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Addictive effects of alcohol

Alcohol – a bit of history

In the common understanding, that is the awareness of an average person, alcohol is identified primarily as a consumable product. Such thinking dates back to as early as prehistoric and ancient times, when the first alcoholic beverages were created by chance and coincidence. This happened during the improper storage of ripe fruit, mostly grapes, which led to unintended alcoholic fermentation, which resulted – undoubtedly to the surprise of the primitive man – in the natural transformation of fruit into wine, and of improperly stored fermenting barley grains into beer (Maciejczyk, 2012). As is mentioned in the Bible, the most common crops grown at that time in the Middle East, along the Nile, were wheat and barley. Wheat was considered to be a basic food, but also a measure of wealth of those who grew and traded it. Barley was the crop of the poorer classes. Nevertheless, both wheat and barley were very often consumed in the natural, raw form, milled into flour and groats (Abdali, 2001). After the exodus from Egypt, the settlers in Canaan "actively planted vineyards and gardens". Grapevine was commonly grown practically throughout the whole period covered by the Old Testament, planted in valleys and rough plateaus alike. It was a particularly favored plant and wine was drunk in large amounts, not only during feasts but in everyday life as well, also in sanctuaries, as it symbolized the mystery of living "with God and in God" (Fouquet, de Borde, 1990). Red wine was given preference, for although it was not known for certain, it was assumed to have antioxidative properties, as it contained resveratrol – a phenol with strong antioxidant activity. Grapes were used for the production of not only wine, but also preserves, juice, honey, grape vinegar and raisins. Both food and wine were considered by the Hebrews to be a gift from God. All kinds of alcoholic beverages were treated with respect and reverence by the Egyptians.

Since the beginning of mankind, the history of alcoholic beverages is closely connected with the religion and history of nations. Wine and other alcohols – prevalent and ubiquitous elements of whole nations – were capable of bringing the

joy of life and providing relief from suffering. It was believed that the inebriating power of alcohol evoked the transcendental feeling of immortality. At the same time, it was acknowledged that it must be treated with a high degree of caution, as it could be a source of not only joy, but also suffering and wrong (Gabriel, Geaves, 2007). Indeed, the Old Testament reveals that people were warned against drunkenness and forbidden to drink immoderately, as it was against God's will (Wojciechowski, 2009). The issue of alcohol has been addressed by numerous papers in the fields of biology and medicine, also in the context of the mental, somatic and neurological consequences of alcohol abuse, as well as the social implications following the manifestation of alcoholism.

Alcoholism as a disease?

Alcoholism, alcoholic disease or alcoholic toxicomania – these concepts refer to the kind of disorder which consists in the loss of control over the amount of alcohol consumed. The loss of control results from a compulsion of mental and somatic nature, and is independent of a person's will. The development of the mechanism of the addiction has still not been fully determined, and is not directly connected with alcohol abuse, although it eventually leads to such a result.

Research studies show that the mechanisms of action of ethanol and morphine seem to be closely comparable. The chronic use of alcohol increases its consequent consumption, similarly to the use of small doses of morphine which, over time, evolves into the need to increase them (Reid, Hunter, 1984). Studies on alcohol dependence show that alcohol often causes irreversible changes to the structure and functions of the central nervous system (CNS), including in terms of memory disturbances and the ability to make associations and think in the abstract way. Changes in CNS caused by alcohol abuse result in impairment of the secretion of neurotransmitters, changes in the properties of receptor membranes and the activity of many membrane enzymes. The said changes develop, and even intensify, as the period of excessive alcohol consumption lengthens, and thus intensify the ensuing need to drink it in increasingly greater amounts.

Is alcoholism a disease? The problem was repeatedly addressed by Elvin Jellinek (1942; 1960; 1993), who described alcohol dependence as nothing other than disease. His proposition attracted supporters from among not only doctors and therapists, but also the persons concerned, that is alcoholics. According to Jellinek, the loss of control over drinking is a result of pathological biological processes induced by the toxin, i.e. alcohol, and not a person's bad character or lack of strong will. This led to the creation of a *disease-based* model of addiction, broader than merely a *moral* problem. Since alcoholism is a disease, it can be cured. It is enough to administer an adequate therapy and – most importantly – stop drinking.

Lewis (1991) believes that alcoholism can be compared to other diseases, such as diabetes or schizophrenia. Many researchers share the opinion while emphasizing that alcoholism is of a very complex nature, is chronic and often incurable, and can

even lead to death. Accepting the thesis that alcoholism is an incurable disease would be tantamount to setting bounds to the possibilities for its treatment, hinder the successful therapy and individual rehabilitation of alcoholics, and generally prevents solving various alcohol-related problems. While a conventional (normal) disorder can be managed with an adequate therapy, curing an alcoholic from alcoholism without their consent is impossible. Treatment imposed *by force* and against the will of a patient will not be efficient. Administering therapeutic and pharmacological agents will not fulfil its remedial role unless the patient is willing to limit or quit drinking altogether, and attempt to fight the addiction (Tesson et al., 2005). Effective results can be achieved mainly by means of psychological therapy. For that reason, many researchers assume that the problem of alcoholism should be analyzed primarily in the context of behavioral processes related to alcohol consumption.

Such reasoning might lead to the conclusion that if a given functional state of the organism is a disease, pathological factors and pathological changes should manifest themselves in the formerly healthy organism – changes leading to the loss of the broadly defined functional efficiency of the organism. If alcohol dependence is a disease, then the pathological factor should be identified as nothing else but ethyl alcohol, which is considered to be a poison, particularly when consumed frequently and in large amounts. As a poison, alcohol induces noticeable and *medical* changes in the organism, such as impaired control over alcohol use, distinctive behavior after its consumption, or the intensifying need to drink it. What is also significant is the biological (morphological) degradation of organs and tissues developing at a rate of months to years, a higher degree of tolerance to increased amount and frequency of alcohol consumption, or the deterioration of mental health through chronic intoxication. Such data indeed suggest that alcoholism can be considered a disease (Mazur, Małkowska-Szkutnik, 2010; Tesson et al., 2005).

However, if alcoholism is not a disease, then what kind of phenomenon is it? Many people drink alcohol, yet they are not ill, they behave reasonably, do not fall into addiction. After all, not everyone who frequently abuses alcohol should be regarded as an alcoholic or addict. Such *normal* drinking patterns are found in every culture and religion (except Islam), and every continent. There is, however, one condition that must be fulfilled – the drinking should fall within the bounds of the so-called *moderate alcohol consumption*. There are those who believe that this level of alcohol consumption can even bring positive outcomes, e.g. it can contribute to life extension, that is longevity (Brodsky, Peele, 1999).

It is thus evident that alcoholism constitutes a problem when alcohol consumption is more than moderate. It then becomes not only risky and harmful to health, but also detrimental to the mental and social functioning of an alcoholic. For this reason, some researchers in the field propose that alcoholism be treated as a set of behavioral disorders generating the so-called addictive behaviors which increase the risk for not only disease, but also serious personal and social

complications. Such behaviors might manifest themselves in, among other things, the loss of control over drinking (Maisto et al., 2003; Marlatt, Witkiewicz, 2002). Many experts acknowledge alcoholism to be a serious medical problem, the solving of which should be approached through medical means (Lindenmeyer, 2007).

What do we know about alcoholism?

Attempts at explaining the mechanisms behind alcoholism have been and still are made by many experts in the field. From the sociological perspective, alcoholism is considered a social phenomenon which manifests itself in social maladjustment and is thus highly undesirable. It is known that alcoholism is a problem faced by not only an individual, but the whole community where the person lives, particularly their family and co-workers.

Alcoholism causes considerable moral and economic damage and generates losses at every level of the coexistence of an alcoholic with other members of the society. The social costs incurred by alcoholics are very high. Moreover, the estimated life expectancy of a habitual alcoholic is approximated at 10–12 years shorter than the mean life expectancy of non-drinkers. It has been determined that mortality among alcoholics is over twice as high as that of non-addicts. Alcohol is one of the major causes of traffic accidents and a contributor to their increased risk. It is estimated that nearly 50% of household accidents and 65% of all instances of drowning are a result of alcohol abuse. It turns out that nearly 80% of suicides are triggered by alcoholism or its short-term influence. Alarming criminal data indicate that chronic alcohol consumption constitutes a factor stimulating homicide, misconduct and physical violence. Approximately 20% of hospitalized alcohol abusers are a source of trouble to the healthcare staff, irrespective of the type of diagnosis. The social costs of the phenomenon of alcoholism and the expenses related to the strategies for its prevention amount to 20% of the total healthcare expenditures (Dymek-Balcerek, 2000; Fudała, 2007).

While the physiological interpretation of alcoholism rests on the analysis of the biochemical and health damage that it causes to the organism of the abuser, the consequences of drinking also translate into implications for his social environment. Analysis of different routes to addiction draws attention to the relationship between psychological dependence, the physiological homeostasis in the living organism of an alcohol abuser, and the person's external social environment (Griffith, 2001; Herzberger, 2002).

Attempts at defining alcoholism

There exist various definitions of alcoholism. Some of them are merely of a descriptive character, and some are more detailed. Some focus on the effects and consequences of alcohol abuse, while others on its symptoms or the frequency of excessive consumption. Some organizations, such as the American Psychiatric

Association, an international federation of psychiatrists, believe that alcohol abuse and alcohol addiction can be considered separately. Alcohol abuse can be interpreted as the level of drinking which leads to the impairment of and even threat to health, while addiction involves psychological dependence which eventually leads to physical dependence.

It was only over 60 years ago that Elvin Morton Jellinek (1890–1963), an American biostatistician and physiologist of Czech descent, became a pioneer in the study of alcoholism as a phenomenon and the author of the original typology of alcoholism. He sought to prove that alcohol addicts should not be the target of contempt; instead, they should be treated as persons who need help and should receive treatment. Jellinek was appointed an expert at the World Health Organization (WHO) and spent much of his time working in the USA, Hungary, as well as South American countries. In 1956, thanks to his inspiration, the American Medical Association decided to recognize alcoholism as a disease, and not merely a set of specific moral disorders. Five years earlier, in 1951, WHO accepted the postulate that alcoholism was a medical problem and made an attempt at its classification (Pospiszyl, 2008; Woronowicz, 2009). In 1960, Jellinek published his influential book entitled "The disease concept of alcoholism". Consideration should also be given to the thesis advanced by Jellinek whereby alcoholism bore the characteristics of a disease as the loss of control over alcohol consumption triggered the progression of pathological symptoms and consequently lead to premature death. In 1969, Jellinek presented a fairly comprehensive theoretical model of alcoholism which assumed that an alcoholic was unable to control the level and frequency of alcohol consumption.

Apart from Jellinek (Jellinek, 1942), the opinion that alcoholism should be considered a disease was also shared by many other researchers in the field, such as Edwards and Gross (1976), Habrat (2013), Horvath and Kekesi (2006), Pospiszyl (2008), Vaillant (1983), or Wallace (1989). Other models of alcoholism were subsequently created, e.g. the compensation or the psychosocial model (Brickman et al., 1982; Marlatt, 1992).

In 1976, the American Council on Alcoholism accepted the definition of alcoholism as a chronic, potentially life-threatening disorder manifested by an increased tolerance to alcohol consumption, physical dependence and pathological changes in several organs (Jelski et al., 2007; Joshi, Guidot, 2007; Orywal et al., 2009).

Alcohol dependence and tolerance

The International Statistical Classification of Diseases and Related Health Problems (ICD) has introduced ten versions of the definition of alcoholism, the last of which leaves off the term "alcohol-related problems". Instead, it refers to the harmful effects of alcohol intake while avoiding or somewhat disregarding the problem of addiction. It is assumed that there are more non-addicts who drink "normal" amounts of alcohol than addicts and the difference between them can

amount to as much as 30%. On the basis of results obtained from numerous sources, Woronowicz (2009) reports that in modern Europe, that is at the turn of the 21st century, approximately 5% men and 1% women are alcohol dependent.

An interesting though somewhat surprisingly naïve stance was adopted in 1969 by WHO, which suggested that alcohol dependence was a specific mental and physical state. According to Woronowicz (2009), it is a state "resulting from the interaction between the living organism and alcohol". The said "state" leads to changes and consequences to the behavior of the abuser which force him to make every effort when circumstances are conducive to alcohol consumption, or – if they are not – to seek to obtain alcohol for ad hoc drinking wherever possible, so as to experience pleasure derived from the act and relieve the growing mental discomfort as quickly as possible. The processes involved in alcohol dependence are also dependent on the volume, and – most importantly – frequency of intake of doses of this addictive substance, framing the concept of the so-called tolerance.

In physiology, tolerance is defined as a specific functional state in which gradually stronger stimuli are required in order for a given reaction to be triggered. In the context of alcohol this means that in order to achieve the desired effect of its consumption, the drinker is forced to gradually increase its dosage, or that the effect gradually becomes weaker when the doses are kept at a constant level. In other words, a person addicted to alcohol must drink more and more in order to achieve the same effects of consumption.

It seems that the task of defining alcohol dependence presents a challenge already in terms of the initial stage of its diagnosis. Its analysis ought to be based on numerous aspects – the amount of consumed alcohol, the frequency of consumption, the physical and mental response after drinking, inducing changes in behavior and attitude toward the immediate environment, as well as the prevalence and severity of biological changes incurred. These add up to a set of somatic and psychological symptoms which have a bearing on the social relations of the alcoholic.

The aforementioned psychological and physical dependence should be taken into consideration when analyzing the concept of addiction. The first type "orders" to continue drinking, so as to give oneself the opportunity to experience feelings or sensations that accompanied the previous acts of drinking and that were or seemed to be pleasant. The second, physical type of dependence, is something of an adaptation to alcohol consumption driven by purely biological needs, that is those governing the normal, everyday functioning of the organism of the abuser. Therefore, stopping the consumption of alcohol might lead to the so-called withdrawal, or abstinence, syndrome (Kumański, Pisarski, 2010).

Due to the aforesaid difficulties in classifying addiction-related problems, internationally recognized and adopted projects have been created which cover the fundamental methodological assumptions and also provide adequate practical solutions. These are the Diagnostic and Statistical Manual of Mental Disorders

(DSM-IV) and the International Statistical Classification of Diseases and Related Health Problems (ICD-10).

DSM is based on a classification developed by the American Psychiatric Association and was introduced in 1994. ICD-10 is the tenth version of the International Classification of Diseases and was introduced by WHO in 1992. In Poland, ICD-10 has been complied with since 1997, that is for nearly 20 years. Both proposals for the classification of alcohol dependence stress the significance of individual traits and individual circumstances surrounding the development of addiction and affecting its severity.

As has already been mentioned, alcohol consumption, even in relatively small amounts, is harmful to a person's health and affects the shaping and development of their personality, as well as their social development. It also alters the previously normal behavioral patterns of the individual which in turn generate new ways to satisfy his needs. For this reason, the consequences of alcohol consumption are of interest to the field of not only medicine, but also social sciences. For instance, pedagogy focuses on analyzing the "acceptable values fostered particularly by the young generation". The said acceptable values stimulate the motivation to act, whereas values which are externally "imposed" by, for example, parents or teachers, only reinforce that motivation in a drinking individual. Issues related to systems of values have been reflected in theoretical and empirical considerations of researchers from many scientific fields. Most scientists share the belief that the shaping of a person's value system is of significance to the process of education of not only young people, but also the society as a whole (Lipiński, 1996; Tobiasz-Adamczyk, 2000).

In common opinion, one of the values of the highest significance is health. It is a universal, timeless and fundamental value common to the whole *Homo sapiens* species and independent of the various social norms, customs, trends, ideologies and political systems which have been and are being introduced. Health is a value which allows every member of the *Homo sapiens* species to establish and pursue their own goals, both individually and within a social group. In the light of this fact, it seems that health should be given special attention, not only provisionally, but also educationally, that is already at the initial stages of education of children, whose understanding of the hierarchy of values – particularly with respect to health – should be developed relatively early (Jankowski et al., 2013; Leonard, Blane, 2003; Maisto et al., 2003). It can be agreed that those individuals who are more concerned about their health tend to treat it with more respect and generally display more health-oriented behaviors while avoiding potential health risk factors, such as the abuse of nicotine, alcohol or drugs (Mellibruda, 2001).

It is known that the basis for the cooperative functioning of individuals is their ability to communicate with one another. This communication is necessary to build a close rapport within the family, which is especially critical when it comes to alcoholic families. The first symptom of disorders affecting interpersonal

communication within a family is impaired social development of a child growing up within that family. A parent's alcoholism exerts a significantly negative effect on the child's psychological, mental and physical development. It contributes to mental deviations as it eliminates the normal, healthy connections and emotional relationships. The child is deprived of the sense of personal safety, as well as moral and spiritual support, and follows abnormal patterns of behavior.

A report prepared by the Confederation of Family Organizations in the European Union (COFACE) revealed that approximately 42 million of European Union citizens, both men (14%) and women (4%), admitted to alcohol abuse or alcoholism. Provided that an average drinker lives in any kind of relationship with another person, including non-drinkers, it might be assumed that about 84–85 millions of Eastern Europe citizens remain somehow linked to the problem of alcohol abuse. If we add other family members, that is children, it will amount to about 4–5 millions of young – very young – citizens suffering from the problem of alcohol dependence.

The costs of losses sustained due to any of the abovementioned reasons are difficult to be reliably estimated, especially at a national level. The rate and scope of their development vary as the alcoholic disease progresses in an individual. The process initially seems to be virtually unnoticeable and can be reversible up to a certain point, and the criteria for estimating the related losses are not always exact and explicit. Many people decide to stay with their partners despite their progressing alcoholic disease for reasons connected with accommodation, children, financial input of the alcoholic into the shared household budget, or simply out of fear.

Is it possible to drink safely?

It must be conceded that it is impossible to determine the limit to safe drinking, as it is practically unmeasurable. In differing circumstances, a person might respond differently to the same amounts of alcohol consumed or respond similarly to different amounts consumed. These relations appear to be highly variable and depend on many factors, such as the physical condition, nutritional status, satiety status, mental state, fatigue, or motivation of the drinker, or the quality of alcohol consumed. The inability to determine safe drinking limits results in the loss of control over the amount of alcohol consumed, which can, in its mild form, lead to a harmless alcohol intoxication, but when taken to extremes – result in complete dependence with all its consequences, including death (Pospiszyl, 2008; Szabo, Mandrekar, 2009). Most researchers unanimously agree that the phenomenon of alcohol dependence is a complicated, complex and multifaceted process, affected by various determinants within different domains of health. Keller (1993) explains that addiction as a phenomenon and a process is attributable to human beings and not to the lifeless substance called alcohol, and that physical dependence does not exist without mental dependence. If, however, the said assumptions preclude alcoholism from being considered a disease, then all agree that it might lead to a disease, or even a number of diseases (Kamińska, Kumański, 2012).

What is important is when and how alcoholics start to drink, how they learn to drink and how they organize their drinking until they cross the threshold of addiction. Over time, negative behaviors become reinforced and lead to the loss of control, increased tolerance and, consequently, pathological drinking (Gilpin, Koob, 2008). This points to the reasonable conclusion that a drinker develops addiction through developing behavioral patterns when drinking, observing the consumption of alcohol by others, and strengthening one's motivation to drink and response to alcohol consumed. Drinking behaviors are significantly affected by a person's psychological background, particularly stress, negative emotional states, depression, or helplessness against the consequences of drinking (Rosenberg, 2007). When diagnosing alcoholism, consideration should be given to many symptoms, both those that are somewhat interrelated, and those that are recurrent.

WHO defines alcoholism as "any form of drinking which exceeds the traditional and customary consumption of alcohol and departs from social norms of drinking accepted by the community, regardless of the etiological factors behind such behaviors and of the degree to which those etiological factors are determined by the genetic and physiological capabilities of an individual" (The World Health Report, 2004). While many publications interpret alcoholism as mental dependence, i.e. a process remaining outside the control of a drinker, medical literature acknowledges that there exist physiological differences which are linked to genetic elements, that is hereditary factors governing the susceptibility to psychoactive substances, between people who drink compulsively because of addiction, and those who follow healthy (normal) patterns in this respect, in that they consume alcohol at low to moderate levels (Baumeister et al., 2000).

Alcohol – what next?

The neurophysiological areas of alcohol dependence have still not been explored and described thoroughly enough so that a comprehensive and efficient treatment regimen could be developed. It is known that prolonged consumption of alcohol by addicts is directly connected not only with somatic and physical needs but, above all, with the psychological imperative consisting in the loss of control over the consumption. An addicted person displays marked behavioral changes which concentrate his actions on seeking and obtaining alcohol. According to the World Health Organization and the American Psychiatric Association, the said changes constitute main symptoms of mental, and not necessarily physical, dependence. In this context, administering an alcohol addiction therapy based on detoxification is insufficient, as it does not ensure an end to addiction. An alcohol addiction therapy should allow for the need for a cause-targeted intervention, which would provide an insight into neurophysiological processes and phenomena determining dependence syndromes. Another issue essential for such a therapy is knowledge about negative emotional states experienced by an addicted person, about conditioned response to repeated negative stimuli, such as the smell of alcohol or the sight of people drinking

it, as well as about stressful situations related to professional and personal life. All those situations might trigger a relapse of heavy, uncontrolled drinking after a period of abstinence. Researchers studying this issue have been investigating possible ways to prevent such relapses. To advance the research methodology, animal models are also used, though with respect to the emotional factor, as compared to the physical one, their application is rather problematic (Lovinger, Crabbe, 2005; Spangel, 2003). Many experts stress the significance of the co-existence of alcohol dependence with depression, stress, as well as genetic predispositions of addicted persons. It is commonly believed that alcohol consumption is associated with its capacity to reduce fear and anxiety (Preuss et al., 2002).

Alcohol dependence is a complex disease of the central nervous system characterized by a compulsion to obtain and consume the substance. It is a chronic disease in which relapses might occur even after a long period of abstinence. Understanding the mechanisms behind alcohol dependence might help in the search for new medications which would contribute to the development of a more effective pharmacotherapy of alcoholism.

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Addictive effects of alcohol

Abstract

Alcohol is one of legal psychoactive substances which are commonly consumed and often abused by people of all social classes. Alcohol is capable of changing the functions of individual organs and systems of the organism, as well as the structure and function of cells. Research studies have determined a significant correlation between prolonged consumption of alcohol, the generation of reactive oxygen species, and the increased risk for many disorders, including cardiovascular diseases, arterial hypertension, neoplastic diseases, or diseases of the nervous and muscular systems. The organ which is the most susceptible to its toxic effects is the liver. In acute and chronic alcohol poisoning, the excessive build-up of lipids in the liver may lead to chronic diseases of the organ, such as cirrhosis, hepatitis or hepatic steatosis. Continuous consumption of alcohol may also contribute to undernutrition and consequently a deficiency of many nutrients, including vitamins. Alcohol consumption also induces changes to the

carbohydrate and lipid metabolism in skeletal muscles. Its excess may lead to such conditions as myopathy, resulting in the atrophy of skeletal muscles. Changes triggered by the chronic or excessive consumption of alcohol can be observed at the structural, physiological and molecular levels of the organism.

Key words: alcohol, alcoholism, dependence

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