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Development of a Definition for the Alcohol Hangover: Consumer Descriptions and Expert Consensus



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Abstract: Up to now, there is no adequate definition of the alcohol hangover. The purpose of the current study was to develop a useful definition, and consensus among those who will use it in scientific publications. A survey was conducted among N=1099 social drinkers who recently had a hangover. They were asked to provide their definition of the alcohol hangover. Text mining and content analysis revealed 3 potential definitions. These were submitted to members of the Alcohol Hangover Research Group, who were asked to give their expert opinion on the proposed definitions. Taking into account their comments and suggestions, the following definition for the alcohol hangover was formulated: "The alcohol hangover refers to the combination of mental and physical symptoms, experienced the day after a single episode of heavy drinking, starting when blood alcohol concentration approaches zero."

Keywords: Alcohol, hangover, definition, development, consensus, consumer.

INTRODUCTION

The Suśruta Samhitā, a textbook on Vedic medicine, is one of the oldest scientific sources describing the alcohol hangover [1]. Over three thousand years ago, it called the alcohol hangover state 'paramada', and characterized it by experiencing thirst, pain in the head and joints, heaviness of the body, and loss of taste after heavy alcohol consumption. Since then, researchers have used a variety of alternative definitions and descriptions of the alcohol hangover. However, up to now there is no consensus about an adequate definition for the alcohol hangover. This is worrisome, as it may lead to confusion about the topic under investigation (e.g., alcohol hangover versus withdrawal effects) and the appropriate research methodology (e.g., "should BAC be zero when testing subjects?"). Consensus regarding an adequate definition of the alcohol hangover is therefore warranted.

A search for hangover definitions presented by popular English and American dictionaries revealed that most definitions include statements regarding the intake and overconsumption of alcohol, and list several hangover symptoms. Table 1 lists several of these definitions. Few dictionaries address a specific time relationship with alcohol consumption (e.g., the day after alcohol consumption), and none of

the dictionaries addressed the duration of hangover symptoms. Also, the negative effects on next-day functioning and mood were not mentioned in these descriptions of the alcohol hangover.

It should be taken into account that dictionaries are written for the general public. Definitions are meant for laymen, and may therefore be less useful for scientific purposes.

Recently used definitions of the alcohol hangover in scientific literature [2-11] are presented in Table 2.

From Table 2, it appears that researchers use broader definitions than dictionaries. In addition to mentioning hangover symptoms, they often refer to the duration of the hangover state, and point at potential next-day negative consequences of heavy drinking. Furthermore, several researchers refer to the start of the hangover state, *i.e.* when BAC has returned close to zero.

Adding this information to the usual dictionary definition of the alcohol hangover is regarded as valuable as it helps to differentiate the hangover state from the alcohol intoxication state (experienced when BAC levels are high) and alcohol withdrawal (seen in alcoholics after stopping drinking, and characterized by specific symptomatology such as experiencing seizures).

Some researchers describe the alcohol hangover by listing several symptoms of which they believe are core hangover symptoms, present the day following heavy alcohol consumption. There is however no consensus regarding which symptoms should be regarded as the core symptoms of the

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Table 1. Popular dictionary definitions for the alcohol hangover.

Dictionary	Definition	Source
Cambridge dictionary	A feeling of illness after drinking too much alcohol	http://dictionary.cambridge.org/dictionary/english/hangover
Dictionary.com	the disagreeable physical aftereffects of drunkenness, such as a headache or stomach disorder, usually felt several hours after cessation of drinking.	http://www.dictionary.com/browse/hangover?s=t
Thesaurus.com	Result of heavy drinking	http://www.thesaurus.com/browse/hangover?s=t
MacMillian dictionary	the feeling of being tired and sick because you have drunk too much alcohol or taken too many drugs	http://www.macmillandictionary.com/dictionary/british/hangover
Oxford dictionary	A severe headache or other after-effects caused by drinking an excess of alcohol	https://en.oxforddictionaries.com/definition/hangover
American Heritage dictionary	A temporary, unpleasant physical condition, typically characterized by headache and nausea, following the consumption of an excessive amount of alcohol.	http://www.thefreedictionary.com/hangover
Collins English dictionary	The delayed aftereffects of drinking too much alcohol in a relatively short period of time, characterized by headache and sometimes nausea and dizziness	http://www.thefreedictionary.com/hangover
Random House Kernerman Webster's College dictionary	The disagreeable physical aftereffects of drunkenness, usually felt several hours after cessation of drinking.	http://www.thefreedictionary.com/hangover
Merriam-Webster	Disagreeable physical effects (as headache or nausea) following heavy consumption of alcohol or the use of drugs	https://www.merriam-webster.com/dictionary/hangover

Table 2. Examples of hangover descriptions used in recent scientific literature.

Reference	Alcohol Hangover Description
[2]	The alcohol hangover develops when blood alcohol concentration (BAC) returns to zero and is characterized by a feeling of general misery that may last more than 24 h. It comprises a variety of symptoms including drowsiness, concentration problems, dry mouth, dizziness, gastrointestinal complaints, sweating, nausea, hyper-excitability, and anxiety.
[3]	A great number of authors have defined hangover as a general discomfort, which appears several hours after the consumption of an intoxicating dose of alcohol. More descriptive studies have identified hangover with a common set of symptoms that appear after the complete metabolism of an intoxicating amount of alcohol.
[4]	The alcohol hangover develops when blood alcohol concentration (BAC) falls considerably and peaks when it returns to almost zero. The alcohol hangover may last up to 24 hours, and besides a feeling of general misery, several symptoms characterize the alcohol hangover including headache, tiredness, concentration problems, thirst, dizziness, nausea, cognitive impairment, and mood changes.
[5]	The morning after a night of excessive drinking, many people wake up with a familiar but unpleasant feeling. The symptoms experienced during this post-intoxication state are caused by the alcohol hangover, which develops when blood alcohol concentrations return to zero. The feeling of general misery can persist up to 24 h and can significantly affect the planned activities and cognitive functioning.
[6]	Alcohol hangover is the most commonly reported consequence of heavy drinking. It develops when blood alcohol concentration (BAC) returns to zero and is characterized by a feeling of general misery that may last up to 20 h. Alcohol hangovers can significantly affect planned activities and impair cognitive functioning, and negative consequences such as absenteeism at work or school are commonly reported.
[7]	A constellation of unpleasant symptoms that emerge as the blood alcohol concentration approaches zero after excessive alcohol use.
[8]	Hangovers are characterized by a constellation of aversive physiological and affective symptoms that occur following excessive alcohol consumption. These symptoms, which typically include headache, nausea, thirst, fatigue, dizziness, and stomach ache, begin several hours after the cessation of drinking when a person's blood alcohol concentration (BAC) falls to near zero.
[9]	[alcohol hangover] is described in humans as a physiological state which involves the unpleasant next-day effect following an evening of excessive alcohol consumption. Hangover begins when ethanol is absent in plasma and is characterized by a cluster of physical and psychological symptoms which include headaches, nausea, diarrhea, fatigue and tremors combined with decreased occupational, cognitive and/or visuospatial skills.
[10]	The next-day negative effects of alcohol consumption are collectively called the alcohol hangover.
[11]	Alcohol hangover refers to the set of adverse symptoms experienced following alcohol consumption once alcohol has been eliminated from the blood.

Note: references in the descriptions were omitted.

alcohol hangover. As much as 49 different hangover symptoms have been identified in scientific literature [6]. Exemplary for the lack of consensus among researchers is the fact that the three currently used hangover severity scales each include different individual hangover symptoms to summarize into an overall hangover severity score [7, 12-13]. To complicate matters, some symptoms that are commonly present and have high severity scores (e.g., thirst and dry mouth) have little to no impact on cognitive and physical performance, or mood [14]. Some people may use these symptoms in their description of the alcohol hangover because they are frequently experienced and have high severity scores. Others, however, tend to omit these symptoms from their definition as they contribute little to the general misery experienced during the hangover state, and do not have a negative impact on the execution of daily activities.

Taken together, a good definition should explain the concept of a topic, and differentiate it from other topics [15-16]. And, of course, there should be consensus about the usefulness of the definition by those who will use it. A definition is therefore partly a solid description of the topic, but at the same time an agreement between experts that can change over time [15]. Given the lack of consensus, the current study was conducted to develop an adequate definition of the alcohol hangover.

METHODS

In December 2016, an online survey was held among Dutch students, 18-30 years old, who recently experienced a hangover. The survey was designed using www.surveymonkey.com, and advertised *via* www.facebook.com. Online informed consent was obtained, and participants could win a 100 Euro gift voucher. In this short survey, demographic data and alcohol consumption patterns were recorded, which are discussed elsewhere [14]. In addition, subjects were asked to give their best definition of the alcohol hangover. For the text analysis, the program Wordstat (version 7.1.10) was used as an add-on for the statistical program Simstat (version 2.6.3).

Of particular interest was to examine the most frequently reported *combination* of hangover symptoms. For the analysis, 22 commonly reported hangover symptoms were examined [10]. These symptoms were translated into English, and all other words were excluded from the analysis. Link analysis was conducted to examine the co-occurrence of these hangover symptoms. To determine the association between these binary variables, Phi-coefficients were computed. The Phi-coefficients were adjusted to ensure that their value will always be between -1 and +1. This way, the interpretation of the adjusted Phi-coefficients is comparable to that of most common correlation coefficients such as the Pearson correlation coefficient. The most frequently reported symptoms, and those combinations having the highest adjusted Phi-coefficients between symptoms, were considered to be the most commonly reported combination of hangover symptoms.

For definition analyses, words, phrases and topics were extracted from text and their correlations were tested. To ensure optimal conditions for testing, the definition texts were edited by means of stop-word removal and spelling

checks. For stop-word removal, all the Dutch articles, pronouns, interrogatives, conjunctions and link verbs were excluded from the analysis. For spelling checks, the Dutch language pack as active spelling dictionary was used to correct all of the misspelled words. In order to adequately determine a correct definition of the alcohol hangover, different types of analyses were conducted to get an overview of the most frequently used words, phrases and topics.

First, to identify the most frequently used words, a frequency list was computed. Words of this frequency list were clustered in a dendrogram (tree graph) to highlight co-occurrences between commonly used words. The dendrogram was composed of 25 clusters in agglomeration order, and was used to assess trends in the definitions given.

Second, *via* phrase search, the most frequently used phrases were identified. The phrase search was conducted on the frequency word list with a minimum of 2 words in the phrase and a maximum of 5. Phrases ending with excluded words were removed from the analysis. The minimum frequency of the occurring phrase was set to 3. Assessing frequently used phrases can be a useful guide when formulating the definition of the alcohol hangover.

Third, topic search identified different topics to reveal unseen thematic structures within the description of the alcohol hangover. The topic search was segmented by document, with the maximum number of topics set at 6. The loading, a measure of how representative the individual words are for the topic, was set to 0.40. The thematic structures are sufficient to get an overview of the different components that the alcohol hangover definition should consist of.

After the most frequently used words, phrases and topics were identified, co-occurrences between these were determined *via* link analysis, to extract patterns from the given definitions. Adjusted Phi-coefficients were calculated for the associations between words, phrases and topics, and the co-occurrences were visualized in word clouds. The analyses yielded nine different word clouds, consisting of trends, frequently used phrases and components of the definition of alcohol hangover. By visually comparing these word clouds, the core elements of the definition of the alcohol hangover could be identified and these core elements were used to compose three different versions of the alcohol hangover definition.

These consumer definitions were presented to N=35 members of the Alcohol Hangover Research Group. These experts were asked to comment on the proposed definitions of the alcohol hangover. They were informed that the purpose of this exercise was to develop an adequate definition of the alcohol hangover that could be used in future publications. Therefore, they were encouraged to provide a clear rationale for their choice, and if warranted, suggest any changes or improvements to the proposed definitions. Their comments were weighted and taken into account when formulating the final definition of the alcohol hangover. The final definition was formulated by the authors of this article.

RESULTS AND DISCUSSION

N=1099 subjects (47.4% men) who reported as having a recent alcohol hangover completed the survey, and provided

a definition for the alcohol hangover. Their mean (SD) age was 20.9 (2.3) years old. The evening before their latest hangover, they consumed 12.5 (5.6) alcoholic drinks, resulting in a peak estimated BAC of 0.19% (0.1%).

Hangover Symptom Combinations

The most frequently reported hangover symptoms are listed in Table 3. Table 4 lists the hangover symptom combinations that were most commonly mentioned, and the corresponding adjusted Phi-coefficients. The strength of the association between the different hangover symptoms is visualized in Fig. (1).

Table 3. Frequency of hangover symptoms, reported as part of a definition for the alcohol hangover.

Hangover Symptom	Mentioned by % of Participants
Nausea	23.1%
Headache	22.8%
Being tired	9.6%
Apathy	5.4%
Vomiting	5.2%
Weakness	4.9%
Dizziness	4.1%
Thirst	3.9%
Stomach pain	3.5%
Concentration problems	2.9%

Table 4. Associations between individual hangover symptoms, mentioned together in a hangover definition.

Hangover Symptom Combination	Adjusted Phi-coefficient
nausea-headache	0.75
nausea-tired	0.40
headache-tired	0.38
headache-vomiting	0.36
nausea-dizziness	0.33
headache-stomach pain	0.32
nausea-vomiting	0.32
headache-dizziness	0.30
headache-thirst	0.29
headache-apathy	0.28

A higher adjusted Phi-coefficient implies that two symptoms are more frequently mentioned together.

Two out of 22 symptoms (heart racing and clumsy) were not mentioned by any subject, resulting in a dataset consisting of 20 symptoms. Table 1 shows that the most frequently

reported hangover symptoms include nausea (23.1%), headache (22.8%), being tired (9.6%), and apathy (5.4%).

Link analysis identified the 87 most predominant primary links between symptoms. These links between co-occurring symptoms had an adjusted Phi-coefficient of at least 0.063.

Nausea, headache, being tired, and apathy also showed the highest associations between each other, and other hangover symptoms (see Table 4. Adjusted Phi-coefficients). Therefore, these four symptoms can be regarded as the core symptoms used to define the alcohol hangover. The associations between the four symptoms are summarized in Fig. (2).

Hangover Definitions of Consumers

Link analysis was conducted to identify potential definitions for the alcohol hangover. Nine different definitions were composed. The researchers noted a number of factors that were often used when describing the alcohol hangover. These included:

- Intake of alcohol
- Overconsumption of alcohol
- Symptoms of hangover (not specified)
- Symptoms of hangover (specified)
- Time relationship between intake of alcohol and the symptoms of the hangover
- Duration of the hangover symptoms
- Consequences (e.g., impaired mental and physical functioning)

As there was considerable overlap between the nine definitions, they were summarized in the following three definitions:

- (1) The alcohol hangover is a combination of mental and physical symptoms, including headache, nausea, being tired and apathy, experienced the day after excessive alcohol consumption, which may negatively impact daily functioning and mood.
- (2) The alcohol hangover is a combination of mental and physical symptoms, including headache, nausea, being tired and apathy, experienced the day after excessive alcohol consumption.
- (3) The alcohol hangover is a combination of mental and physical symptoms, experienced the day after excessive alcohol consumption.

The first definition was most elaborate, including both the most frequently mentioned combination of symptoms, as well as the consequences of the alcohol hangover. The second definition left out the consequences, and the third definition left out both the symptom combination and the next-day consequences of heavy alcohol consumption. Members of the Alcohol Hangover Research Group were consulted to give their opinion on these three definitions.

Expert Opinions

N=16 experts responded to the call to give their opinion on the proposed hangover definitions, and provided valuable

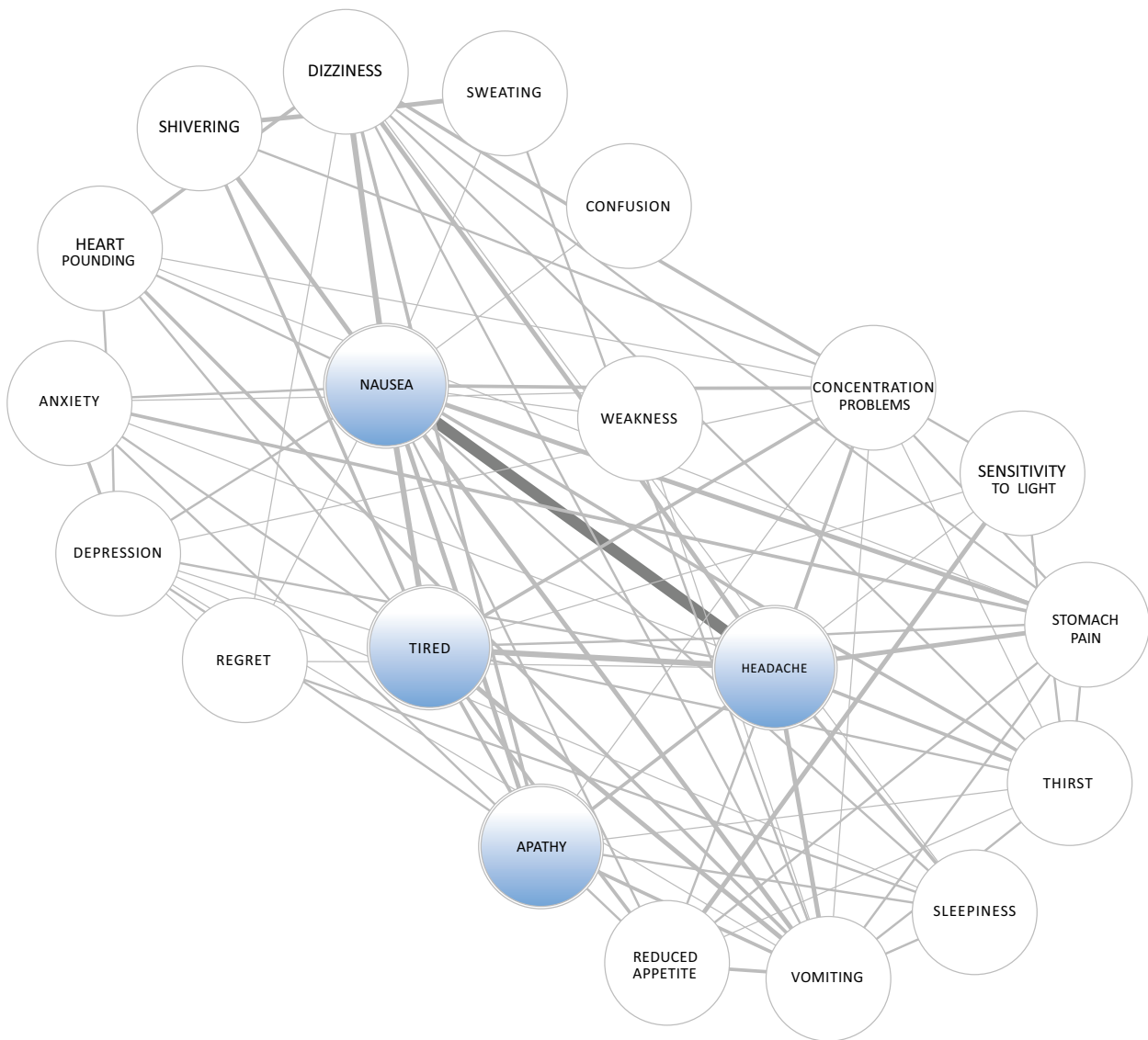


Fig. (1). Reported hangover symptoms and their interrelationship. The blue dots are the most frequently reported hangover symptoms. Strength of associations between symptoms is indicated by the thickness of the interconnecting lines (bolder lines indicate stronger associations). The highest adjusted Phi-coefficient (0.75) was observed between nausea and headache.

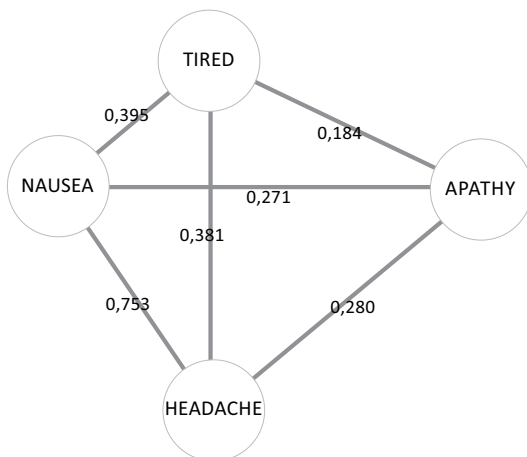


Fig. (2). Associations between the four hangover symptoms that were mentioned most frequently together in the hangover definition. Adjusted Phi-coefficients are shown. A higher adjusted Phi-coefficient implies that two symptoms are more frequently mentioned together.

arguments for improvement which are discussed in the following sections.

It was noted that the three definitions provided are those that social drinkers believe the definition of hangover should be. Based on the scientific literature and research knowledge, experts can add important components to the definition in order to improve its accuracy.

The first definition stated “The alcohol hangover is a combination of mental and physical symptoms, including headache, nausea, being tired and apathy, experienced the day after excessive alcohol consumption, which may negatively impact daily functioning and mood”. Several experts liked this definition, as it captures both the symptoms and the consequences of the alcohol hangover, as well as giving examples of the most commonly mentioned symptoms.

Other experts argued however that a construct should not be defined with respect to its putative outcomes or antecedents. As it causes conceptual confounding, the functional consequences should not be part of a definition for the alco-

hol hangover. In other words, any definitive definition of hangover needs to separate what the phenomenon is from how it is experienced and what it affects.

It was suggested to include a reference to the pathology of the alcohol hangover in a definition. For example, referring to immunological changes, or to physiological imbalance and restoring homeostasis. While this is tempting, at this moment, it should be avoided to include a possible causal mechanism behind the alcohol hangover state in a definition. Currently, the pathology of the alcohol hangover is poorly understood [17], making it impossible to be confident that including causal information will be correct. Only referring that the body is restoring homeostasis does not add to the understanding of the concept of alcohol hangover.

Several experts liked the second definition, stating: “The alcohol hangover is a combination of mental and physical symptoms, including headache, nausea, being tired and apathy, experienced the day after excessive alcohol consumption”. This definition omits the consequences but gives examples of hangover symptoms.

Experts who like this definition often stated that providing a few symptom examples in the definition is informative and useful. However, others argued that providing specific examples may be problematic. Research has identified 49 hangover symptoms in literature [6]. The decision which symptoms should be included in a definition depends on the rationale one has. The four symptoms listed in the proposed definition are the symptoms most commonly reported by social drinkers providing a definition for the alcohol hangover. However, these symptoms differ from the most frequently experienced hangover symptoms [6-7], and they also differ in part from symptoms that have the most negative impact on mental and physical performance, or mood [14]. It was therefore argued that for a definition, instead of mentioning specific symptoms, it might be better to combine these into mental and physical symptoms. Examples can then be given next to the definition, if needed.

Although some experts argued that this definition without naming symptoms is too sparse, others mentioned that symptoms may vary from drinker to drinker, and between drinking occasions. For example, a drinker may experience a headache on one hangover occasion, but not on another hangover occasion. In this sense, presenting a subset of symptoms limits the concept of the alcohol hangover, and disregards the fact that the presence and severity of specific symptoms depend on a variety of factors, including but not limited to type of drink, quantity of alcohol, tolerance, weight, gender, and more. In this context, it should also be taken into account that the survey sample only comprised students, 18 to 30 years old. Although hangovers are much more commonly experienced in this age group than other age groups, research has shown that the presence and severity of hangover symptoms may differ across age groups [18]. Given this, the third proposed definition, “*The alcohol hangover is a combination of mental and physical symptoms, experienced the day after excessive alcohol consumption*”, may be the most correct one.

There was some debate as to whether ‘mental’ should be replaced by the term ‘cognitive’. As mental is inclusive of both poor cognition and emotional and mood changes, it was

decided that mental should be the preferred terminology. Changing ‘physical’ into ‘somatic’ was not supported by most experts. It was further argued that ‘heavy’ drinking is more accurate than ‘excessive’ drinking. Excessive drinking involves subjective judgment of what is “too much”. Where one person may think consuming three alcoholic drinks in 3 hours is excessive, others may regard consuming 12 drinks in 3 hours as not excessive. Although ‘heavy’ in itself is also a subjective classification, it is more easily to define. For example, heavy drinking can be defined as consuming a certain number of alcohol units in a given period of time, or as consuming alcohol to reach a certain BAC. The discussion regarding a necessary peak BAC or amount of alcohol consumed to develop a hangover is an important one, that may contribute to future refining of the concept of the alcohol hangover. For the definition of the alcohol hangover, using the term ‘heavy’ is adequate and sufficient to differentiate these drinking sessions from normal drinking occasions from less alcohol consumed that do not result in a hangover.

Although the third definition was regarded as most correct, it was also argued that it should be more specifically describing some of the key elements of the alcohol hangover. Most importantly in this regard, the information was to be elaborated concerning the timing of the hangover to differentiate it from the phenomenon of alcohol withdrawal. Experts agreed that the definition should clarify that the hangover state starts when BAC approaches zero. The latter is important to differentiate the hangover state from intoxication effects. Distinguishing the transient state of alcohol hangover from the state of alcohol withdrawal syndrome that requires a chronic administration of ethanol was most easily established by including in the definition that alcohol hangover occurs after a single episode of alcohol consumption.

CONCLUSION

Taken together, the final definition of the alcohol hangover reads as follows:

“The alcohol hangover refers to the combination of mental and physical symptoms, experienced the day after a single episode of heavy drinking, starting when blood alcohol concentration approaches zero.”

In addition to this definition, authors can of course discuss typical symptoms, functional consequences and possible explanations for the pathology of the alcohol hangover. However, although these are all important topics, they should not be part of the definition itself.

CONFLICT OF INTEREST

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REFERENCES

- [1] Srikantha-Murthy KR. Illustrated suśruta samhitā. Volume III. Chaukhambha Orientalia, Varanasi, India 2008.
- [2] Verster JC. The alcohol hangover - a puzzling phenomenon. *Alcohol Alcoholism* 2008; 43: 124-6.
- [3] Prat G, Adan A, Sánchez-Turet M. Alcohol hangover: A critical review of explanatory factors. *Hum Psychopharmacol* 2009; 24(4): 259-67.
- [4] Verster JC, Stephens R, Penning R, *et al.* On behalf of the Alcohol Hangover Research Group. The alcohol hangover research group consensus statement on best practice in alcohol hangover research. *Curr Drug Abuse Rev* 2010; 3(2): 116-27.
- [5] Penning R, McKinney A, Verster JC. Alcohol hangover symptoms and their contribution to the overall hangover severity. *Alcohol Alcohol* 2012; 47: 248-52.
- [6] Penning R, McKinney A, Bus LD, Olivier B, Slot K, Verster JC. Measurement of alcohol hangover severity: Development of the alcohol hangover severity scale (AHSS). *Psychopharmacology* 2013; 225(4): 803-10.
- [7] Slutske WS, Piasecki TM, Nathanson L, Statham DJ, Martin NG. Genetic influences on alcohol-related hangover. *Addiction* 2014; 109(12): 2027-34.
- [8] Huntley GAB, Treloar H, Blanchard, ABS, Monti, PM, Carey, KB, Rohsenow, DJ, Miranda, R. An event-level investigation of hangovers' relationship to age and drinking. *Exp Clin Psychopharmacol* 2015; 23(5): 314-23.
- [9] Karadayian AG, Bustamante J, Czerniczyniec A, Lombardi P, Cutrera RA, Lores-Arnaiz S. Alcohol hangover induces mitochondrial dysfunction and free radical production in mouse cerebellum. *Neuroscience* 2015; 304: 47-59.
- [10] Hogewoning A, Van de Loo A, Mackus M, *et al.* Characteristics of social drinkers with and without a hangover after heavy alcohol consumption. *Subst Abuse Rehabil* 2016; 7: 161-7.
- [11] Grange JA, Stephens R, Jones K, Owen L. The effect of alcohol hangover on choice response time. *J Psychopharmacol* 2016; 30(7): 654-61.
- [12] Slutske WS, Piasecki TM, Hunt-Carter EE. Development and initial validation of the Hangover Symptoms Scale: Prevalence and correlates of hangover symptoms in college students. *Alcohol Clin Exp Res* 2003; 27(9): 1442-50.
- [13] Rohsenow DJ, Howland J, Minsky SJ, Greece J, Almeida A, Roehrs TA. The acute hangover scale: A new measure of immediate hangover symptoms. *Addict Behav* 2007; 32(6): 1314-20.
- [14] Van Schrojenstein Lantman M, Mackus M, Van de Loo AJAE, Verster JC. The impact of alcohol hangover symptoms on cognitive functioning, physical activity, and mood.
- [15] Western Oregon university, how to write an extended definition. 13-10-2004. [Accessed *via*: <http://www.wou.edu/~cornin/wr135/definition.html>].
- [16] Pepper M, Driscoll DL. Writing definitions. Purdue Online Writing Lab. 30-07-2015. [Accessed *via*: <https://owl.english.purdue.edu/owl/resource/622/01/>].
- [17] Penning R, Van Nuland M, Fliervoet LAL, Olivier B, Verster JC. The pathology of alcohol hangover. *Curr Drug Abuse Rev* 2010; 3(2): 68-75.
- [18] Tolstrup JS, Stephens R, Grønbaek M. Does the severity of hangovers decline with age? Survey of the incidence of hangover in different age groups. *Alcohol Clin Exp Res* 2014 ; 38(2): 466-70.