the AAC, which coincided with the peak of optimism at the beginning of the economical reforms around 1991. Thereafter, both the BAC-positive and BAC-negative suicide rates increased considerably, the latter up to approximately 10.4 in 2003 [60]. These figures indicate that dynamics of suicides depend not only on the amounts of consumed alcohol, but also on social factors. It can be reasonably assumed that the increase in the suicide rate after 1991 has been partly caused by deterioration of the social assistance, when many unemployed people were abandoned in a desperate condition.

Discussion

During the AAC, launched by Mikhail Gorbachev in 1985 and ended by 1989, the consumption of non-beverage alcohol was widespread. Large-scale sales of cheap lotions, eau-de-colognes and window cleaners in some areas were tolerated by authorities. The drinking of alcohol-containing technical liquids and perfumery decreased abruptly after the AAC, when vodka and beer have become easily available and relatively cheap[61]. Numerous shops and kiosks were opened after 1990; there have been no queues as in the Soviet time. The average salary (pension) / vodka price ratio remained several times higher than it had been prior to the AAC; the price dynamics in relation to salaries and pensions are summarized in the review[62]. The supposition that alcohol-dependent people would voluntarily drink surrogates when regular beverages are available is unrealistic. They have their experience, distinguish good and bad products, know their ailments that may exacerbate after the intake of poor-quality beverages. The alcohol consumption predictably increased after the AAC. It facilitated economic reforms of the early 1990s. As mentioned above, employees did not oppose privatization of the state property by administration and party functionaries due to the widespread drunkenness.

High quality beverages can be found in renowned shops like the "Gastronome No. 1" within the famous GUM (Upper Trading Rows) in Moscow(Figure 1). The same is true for the refectory upstairs in the GUM (Figure 2), where hors d'oeuvres are always fresh. Elsewhere, a product with the same foreign or domestic label may taste differently. The quality of counterfeit beverages depends on their origin: they can be produced by regular factories, being concealed from excise duties, or "in garages", using technical ethanol diverted from the

Figure 1: "Gastronome No. 1" within the famous GUM (Upper Trading Rows). The wine collection here is one of the best in Moscow.

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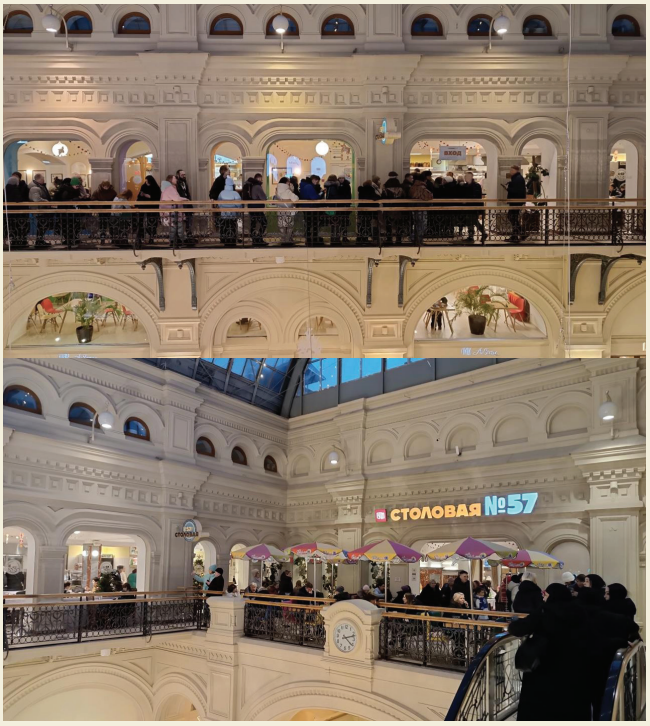

Figure 2: Refectory in the 3rd floor of the GUM has always fresh hors d'oeuvres and drinks of standard quality. It is not always the case in other places, even at a bar nearby.

industry or imported[1,14]. Since the 1990s, the Caucasus has been known as a nationwide source of cheap alcoholic drinks. Almost all vodka concealed from excise duties in North Ossetia was reported to be produced from technical ethanol[13]. According to another source, in the early post-Soviet years, North Ossetia produced ~40% of vodka consumed in RF, most of it coming from illegal sources[15]. Paradoxically, unrecorded alcohol (manufactured by a regular factory and concealed from excise duty) can be good quality but "recorded" vodka is sometimes made from sawdust being insufficiently purified, as it has been the case in some places e.g., in Siberia since decades. The same pertains to wines fortified with alcohol of different quality.

Conclusion

It should be stressed in conclusion that the government must care about weaker members of the society, including those suffering of substance use disorders and alcohol-related dementia[63],because they can be poisoned by toxic beverages, abused and expropriated by criminals. Authorities should investigate the cases, when alcohol-dependent, disabled and other people were deprived of their apartments or houses as a result of criminal acts, having become homeless, and help them to obtain accommodation or shelter. Alcoholics underwent compulsory treatment and hypertherapy using invasive procedures, one of the motives being the training of medical personnel with the objective of readiness for war [64]. Alcohol consumption and heavy binge drinking tended to decline in Russia since approximately 2010[26]but the current level is difficult to determine for lack of reliable statistics. In any case, alcohol still remains a part of life; and it can be eliminated only together with the life. The last AAC (1985-1989) has demonstrated this. Figuratively speaking, the AAC was a surgery performed without sufficient indications[64]. In regard to future research, poor quality alcohol containing toxic admixtures is of particular importance. Addition of alcohol from non-edible sources to beverages should be prohibited or, at least, its presence must be indicated on labels. In order to make rational choices, consumers have to be informed about qualities of what they consume, including risks they will be exposed [65].

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