Analele Universității din Oradea, Fascicula: Ecotoxicologie, Zootehnie si Tehnologii de Industrie Alimentara, Vol. XV/B Anul15, 2016

# ARTISANAL PRODUCTION OF SPIRIT BEVERAGES - RISK FACTOR FOR CHRONIC POISONING WITH METHYL ALCOHOL

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#### Abstract

Artisanal production of distilled beverages is a well - known fact in the countryside, and it is only the raw material and 'technology' that varies from one geographical area to the other. These traditional products sundry composition includes a series of volatile congeners with a higher or lower toxicity level, one of them being methanol. Daily consumption of such beverages can lead to chronic poisoning cu methylic alcohol, despite of the fact that methyl alcohol antidote, that is ethylic alcohol is simultaneously administered. The clinical expression of this pathology is the occurrence of a multiple sclerosis type of symptomatology. We report a case of a patient, chronic consumer of artisanally produced alcohol, in whom the histopathological examination, corroborated with the clinical data led to confirming the multiple sclerosis diagnosis.

Key words: methanol, home-made beverages, fruit spirits, multiple sclerosis, wood alcohol.

## **INTRODUCTION:**

Artisanal production of alcoholic beverages is a fact in the Roman countryside. The definition given by the EU to the 'spirit beverage' as as follows: "an alcoholic beverage intended for human consumption, possessing particular organoleptic qualities, having a minimum alcoholic strength of 15 % volume." (The European Parliament, 2008). The raw material used is fruit or cereals, and the producing modality is diverse: distillation, maceration in distilled alcohol, or "addition of flavourings, sugars or other sweetening products" to such distilled products. According to the above mentioned European norm, the concentration in ethylic alcohol has to be over 15 % vols. Spirit beverages composition includes some congeners volatiles, of which some could matter in the legal examination: methanol, N-propyl alcohol, isobutyl alcoholacetaldehyde, acetone (Jung et al., 2010). Among the most toxic compounds can be mentioned ethyl carbamate and acetaldehyde (Lachenmeyer et al, 2011), whose margin level of exposure is set at 1.8 mg/100 litres pure ethyl alcohol, 0.8 g/100 litres pure ethyl alcohol respectively. As for methanol, the same source evaluates

as being acceptable daily intakes 3000 g/100 litres pure alcohol, in the circumstances of an assumptive daily consumption of 100 ml alcoholic beverage of 40 %. On the other hand, the European normative above mentioned sets the highest admitted level of methanol in alcoholic beverages at 1000 grams/ 100 litres of pure ethyl alcohol in the case of the fruit distilled products, except for those made of plums, apple, pear, cherry plums, in which it is acceptable a maximum content of 1200 de grams/ 100 litres of pure ethyl alcohol, and 1350 grams/ 100 litres pure ethyl alcohol in those from berries and Williams pears. It is also mentioned that the minimum alcoholic strength by volume of these beverages shall be 37,5 %.

We notice a seeming discrepancy between the EU norms and those suggested by Lachenmeyer et al., with the amendment that the latter study sets out with the assumption of a highest daily consumption of 100 ml beverage, in a person of 60 de kg weight.

There were several studies attempting to evaluate the quantity of methanol in home-made spirit beverages. One of those analysed the volatile alcohol congener content in 5 samples of Romanian home-made plum spirits originating in 4 counties (Jung et al., 2010):

	Ethanol (% v/v)	Methanol (mg/l)
Sample 1 (BN)	56	554
Sample 2 (SJ)	52	3710
Sample 3 (MM)	60	3558
Sample 4 (MS)	76	4170
Sample 5 (MS)	53	4028

This data suggests that in case of the double distilled beverages specific to Transylvania, where it is mainly practiced fractional distillery, which removes the largest amount of the methyl alcohol , whose boiling point is  $65^{\circ}$  C, the European norms are observed, all the samples revealing less than 1000 grams methyl alcohol in 100 de litres pure ethyl alcohol. This happens due to the fact that the boiling point for ethyl alcohol is 78° C and it takes place a separation of the two types of alcohol by the removal of the first fraction of distillation in the second sequence of the preparation process.

Another study, (Moales, D, 2011) analyses 98 samples of spirit beverages traditionally produced in counties in the Moldavian area of Romania, in which it finds levels of over 1000 grams per 100 litres pure alcohol in 19 cases. The limits were mostly exceeded in the cases of distilled products obtained from fermented plums. Mention should be made that in Moldavia it is no practised fractionated distillation, thus the first distillation fraction is not separated from the rest of the product, while double distillation is a rather a rare occurrence.

In Romania, in 1992, it was appreciated that around 950,000 women and 3.8 million men were heavy drinkers – with more than 40 g alcohol/day in women and 60 g alcohol/day in men, respectively (Furtunescu et al, 2009). This means that, assuming the highest admitted level of methanol in the beverage, all heavy drinkers could be exposed to a higher dose than that allowed by the EU norms.

Methanol intoxication antidote is ethyl alcohol administration, with which competes at the level of alcohol dehydrogenase, the former evincing affinity for ethanol metabolism, allowing the body to gradually eliminate non-metabolised alcohol.

Theoretically, in the case of alcoholic beverages, with the intoxicating substance the antidote is administered. In fact, the time necessary for the methanol to get eliminated is longer than the time needed to metabolise ethanol, and also methanol metabolise is 5-10 times slower than for ethanol, (Belis et al, 1995), and thus, while the antidote gets used up, a large amount of the toxic remains in the body.

The chronic exposure to methanol is characterised by headaches, asthenia, dizziness, nausea, depression, agitation, nervous and mostly ocular degeneration (Mogos, G., N. Sitcai, 1990). There also occur digestive and respiratory disorders, liver lesions, central nervous system disorders and Parkinson type symptoms (Popa, I., 1978). Methanol is not so toxic by itself, but rather because it is metabolised in formic acid, which is 6 times more toxic (Dermengiu, D., G. Gorun, 2006). There are hypotheses supporting the idea that chronic methanol poisoning leads to clinical and histological features of multiple sclerosis (Henzi, H., 1984), but such situations are less frequent than those of the acute intoxications, when multiorgan failure involvement is possible, with primary lesion of the nervous system (Jung, H., 2014).

## CASE REPORT:

In 2013, an autopsy was performed at the Legal Medicine Bistrita County Service on the corpse of a 36-year old male. The investigation data showed a daily and abusive consumption of alcoholic beverages traditionally distilled, the man having been illegally employed at a traditional distillery for the previous two years, and having been permanently exposed to ethylic and methylic alcohol vapours. Within the secondary distillation, the man was, by his own will, to test organoleptically, including gustatory, the first distillation fraction, in order to establish the start of collecting the finite product. According to his relatives, within two weeks from his hiring, he started to present clinical Parkinson-type symptomatology with acute tremor and lack of stamina and strength in limbs. Apparently in the previous day of his death he drank a glass full with first distillation fraction. The forensic exam revealed cortical atrophy, cerebral decrepitude at the level of the basal nuclei, older rib fractures, now consolidated, pulmonary lung stasis and acute oedema, myocardocoronarysclerosis, aortic atheroma, liver steatosis, pancreas oedema, gastritis and general visceral stasis. On opening the cavities, a strong smell of alcohol gave out. The toxicology test determined an ethylic alcohol level of 2.25 ‰, with the level of methyl alcohol of 2.38 ‰. The literature accepts as average lethal the amount of 0.40 ‰ for methanol, with large individual variation, from 0.20 ‰ to 6.30 ‰ (Dermengiu, D., G. Gorun, 2006). The microscopic anatomopathological exam revealed, at the lung level, interstitial hyperemia with emphysema zones, tubular epithelial dystrophy in kidneys, and, at the cerebral level, there was found a proliferation of lymphocytes in the perivascular space without atypical features by haematoxylin-eosin, which suggests a possible multiple sclerosis, all the above converging with the clinical data gathered from the dependants.

The case was interpreted as being a violent death induced by an acute intoxication with methyl alcohol, occurred on the background of a chronic intoxication. Lack of microscopic investigations with electronic microscope or using special staining methods, the multiple sclerosis was not considered as a certitude.

### **CONCLUSIONS:**

Methyl alcohol is a un volatile congener of real medico-legal importance, with a constant presence in the traditionally distilled products. To keep his concentration under the toxic level pertains to basic knowledge of food chemistry.

The technology by which the spirit beverages from fruit are manufactured is essential for obtaining products with the lowest level of toxicity as far as the methyl alcohol is concerned, and in this respect the fractioned distillation is crucial.

Chronic exposure to methyl alcohol, either by ingestion or via the respiratory tract, could lead to the risk of producing neurological modifications with irreversible potential and Parkinson-type symptoms that can be interpreted as a variant of chemically induced multiple sclerosis.

### **REFERENCES:**

Belis, V., sub redactia, 1995, Tratat de Medicina Legala, Editura Medicala, vol 2, 155-158.

Dermengiu, D., G. Gorun, 2006, Toxicologie medico-legala, Editura Viata Medicala Romaneasca, 196-197.

Henzi, H. 1984, Chronic methanol poisoning with the clinical and pathologicanatomical features of multiple sclerosis, https://www.ncbi.nlm.nih.gov/pubmed/6708848

Jung, A., H. Jung, V. Auwarter, S. Pollak, A.A. Farr, L. Hecser, A. Schiopu, 2010, Volatile congeners in alcoholic beverages: analysis and forensic significance, Romanian Jurnal of Legal Medicine 18, 265-270.

Jung, H., A., Idor, M. D. Bucur, A. Jung, A. A. Keresztesi, 2014, A rare case of fatal materno-fetal methanol poisoning. Volatile congeners analysis as forensic evidence, Romanian Jurnal of Forensic Medicine, 22, 63-68.

Lachenmeier, D W., K. Schoeberl, F. Kanteres, T. Kuballa, E. Sohnius, J. Rehm, 2011, Is contaminated unrecorded alcohol a health problem in the European Union? A review of existing and methodological outline for future studies, http://onlinelibrary.wiley.com/doi/10.1111/j.1360-0443.2010.03322.x/full DOI: 10.1111/j.1360-0443.2010.03322.x

Moales, D., 2011, Contribuții la cercetarea chimico-toxicologică a alcoolului metilic, Rezumatul tezei de doctorat, UMF Gr. T. Popa, Iasi, in http://www.umfiasi.ro/scoaladoctorala/tezedoctorat/teze%20doctorat/rezumat%20 bejan%20(moale%C5%9E)%20doina.pdf

Mogos, G., N. Sitcai, 1990, Toxicologie clinica, Editura medicala, Bucuresti, volume 2, 58-59.

Popa, I., 1978, Toxicologie, Editura Medicala, Bucuresti, 149-150.

REGULATION (EC) No 110/2008 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 15 January 2008 on the definition, description, presentation, labelling and the protection of geographical indications of spirit drinks and repealing Council Regulation (EEC) No 1576/89, http://eur-lex.europa.eu/eli/reg/2008/110(1)/oj.