The myth of slow alcohol metabolism in old age: Ignorance or public health misinformation?

Dr Erik Skovenborg examines the latest medical studies on the effects of alcohol consumption on the physical and mental health of older drinkers

What though youth gave love and roses,
Age still leaves us friends and wine
—Thomas Moore

The potential benefit that moderate drinking may have upon psychosocial functioning among the elderly is often underappreciated. In many societies, drinking provides a means for friends and family to gather, relax, eat, and enjoy each other's company.[1] Wining and dining your friends is a sensible strategy—those who eat and drink socially more often feel happier and are more satisfied with life. Evening meals at which laughter and reminiscences occur and alcohol is drunk are especially likely to enhance feelings of closeness.[2]

A drink to healthy aging

The quality and quantity of individuals' social relationships have been linked not only to mental health but also to healthy aging. Data from 148 studies (308,849 participants) indicate that individuals with strong social relationships have a 50 percent greater likelihood of survival compared to those with poor or insufficient social relationships. The magnitude of this effect is comparable with quitting smoking, and it exceeds many well-known risk factors for mortality such as obesity and physical inactivity.[3] Let's take a look at the quality of life of moderate drinkers around the world and how they handle their social relationships.

- Studies of behavior in pubs and UK survey data show that social drinkers have more friends on whom they can depend for emotional and other support; they also feel more engaged with, and trusting of, their local community.[4]

Isidor Kaufmann (1853–1921), *Wor Time Remnicenes*. © Christie's Images / Bridgeman Images

- Interviews with a self-selecting sample of retired people from the west of Scotland found use of alcohol most often framed in terms of pleasure, relaxation, and socializing.[5]
- In a sample of 7,820 community-dwelling individuals aged 40 to 95 years in Germany, occasional and daily drinking (compared with never drinking) were positively associated with a decreased loneliness, a higher life satisfaction, a higher positive affect, a higher optimism, a higher self-efficacy, a higher self-esteem, and less perceived stress.[6]
- In-depth interviews with 20 men and 22 women aged 65 to 74 years from Perth, Western Australia, indicated that moderate alcohol use was linked with social engagement in activities and appeared to serve an important function as a "social lubricant."[7]
- Among 1,594 Rancho Bernardo residents aged 50 to 97 years, regular alcohol consumption was associated with increasing quality of life and mood.[8]

Is alcohol good or bad for you?

Apart from the possible role of low to moderate levels of alcohol consumption as a social lubricant, when you are informed that large observational studies of elderly men and women in Denmark[9] and elderly US adults[10] found light drinking (1–2 drinks per day) associated with lower mortality than abstention or heavy drinking, and when you read that moderate drinkers (up to 3 drinks/day for women and men aged 65 and over) in the Rancho Bernardo Study, relative to nondrinkers, had significantly higher odds of survival to age 85 without cognitive impairment,[11] you would suppose that the road to enjoyment of wine in moderation in old age would be paved with widespread acceptance. But that is not the case at all. From the day you reach age 65, officially transitioning from middle age to old age, you will be told repeatedly that alcohol consumption is a risky business and that you have to take care.

"Despite drinking comparatively little, older drinkers consume alcohol far more often than any other age group. The cumulative effect of regular drinking takes its toll on the body of an older person, which is less able to handle the same levels of alcohol as in previous years," a factsheet from Alcohol Concern concludes.[12] "Tolerance to alcohol is significantly lowered in the aged person, so it is possible that the same amount of alcohol can have a more detrimental effect than it would on a younger person. Older people are less tolerant to alcohol because of physical changes such as":

- A fall in ratio of body water to fat, meaning there is less water in which alcohol can be diluted.
- Decreased hepatic blood flow, leading to weakening of the liver. Liver enzyme inefficiency, so alcohol will not be broken down as well as in younger people.
- An altered responsiveness of the brain; alcohol affects older brains more quickly than younger ones.

The IAS Factsheet does not offer any scientific evidence to substantiate these assertions. Furthermore, the population of adults aged 65 years or older is very varied, ranging from the most robust healthy individuals with excellent marathon performances, to the frailest residents of assisted living facilities and nursing homes. No single formula can predict the alcohol metabolism, alcohol tolerance, and consequences of drinking for this heterogenous group, but let's take a look at the recent scientific literature on alcohol, its absorption, distribution, and metabolism.[13]

Total body water (TBW) Once in the bloodstream, alcohol is distributed into the TBW compartment, which comprises around 55–60 percent of body weight in non-obese males and around 50–55 percent in females. The volume of distribution of alcohol depends on a person's age, gender, and degree of adiposity. In men, TBW declines with age, from on average 45.6 liters (96.4 US pints, age 20 to 29 years), to 42.5 liters (89.8 US pints, age 80 to 89 years) = a loss of 3.1 liters (6.5 US pints, 6.9 percent) of TBW during 60 years. In women, TBW declines from 32 liters (67.6 US pints, age 20 to 29 years), to 30.2 liters (63.8 US pints, age 80 to 89 years) = a loss of 1.8 liters (3.8 US pints, 5.6 percent) of TBW during 60 years.[14]

Alcohol metabolism Elimination of alcohol from the body occurs primarily through metabolism by hepatic alcohol dehydrogenase (ADH), an enzyme located in the liver. A small fraction (around 2 percent) of the dose undergoes metabolism in the stomach by gastric ADH. The hepatic ADH enzyme is saturated with substrate (alcohol) at a blood alcohol concentration (BAC) above 15–20mg/100ml (15–20 mg%), and the BAC decreases at a constant rate per unit time ranging from 10 to 35mg% per hour (average 15mg% per hour for moderate drinkers).[15]

Vestal et al's 1977 study of the effect of aging on the elimination of alcohol in a group of 50 healthy subjects ranging in age from 21 to 81 years found no influence by age on the rates of ethanol elimination.[15] A well-preserved hepatic ethanol elimination in old age has been confirmed in 11 studies published from 1968 to 2014, and Fiorentino & Moskowitz even found a higher alcohol elimination rate for older subjects (51 to 69 years) than for younger subjects (19 to 50 years).[16]

An altered responsiveness of the brain? Jones & Neri observed that young men (20–29 years) reported significantly lower subjective intoxication scores than did older subjects (30–59 years) tested at the same blood alcohol levels after the administration of 0.68g alcohol/kg as neat whiskey.[17] Quillan et al compared simulated driving performance of 14 middle-aged men (mean age 36 years) and 14 older men (mean age 69 years) while sober and legally intoxicated (BAC > 80mg/100 ml). Both age and legal intoxication affected driving performance, but older men were no more sensitive to alcohol in terms of peak BAC, driving performance, awareness, or judgment than middle-aged men.[18]

Bane or boon in old age?

In the ongoing discussion of whether wine is a bane or a boon in old age, let's take a look at the evidence. Alcoholic beverages may be considered either a tonic or a toxin in a dose-dependent fashion, with binge drinking, especially on an empty stomach, an example of a toxic drinking pattern, as distinct from the moderate intake of wine with meals as part of a balanced diet. Beresford & Lucey studied the influence of age and gender on blood-alcohol concentrations in 14 men and 14 women 21–40 years old and 14 men and 13 women ≥ 60 years old. All subjects were given alcohol (0.3g/kg) on three occasions: orally after an overnight fast; orally after a standard

RATE OF DISAPPEARANCE OF ALCOHOL

Rate of disappearance of alcohol from the blood is measured in milligram alcohol per 100ml body water per hour. The absorption, metabolism, and blood clearance of alcohol are all subject to high interindividual variability due to hereditary traits, gender, habitual alcohol intake, and drinking pattern.[13]

- Normal values for fasting persons: 10–15mg alcohol/100ml body water/hour.
- Normal values after a meal: 15–20mg alcohol/100ml body water/hour.
- Normal values for heavy drinkers: 25–35mg alcohol/100 ml body water/hour.

On average, an occasional drinker metabolizes 10mg alcohol/100 ml body water/hour = 100mg (0.10g) alcohol/liter body water per hour, while a person with a regular, moderate consumption of alcohol metabolizes 15mg alcohol/100 ml body water/hour = 150 mg (0.15g) alcohol/liter body water per hour. The volume (liter) of total body water (TBW) for men is calculated as body weight (kg) x 0.68, while TBW for women (who have more body fat than men) is body weight (kg) x 0.55.

- A male regular drinker weighing 75kg (165lb) metabolizes 0.15g alcohol x 75 x 0.68 = 7.65g alcohol per hour.
- A female regular drinker weighing 50kg (110lb) metabolizes 0.15g alcohol x 50 x 0.55 = 4.12g alcohol per hour.

Fig 1. BAC curves for young and old women

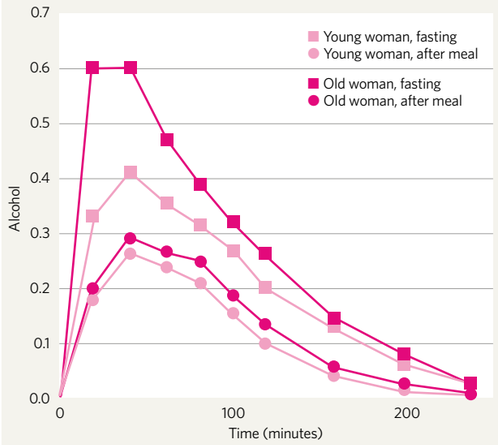
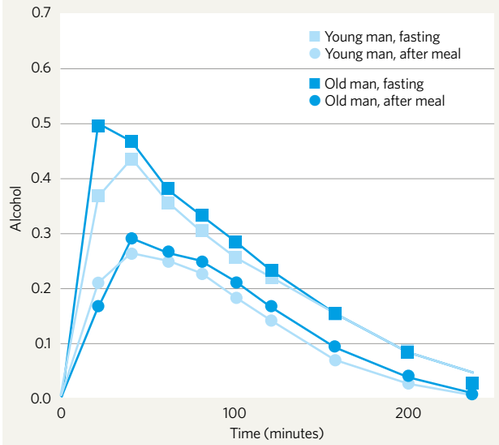


Fig 2. BAC curves for young and old men



meal; and by intravenous infusion after a standard meal.[19] As few elderly wine lovers inject their favorite tipple directly into the bloodstream through a vein, we shall focus on the other two conditions: fasting or after a meal.

Figures 1 and 2 are redrawn from the results of Beresford & Lucey's experiment. The downward sloping parts of the BAC curves (depicting alcohol metabolism) are identical for young/old women and young/old men whether in fasting conditions or after a meal (in accordance with the studies showing no influence by age on the rates of ethanol elimination). And while under fasting conditions older men, and especially older women, have higher BACs than the younger participants (in accordance with a modest decrease of total body water with age), the peak BACs are practically identical for young and old alike when alcohol is taken after a light meal ("Alkoholpromille" 0.1 = BAC 10mg/100ml). The Mediterranean way of drinking—a glass of red wine with your meal—is cheerfully recommended!

Fear of alcoholism: no excuse for false information

With increasing age, the proportions of people consuming higher quantities of alcohol (≥2–3 drinks) decrease, while the proportions consuming about one drink frequently (260–365 days per year) increase, according to a cross-sectional study of 40,556 Americans aged 60 and over.[20] The blood alcohol levels that are achieved during drinking occasions represent the most direct measure of the biological impact of alcohol consumption on the body. A survey of 1,833 current drinkers of 18–89 years revealed that, for both men and women, there was an age-related decrease in the predicted peak BAC achieved on typical drinking occasions.[21] A common factor in the drinking habits of older adults is the everyday nature of drinking small amounts of beer or wine, and the majority of older adults from pooled studies do not view themselves as risky drinkers.[22]

A recent review by Bareham et al reported a number of studies where older people recognized the positive effects of drinking; alcohol could create feelings of pleasure and relaxation,

> "Ferdinand C Helwig had a relative who occasionally dined with him. Before and after a full dinner, this relative would have a drink which he enjoyed. His conversation sparkled, and he was full of life. When he later went home to bed, he would have a pleasant, relaxed night of sleep. When he did not dine out, he was neither sparkling, nor vivacious; and he customarily slept badly. His difficulty lay in the fact that his daughter, with whom he lived, would not permit him to drink, because she feared that he might be addicted to alcohol. He was then eighty-three years old."[26]

important for enjoying later years.[23] The pleasures of alcohol use in older people's lives presented in this review contrast with the majority of quantitative studies of older people's drinking, with the presentation of drinking in older age as a risky health behavior.[24]

Why do some physicians and public health officials keep on issuing dire warnings to elderly people about the dangers of alcohol? Addiction psychiatrists like the authors of *Our Invisible Addicts* are worried about those who develop problem drinking later in life due to factors such as bereavement, psychological conditions such as anxiety or depression, social isolation, and life changes associated with, for example, retirement.[25] The question is whether alcohol problems for the few should discount the benefits of moderate drinking for the many?

Another cause of worry is the association of alcohol consumption and the risk of certain types of cancer. "To reduce your cancer risk as much as possible, we recommend not drinking alcohol at all" is today's advice from the World Cancer Research Fund.[27] Yet the evidence for a causal association of a small intake of wine embedded in a healthy lifestyle is weak. A systematic review found highest adherence to the Mediterranean diet related to lower risk of cancer mortality reflected by inverse associations between overall cancer risk and consumption of fruit, vegetables, whole grains, and moderate intake of red wine.[28]

Graphs courtesy of Dr Erik Skovenborg

Worries about heavy alcohol consumption and binge drinking in old age are appropriate and legitimate reasons for concern among public health officers and physicians treating patients harmed by alcohol abuse. That good cause, however, cannot excuse the fact that the evidence base at certain points is not handled in a balanced way; and to propagate false claims of decreases in the rate of liver metabolism of alcohol in older adults is downright dishonorable. According to Karl Popper, one of the 20th century's most influential philosophers of science, "True ignorance is not the absence of knowledge but the refusal to acquire it." Despite solid evidence of an unaltered rate of alcohol metabolism in old age published in 1977,[15] there have since been many examples of the pragmatic "good lie"—a false claim of reduced metabolism in old age—in the literature on alcohol and health in old age; too many to be a coincidence. As Goethe wrote, "*Man merkt die Absicht und wird verstimmt!*" ("You sense the intention, and that makes you depressed!").

Approaches to reduce alcohol abuse in older people need to avoid paradoxical harm, with a need for approaches that reduce harm from drinking alcohol but retain the benefit of socializing.[29] In a study of 1,050 adult wine consumers, those perceiving wine as healthy had a higher frequency but not a higher volume of consumption, and no indication of higher potential for alcoholism. There is no reason to suppose that wine drinkers' wellbeing will be threatened by their response to positive information on the health benefits of wine.[30]

Slow food and fine-wine sipping

As opposed to fast food and fast living, slow food is about the pleasure of good local food being enjoyed at a relaxed pace around a lively table in the company of family and friends. As opposed to binge drinking, wine sipping will allow you to savor the complex flavors of the wine together with food, enhancing your dining experience without getting drunk. Quite sensibly, most people do not drink for health reasons but for psychological and social benefits, and no one should be choosing to drink for medical benefits rather than enjoyment and pleasure. The Greek poet Eubulus voted for a wine dose of three Kylix cups, and in one of his plays (c.375 BC) had Dionysus, the god of wine, say, "Three bowls do I mix for the temperate: one to health, which they empty first; the second to love and pleasure; the third to sleep. When this bowl is drunk up, wise guests go home."

In conclusion, older people should not be advised to drink for their health, but rather to drink—moderately—to their health!

NOTES

1. DB Heath, "Why We Don't Know More About the Social Benefits of Moderate Drinking," *Annals of Epidemiology* 17 (2007), S71–S74.
2. RIM Dunbar, "Breaking Bread: The Functions of Social Eating," *Adaptive Human Behavior and Physiology* 3 (2017), pp.198–211.
3. J Holt-Lunstad, TB Smith, JB Layton, "Social Relationships and Mortality Risk: A Meta-Analytic Review," *PLoS Medicine* 7:7 (2010), e1000316.
4. RIM Dunbar, "Functional Benefits of (Modest) Alcohol Consumption," *Adaptive Human Behavior and Physiology* 3 (2017), pp.118–33.
5. D Nicholson, F McCormack, P Seaman, K Bell, et al, "Alcohol and Healthy Ageing: A Challenge for Alcohol Policy," *Public Health* 148 (2017), pp.13–18.
6. A Hajek, J-O Bock, S Weyerer, H-H König, "Correlates of Alcohol Consumption Among Germans in the Second Half of Life: Results of a Population-Based Observational Study," *BMC Geriatrics* 17 (2017), p.207.
7. J Dare, C Wilkinson, S Allsop, S Waters, S McHale, "Social Engagement, Setting and Alcohol Use Among a Sample of Older Australians," *Health and Social Care in the Community* 22:5 2014, pp.24–32.
8. AM Chan, D von Mühlen, D Kritz-Silverstein, E Barrett-Connor, "Regular Alcohol Consumption Is Associated with Increasing Quality of Life and Mood in Older Men and Women: The Rancho Bernardo Study," *Maturitas* 62:3 (2009), pp.294–300.
9. M Grønbæk, A Deis, U Becker, HO Hein, et al, "Alcohol and Mortality: Is There a U-Shaped Relation in Elderly People?" *Age and Ageing* 27:6 (1998), pp.739–44.
10. MJ Thun, R Peto, AD Lopez, JH Monaco, et al, "Alcohol Consumption and Mortality Among Middle-Aged and Elderly US Adults," *New England Journal of Medicine* 337 (1997), pp.1705–14.
11. EL Richard, DG Kritz-Silverstein, GA Laughlin, TT Fung, et al, "Alcohol Intake and Cognitively Healthy Longevity in Community-Dwelling Adults: The Rancho Bernardo Study, *Journal of Alzheimer's Disease* 59:3 (2017), pp.803–14.
12. IAS Factsheet: Older People and Alcohol (Institute of Alcohol Studies, May 2013), ias.org.uk
13. AW Jones, "Alcohol, Its Absorption, Distribution, Metabolism, and Excretion in the Body and Pharmacokinetic Calculations," *WIREs Forensic Science* 1:5 (2019), e1340.
14. WC Chumlea, SS Guo, CM Zeller, NV Reo, et al, "Total Body Water Reference Values and Prediction Equations for Adults," *Kidney International* 59 (2001), pp.2250–58.
15. RE Vestal, EA McGuire, JD Tobin, R Andres, et al, "Aging and Ethanol Metabolism," *Clinical Pharmacology and Therapeutics* 21 (1977), pp.343–54.
16. DD Fiorentino, H Moskowitz, "Breath Alcohol Elimination Rate as a Function of Age, Gender, and Drinking Practice," *Forensic Science International* 233 (2013), pp.278–82.
17. AW Jones, A Neri, "Age-Related Differences in Blood Ethanol Parameters and Subjective Feelings of Intoxication in Healthy Men," *Alcohol and Alcoholism* 120 (1985), pp.45–52.
18. WC Quillian, DJ Cox, BP Kovatchev, C Phillips, "The Effects of Age and Alcohol Intoxication on Simulated Driving Performance, Awareness and Self-Restraint," *Age and Ageing* 28 (1999), pp.59–66.
19. TP Beresford & MR Lucey, "Ethanol Metabolism and Intoxication in the Elderly," *Alcohol and Aging*, T Beresford & E Gomberg, eds (Oxford University Press, Oxford; 1995), pp.117–127.
20. RA Breslow, B Smothers, "Drinking Patterns of Older Americans: National Health Interview Surveys, 1997–2001," *Journal of Studies on Alcohol* 65 (2004), pp.232–40.
21. JL York, J Welte, J Hirsch, "Regulation of Alcohol Intake with Advancing Age," *Alcohol* 36:1 (2005),pp.41–46.
22. N Fudge, "Enhancing Our Understanding of Drinking in Later Life: Qualitative Data Refreshes Parts that Other Data Cannot Reach," *Age and Ageing* 48:1 (2019), pp.3–5.
23. BK Bareham, E Kaner, LP Spencer, B Hanratty, "Drinking in Later Life: A Systematic Review and Thematic Synthesis of Qualitative Studies Exploring Older People's Perceptions and Experiences," *Age and Ageing* 48:1 (2019), pp.134–46.
24. C Wilkinson, J Dare, "Shades of Grey: The Need for a Multidisciplinary Approach to Research Investigating Alcohol and Ageing," *Journal of Public Health Research* 3 (2014), p.180.
25. I Crome, K Dar, S Janikiewicz, T Rao, A Tarbuck, *Our Invisible Addicts: First Report of the Older Persons' Substance Misuse Working Group of the Royal College of Psychiatrists* (Royal College of Psychiatrists; London, 2011).
26. WH Smith, FC Helwig, *Liquor, the Servant of Man* (Little, Brown and Company; Boston, 1939).
27. wcrf-uk.org/uk/preventing-cancer/what-can-increase-your-risk-cancer/alcohol-and-cancer-risk
28. J Morze, A Danielewicz, K Przybyłowicz, H Zeng, et al, "An Updated Systematic Review and Meta-Analysis on Adherence to Mediterranean Diet and Risk of Cancer," *European Journal of Nutrition* 60:3 (2021), pp.1561–86.
29. S Kelly, O Olanrewaju, A Cowan, C Brayne, et al, "Alcohol and Older People: A Systematic Review of Barriers, Facilitators and Context of Drinking in Older People and Implications for Intervention Design," *PLoS One* 13:1 (2018), e0191189.
30. AJ Saliba, CC Moran, "The Influence of Perceived Healthiness on Wine Consumption Patterns," *Food Quality and Preference* 21 (2010), pp.692–96.