

Drinking and Obesity

BACKGROUND

Obesity in Context

The World Health Organization (WHO) defines obesity as an abnormal accumulation of body fat that may have a negative impact on one's health [1]. The combination of excessive energy intake, lack of physical activity, and genetic disposition are believed to be the main drivers of obesity.

- Body mass index (BMI), which is calculated by dividing an individual's weight (in kilograms) by his/her height (in meters) squared, is generally used to measure body fat.
- WHO classifies a person with a BMI greater than 25 as overweight and a BMI greater than 30 as obese [1].

Obesity is a major risk factor for numerous noncommunicable diseases (NCDs), including:

- cardiovascular diseases;
- type 2 diabetes;
- musculoskeletal disorders; and
- some cancers [1-3].

In 2010, an estimated 3.4 million deaths and 93.6 million disability-adjusted life years (DALYs)¹ were attributed to being overweight or obese [4-6]. The worldwide prevalence of obesity increased 28% for adults and 47% for children between 1980 and 2013 [5].

Alcohol as a modifier of body weight

A number of factors have been implicated in the development of adult obesity, one of which is the consumption of alcohol [2].

Compared to other substrates metabolized by the body, ethanol has a relatively high energy content. Pure ethanol has an energy density of 7.1 kcal/g, while that of lipids (fat) is 9 kcal/g; proteins and carbohydrates have an energy density of 4 kcal/g [7].

Thus, excessive consumption of ethanol may result in a positive energy balance, which may, over time, result in being overweight or obese [7].

The current evidence surrounding alcohol as a potential modifier of body weight will be summarized in this health review.

1. DALYs are a measure of years of healthy life lost. They are calculated by summing the years of life lost (YLL) due to premature mortality and the years lost due to disability (YLD) for individuals living with a health condition.

SUMMARY OF THE LITERATURE

Mechanisms of action

To date, research on the relationship between alcohol consumption and obesity has produced inconsistent findings [7-10]. This may be explained, in part, by the myriad of factors that modify the nature of the relationship between alcohol consumption and the development of obesity.

Alcohol consumption has been shown to have differing associations for men and women with respect to both general obesity [11-23] and abdominal obesity [24-26]².

- Numerous studies have reported divergent results for men and women [11, 12, 14-18, 20, 25-31]. For example, one study found no significant relationship between alcohol consumption and BMI or hip circumference among men, but did find positive associations between consumption and waist circumference and waist-hip ratio. Among women, the same study found negative associations between alcohol consumption and BMI, hip circumference, and waist circumference, but a positive association between alcohol consumption and waist-hip ratio [16].

Evidence that certain personality traits, such as impulsivity and sensation-seeking, are associated with both harmful eating behaviors and potentially harmful drinking patterns further supports the notion that both harmful activities involve the same neural pathways [32-40].

Eating behaviors may also modify the relationship between alcohol consumption and obesity. Research has revealed a co-occurrence of alcohol consumption and disordered eating and/or exercise patterns in certain individuals.

- Much of this research has examined college-age women and has found that many young women are likely to limit food intake prior to alcohol consumption, engage in extreme physical activity, or purge following heavy-drinking episodes [41-44].

Increased energy intake from alcohol

Research suggests that some of the same neural pathways in the brain are involved in physiological responses to both alcohol consumption and food intake.

- Release of the neurotransmitter dopamine, a component of the brain's reward system, is stimulated by alcohol intake [45, 46] and also plays a role in the rewarding properties of eating and overeating [47].
- Alcohol acts on the opioid neurotransmitter system, which is also implicated in the regulation of the sensory reward components of eating [48, 49].
- Finally, alcohol binds to a subtype of gamma-aminobutyric acid (GABA) receptor that has been implicated both in the motivation to drink alcohol [50] and in the control of food intake in animal models [49, 51-53].

Studies have shown that overall energy intake is often increased following consumption of alcohol [54]. Although multiple explanations for this have been offered, the empirical evidence is inconsistent.

- Some researchers have hypothesized that alcohol influences taste or stimulates appetite and increases hunger, referred to as the "appetizer effect," yet there is no clear evidence to support this hypothesis [48, 55-58].
- Alternatively, it has been suggested that alcohol may increase energy intake by interfering with mechanisms of satiety, or "fullness." However, studies have failed to find evidence of a direct effect of alcohol consumption on satiety [59-64].
- Another possibility is that the frequent pairing of alcohol and food may lead to a linkage between alcohol and food consumption through associative condition and expectancy effects [57]³.
- Still another interpretation suggests that alcohol may inhibit cognitive controls over eating, leading to increased food intake among restrained eaters in particular [65], but evidence in support of this theory is mixed [66-68].

2. General obesity is typically measured by body mass index (BMI). Abdominal obesity addresses the distribution of fat, using measures such as waist circumference, hip circumference, and waist-to-hip ratio.

3. Individuals can unconsciously affect expected outcomes. If, for example, a person believes alcohol increases his appetite, this expectation may cause him to feel hungry after consuming alcohol.

Drinking patterns and obesity

Research on alcohol consumption and obesity also suggests that variation in drinking patterns, and not simply levels of consumption, may play an important role in alcohol's association with obesity.

While many studies have evaluated the effects of varying levels of consumption, far fewer studies have examined drinking patterns in greater detail. There is, however, some evidence that the relationship between alcohol consumption and obesity may differ depending on the frequency and intensity of consumption.

There is limited evidence suggesting that drinking frequency is inversely correlated with general and abdominal obesity [28, 31, 69, 70].

- For example, one study found individuals consuming 1-2 drinks per week had a higher risk of obesity (odds ratio of 1.8) than those consuming 3-5 drinks per week (odds ratio of 1.6) [69].
- Another study compared obesity among individuals who drank daily, weekly, less than weekly, or abstained entirely, and found daily drinkers had the smallest measures of abdominal obesity, followed by weekly drinkers [28].

Whereas more frequent alcohol consumption may protect against the development of obesity, the available evidence suggests the opposite may be true for drinking intensity.

- Studies have found the number of drinks per drinking day to be positively associated with abdominal obesity [28, 71]. While there is an association, this relationship may be due to underlying personality factors such as impulsivity, which has been linked to obesity, binge eating, and binge drinking [72].

Does type of alcoholic beverage matter?

Although it has been suggested that the type of beverage consumed may also modify the relationship between alcohol consumption and development of obesity, the results are inconsistent.

- Some studies have shown differences across beverage categories [14, 18, 24, 25, 28, 30, 73-82], while others have failed to show a difference [16, 77, 83-85].

A 2012 systematic review and meta-analysis of beer consumption and obesity studies found that higher levels of consumption tend to be associated with greater abdominal obesity in men, with inconsistent results for women. No association was found for general or abdominal obesity at lower levels of consumption for either men or women [9]. However, in the absence of comparable systematic reviews for the other beverage categories, it is difficult to draw meaningful conclusions from this work regarding the influence of beverage type on obesity.

It is also important to keep in mind that in some cases the relationships observed between beverage type and obesity may be attributable to additional factors related to both beverage preference and obesity, and not necessarily due to the properties of the particular beverages themselves.

For example:

- In some cultures, studies have found that, compared to other drinkers or abstainers, wine drinkers tend to have higher education levels, socioeconomic status, diet quality, and levels of physical activity [86-92], all of which are factors associated with a lower obesity risk [93-95].
- Associations can, however, vary across cultures. For instance, in Portugal, research indicates that less-educated men tend to consume higher amounts of wine than beer or spirits [96].
- Beverage preference may also be related to differences in drinking frequency and intensity. The nature of these differences can also vary according to the cultural context [97-99].

When interpreting research findings on risk factors and associated health outcomes, a number of methodological issues should be taken into consideration.

METHODICAL CONSIDERATIONS

Measurement of Obesity

There are many techniques for measuring obesity. Most obesity research relies on BMI as an approximation of general obesity, due to its strong correlation with body fat percentage; however, though more difficult to estimate, abdominal obesity is a stronger predictor of obesity-related diseases, especially cardiovascular disease [100, 101].

Underreporting

The underreporting of drinking is a central concern of alcohol-related research. It is well-established that survey respondents often underestimate their alcohol consumption. The magnitude of underreporting varies by respondent, context, and the approach used to measure consumption.

Misclassification of drinkers

Studies suggest that the underreporting of consumption can result in the misclassification of drinkers, especially between the low and moderate consumption categories. This misclassification can make it difficult to establish a clear relationship between low or moderate alcohol intake and disease outcomes. This, in turn, makes it difficult to identify definitive thresholds at which alcohol consumption increases the risk for specific diseases.

CONCLUDING REMARKS

Unhealthy diet and insufficient physical activity contribute to a positive energy balance that is associated with weight gain. Demographic factors such as age, race, ethnicity, and socioeconomic status also play an important role in the development of obesity [102-104].

Additionally, there is a well-documented inverse association between cigarette smoking and body weight. Individuals who smoke cigarettes tend to have lower body weights than those who do not [105, 106].

Further investigation could look into factors that may modify alcohol's association with obesity, such as

- Gender;
- Extreme eating and exercise behaviors; and
- Drinking patterns, including drinking frequency, intensity, and beverage type.

Future research should also take genetic factors into consideration.

- Genetic factors may account for 45% to 75% of BMI variation between individuals and have been shown to play a strong role in the development of obesity-related outcomes [107].

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