Nordic meeting on Brewing Technology

"Beer and health"

Arne Astrup, MD, DMSc
Head of department & professor
Potential Conflicts of Interest

• Editor of American Journal of Clinical Nutrition.

Consultant or member of advisory board:

• Basic Research, USA
• BioCare Copenhagen, DK
• **Dutch Beer Knowledge Institute**, NL
• Gelesis, USA
• IKEA Food Scientific Health Advisory Board, S
• Lucozade Ribena Suntory Ltd, UK
• McCain Foods Ltd, USA
• McDonald’s, USA
• Nestlé Research Center, Schweiz
• Novo Nordisk, DK
• Omega ACO, Sverige
• Pathway Genomics, USA
• Weight Watchers, USA.
PROF FRANS J. KOK
Emeritus Professor of Nutrition and Health, Wageningen University, the Netherlands
Expertise: Diet in disease prevention, energy balance and body composition

DR RAMON ESTRUCH
Hospital Clinic, CIBER Obesity and Nutrition, University of Barcelona, Spain
Expertise: Mediterranean diet, wine, beer, cardiovascular disease, atherosclerosis, inflammation

Scientific Committee
Prof Arne Astrup | Dr Ramon Estruch | Dr Henk Hendriks | Prof Frans Kok
Prof Ascensión Marcos | Dr Vincenzo Solfrizzi | Dr Corina-Aurelia Zugravu

“BEER CAN BE PART OF A HEALTHY LIFESTYLE”

“THERE IS NO DIFFERENCE BETWEEN MODERATE BEER AND WINE CONSUMPTION IN PROTECTING THE HEART”
**Good news:**

"**Few cardiac deaths in winedrinking France**"

**THE LANCET, MAY 12, 1979**

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**Public Health**

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**FACTORS ASSOCIATED WITH CARDIAC MORTALITY IN DEVELOPED COUNTRIES WITH PARTICULAR REFERENCE TO THE CONSUMPTION OF WINE**

A. S. St. Leger  
A. L. Cochrane  
F. Moore

*Medical Research Council Epidemiology Unit, Cardiff CF2 3AS*

**Summary**  
Deaths from ischaemic heart-disease in 18 developed countries are not strongly associated with health-service factors such as doctor and nurse density. There is a negative association with gross national product per capita and a positive but inconsistent association with saturated and monounsaturated fat intake. The principal finding is a strong and specific negative association between ischaemic heart-disease deaths and alcohol consumption. This is shown to be wholly attributable to wine consumption.

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**THE LANCET, MAY 12, 1979**

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Relationship between I.H.D. mortality-rate in men aged 55–64 and wine consumption.
Most of the wine & health evidence originates from observational population studies such as the very large Nurses’ Health Study.
Alcohol og mortality

![Graph showing alcohol mortality rates](image)

- Fed ryger
- Slank ryger
- Fed ikke-ryger
- Slank ikke-ryger

Relative risk vs. Alcohol consumption (number of drinks per week)
The effect of alcohol intake on mortality did not differ between middle-aged (50-64 years, mean = 56.6 years) and elderly men and women (>64 years old, mean 69.9 years).


Figure 1. Relative risk of mortality in relation to alcohol intake for middle-aged (——) and elderly (.....) people. Risk was set at 1.00 at lowest mortality at 1-6 beverages per week. Vertical lines are 95% confidence intervals for points depicting estimates for all subjects.
We cannot learn more from observational studies

<table>
<thead>
<tr>
<th>Author (Year)</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blackwelder et al (1980)</td>
<td>0.54 (0.37, 0.79)</td>
</tr>
<tr>
<td>Kittner et al (1983)</td>
<td>0.68 (0.39, 1.17)</td>
</tr>
<tr>
<td>Colditz et al (1985)</td>
<td>0.63 (0.44, 0.90)</td>
</tr>
<tr>
<td>Friedman et al (1986)</td>
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<td>Kono et al (1986)</td>
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</tr>
<tr>
<td>Suhonen et al (1987)</td>
<td>0.75 (0.61, 0.92)</td>
</tr>
<tr>
<td>Garfinkel et al (1988)</td>
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<tr>
<td>Boffetta et al (1990)</td>
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</tr>
<tr>
<td>Garg et al (1992)</td>
<td>0.74 (0.61, 0.90)</td>
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<tr>
<td>Suh et al (1992)</td>
<td>0.74 (0.61, 0.89)</td>
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<tr>
<td>Cullen et al (1993)</td>
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<tr>
<td>Rehm et al (1997)</td>
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<tr>
<td>Thun et al (1997)</td>
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<tr>
<td>Yuan et al (1997)</td>
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</tr>
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<td>Maskarinec et al (1998)</td>
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<tr>
<td>Albert et al (1999)</td>
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<td>Renaud et al (1999)</td>
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<td>Valmadrid et al (1999)</td>
<td>0.75 (0.66, 0.85)</td>
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<tr>
<td>Solomon et al (2000)</td>
<td>0.74 (0.66, 0.83)</td>
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<td>Trevisan et al (2001)</td>
<td>0.73 (0.65, 0.82)</td>
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<td>Diem et al (2003)</td>
<td>0.73 (0.65, 0.82)</td>
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<tr>
<td>Mukamal et al (2003)</td>
<td>0.73 (0.66, 0.82)</td>
</tr>
<tr>
<td>Knoops et al (2004)</td>
<td>0.73 (0.65, 0.81)</td>
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<tr>
<td>Doll et al (2005)</td>
<td>0.73 (0.66, 0.80)</td>
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<tr>
<td>Ebbert et al (2005)</td>
<td>0.73 (0.66, 0.81)</td>
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<td>Gun et al (2006)</td>
<td>0.73 (0.66, 0.80)</td>
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<td>Harriss et al (2007)</td>
<td>0.73 (0.67, 0.81)</td>
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<tr>
<td>Xu et al (2007)</td>
<td>0.73 (0.67, 0.80)</td>
</tr>
<tr>
<td>Hart et al (2008)</td>
<td>0.74 (0.68, 0.81)</td>
</tr>
<tr>
<td>Pedersen et al (2008)</td>
<td>0.75 (0.68, 0.82)</td>
</tr>
<tr>
<td>Bazzano et al (2009)</td>
<td>0.75 (0.68, 0.81)</td>
</tr>
</tbody>
</table>

Cumulative Relative Risk (95% CI)

No change in estimated benefit of moderate drinking since ~1990 despite dozens of observational studies

Consistent results; But guidelines fail to acknowledge any benefits of moderate drinking..
1-2 drinks a day increases by 10-15% the blood level of healthy HDL-cholesterol that clears the arteries of arteriosclerosis.
1-2 drinks a day makes the blood thinner, reduces the stickiness of blood platelets (like aspirin) and decreases the future risk of blood clots and heart attacks.
Binge drinking is in bad standing...

For the same average consumption of alcohol, a non-frequent intake implied a higher risk of death than a frequent one.

*Addiction 2004;99:323–30*
Effects of moderate beer consumption on health and disease: A consensus document

G. de Gaetano a,⁎,1, S. Costanzo a,⁎,1, A. Di Castelnuovo a,⁎,1, L. Badimon b, D. Bejko c, A. Alkerwi c, G. Chiva-Blanch b, R. Estruch d, C. La Vecchia e, S. Panico f, G. Pounis a, F. Sofi g,h, S. Stranges c, M. Trevisan i, F. Ursini j, C. Cerletti a, M.B. Donati a, L. Iacoviello a

Low-moderate (up to 1 drink per day in women, up to 2 in men), non-bingeing beer consumption, reduces the risk of cardiovascular disease. This effect is similar to that of wine, at comparable alcohol amounts. Epidemiological studies suggest that moderate consumption of either beer or wine may confer greater cardiovascular protection than spirits. Although specific data on beer are not conclusive, observational studies seem to indicate that low-moderate alcohol consumption is associated with a reduced risk of developing neurodegenerative disease. There is no evidence that beer drinking is different from other types of alcoholic beverages in respect to risk for some cancers. Evidence consistently suggests a J-shaped relationship between alcohol consumption (including beer) and all-cause mortality, with lower risk for moderate alcohol consumers than for abstainers or heavy drinkers.
**Sensible drinking** (men should not regularly drink more than 2-3 units a day, and women 1-2 units a day) is associated with:

- 25% lower risk of cardiovascular disease mortality
- 13% lower risk of all cause mortality
- 30% lower risk of type 2 diabetes
- 23% lower risk of all forms of dementia
- 33% lower risk of kidney stone
- 32% lower risk of gallstones
- 22% - 31% lower risk of rheumatoid arthritis
- 20% lower risk of hip fracture
- 29% higher risk of mouth and throat cancer
- 7% - 12% higher risk of breast cancer per unit folate intake

(mainly in smokers)

(mainly in women with low (<300 µg/d))
The relative contribution of Beer and wine to Danish alcohol consumption

<table>
<thead>
<tr>
<th>Year</th>
<th>Beer %</th>
<th>Wine %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>35,1</td>
<td>53,7</td>
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<tr>
<td>1999</td>
<td>37,6</td>
<td>50,6</td>
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<tr>
<td>2001</td>
<td>39,6</td>
<td>48,3</td>
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<tr>
<td>2003</td>
<td>38,9</td>
<td>47,2</td>
</tr>
<tr>
<td>2005</td>
<td>39,4</td>
<td>44,4</td>
</tr>
<tr>
<td>2007</td>
<td>42,4</td>
<td>42,4</td>
</tr>
<tr>
<td>2009</td>
<td>39,8</td>
<td>43,3</td>
</tr>
<tr>
<td>2010</td>
<td>37,8</td>
<td>45,0</td>
</tr>
</tbody>
</table>
Review of moderate alcohol consumption and reduced risk of coronary heart disease: is the effect due to beer, wine, or spirits?

Eric B Rimm, Arthur Klatsky, Diederick Grobbee, Meir J Stampfer

Key messages

- Moderate alcohol consumption is associated with a reduced risk of coronary heart disease, but whether any specific type of alcoholic drink has particular benefit has not been systematically addressed.

- We examined the relation between specific alcoholic drinks and reduction of risk of coronary heart disease by summarising published reports from ecological, case-control, and cohort studies.

- Most ecological studies suggested that wine was more effective in reducing risk of mortality than beer or spirits, whereas the three case-control studies together did not suggest that one type of drink was more cardioprotective than others.

- Of the 10 prospective cohort studies, four found a significant inverse association between risk of heart disease and moderate wine drinking, four found the association for beer, and four found it for spirits.

- The evidence suggests that all alcoholic drinks are linked with lower risk, so that much of the benefit is from alcohol rather than other components of each type of drink.
Food buying habits of people who buy wine or beer: \textit{a} study

Ditte Johansen, Karina Friis, Erik Skovenvborg, Morten Grønbæk

Abstract

Objective To investigate whether people who buy wine buy healthier food items than those who buy beer.

Design Cross sectional study.

Setting Supermarkets in Denmark.

Data Information on number, type of item, and total charge from 3.5 million transactions over a period of six months.

Results Wine buyers bought more olives, fruit and vegetables, poultry, cooking oil, and low fat cheese, milk, and meat than beer buyers. Beer buyers bought more ready cooked dishes, sugar, cold cuts, chips, pork, butter or margarine, sausages, lamb, and soft drinks than wine buyers.

Conclusions Wine buyers made more purchases of healthy food items than people who buy beer.

Methods

Data were taken from approximately 48 000 purchases chosen at random from 98 of the 160 supermarket chains—16 Bilka and 82 Supermarked, which collects these data. The data provided us with details of which items were purchased and the price of the items, and the total cost of each transaction. The data cannot be matched to consumers.

Because spirits are bought in alcohol shops and are not found on recent Supermarket sales data, only data relating to beer and wine were used. "wine only," "beer only," "mixed," and "none" were dichotomised: 1 if a customer bought

BMJ 2006;332:519-22
• **Results:** Wine buyers bought more olives, fruit and vegetables, poultry, cooking oil, and low fat cheese, milk, and meat than beer buyers.

• **Beer buyers** bought more ready cooked dishes, sugar, cold cuts, chips, pork, butter or margarine, sausages, lamb, and soft drinks than wine buyers.

• **Conclusion:** Wine buyers made more purchases of healthy food items than people who buy beer.

*BMJ 2006;332:519-22*
Wine, beer or spirit drinking in relation to fatal and non-fatal cardiovascular events: a meta-analysis

Simona Costanzo • Augusto Di Castelnuovo • Maria Benedetta Donati • Licia Iaovio • Giovanni de Gaetano

Thus, in relation to health, drinking in moderation is more important than the content of the bottle, at least when wine and beer are taken into consideration.
COMPONENTS IN BEER

Beer is made from natural ingredients, including malted cereals (most often barley), hops, yeast and water. Thanks to these, beer contains minerals, vitamins, fibre, polyphenols and gluten that can benefit health, and the alcohol in beer can also have positive health effects when consumed in moderation.
BAC after drinking 0.5 g of alcohol per kg body weight as vodka/tonic (20% v/v), white wine (12.5% v/v or beer (5.1% v/v) over 20 minutes after an overnight fast. My size = 38 g alcohol.

**Fig. 1.** Geometric mean values for blood alcohol concentrations following consumption of vodka/tonic (red squares), wine (black triangles), or beer (blue circles) are shown over time. Time zero represents initiation of consumption of beverages that was complete within 20 minutes.
• Association in observational studies does not prove causation.
• To prove causation we would need to do a randomised, controlled double-blind study with a group of high-risk men as trial subjects casting and drawing lots whether to be included in the intervention (drinking) group or the control (non-drinking) group.
MACH15 Study

• A worldwide, six-year, balanced-design randomized trial, comparing the effects of one standard serving (~14 grams) of alcohol intake daily to abstention on risk of CVD, diabetes, mortality, and related outcomes among 7,800 adults at above-average cardiovascular risk worldwide.
• We test alcohol consumption *per se* to abstention and thus to offer participants flexibility in their choice of beverage, while employing novel and intensive yet efficient methods to monitor safety.
• The Primary Specific Aim of this trial is to determine the effects of 14 gm of alcohol intake daily compared with abstention on risk of major cardiovascular events or death (myocardial infarction, ischemic stroke, hospitalized angina, need for revascularization, or death).
• Study design: 6 years of follow-up among 7,800 adults aged ≥50 years with estimated 10-year CVD risk ≥15% or prevalent CVD >6 months prior to enrollment.
• Secondary Aims will test the effects of alcohol on risks of incident diabetes and major cardiovascular events.
• ~16 centers worldwide, with a 9-month vanguard phase among 7 centers in the US, Europe, Africa, and South America, followed by a second wave of additional sites to complete enrollment.
• Methods would be needed to ensure that the drinking group had started drinking.

• Methods would be needed to ensure that the control group had not started drinking.
What about body weight and obesity?
Beer belly – myth or fact?

Does beer intake increase the risk of
- overweight / obesity?
- abdominal fatness?

Does intake level matter?
## Calories in beer

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Per 100 ml</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beer</td>
<td>4.6% alc</td>
<td>41 calories</td>
</tr>
<tr>
<td>Wine</td>
<td>12.0% alc</td>
<td>77 calories</td>
</tr>
<tr>
<td>Spirits</td>
<td>40% alc</td>
<td>250 calories</td>
</tr>
<tr>
<td>Milk</td>
<td>0</td>
<td>64 calories</td>
</tr>
<tr>
<td>Orange juice</td>
<td>0</td>
<td>42 calories</td>
</tr>
</tbody>
</table>
Systematic review: What is the evidence for a fattening effect of beer?

- Records identified through databases (n = 2811)
- Full-text articles assessed for eligibility (n = 70)
  - Studies included in qualitative review (n = 45)
    - Observational studies (n = 34)
    - Intervention studies (n = 11)
  - Full-text articles excluded (n = 25)
  - Records identified through other sources (n = 11)
  - Not included in syntheses (n = 22)

- Studies included in quantitative synthesis
  - Intervention studies (n = 10)
    - Beer vs non-alcoholic beer (n = 6)
    - Beer vs. control (n = 4)
- Studies included in dose-response graphs:
  - Observational studies (n = 14)
    - Prospective analyses (n = 5)
    - Cross-sectional analyses (n = 10)
### Observational studies: Association between beer intake and fatness

<table>
<thead>
<tr>
<th></th>
<th>Women</th>
<th></th>
<th>Men</th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Overall fatness (BMI/weight)</td>
<td>Abdominal fatness (WC/WHR)</td>
<td>Overall fatness (BMI/weight)</td>
<td>Abdominal fatness (WC/WHR)</td>
</tr>
<tr>
<td><strong>↑ positive association</strong></td>
<td>![Icons]</td>
<td>![Icons]</td>
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<td>Cross-sectional studies</td>
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<tr>
<td><strong>↔ no association</strong></td>
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<tr>
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<tr>
<td><strong>↓ negative association</strong></td>
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<td>![Icons]</td>
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<td>![Icons]</td>
</tr>
</tbody>
</table>
Is there a dose-response relationship?

Our expectation

Waist circumference

![Graph showing the relationship between waist circumference and beer consumption.](image)
Intervention studies: Alcoholic beer vs low-alcoholic beer

- 3-6 wk
- 40-64 g/day ethanol
  ~1.1-1.8 L alcoholic beer

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Mean Difference</th>
<th>SE</th>
<th>Weight</th>
<th>Mean Difference</th>
<th>Mean Difference</th>
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<tr>
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<td></td>
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<td>IV, Random, 95% CI</td>
<td>IV, Random, 95% CI</td>
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<td>Beulens_2008</td>
<td>0.7</td>
<td>0.276</td>
<td>12.7%</td>
<td>0.70 [0.16, 1.24]</td>
<td></td>
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<tr>
<td>Cox_1990</td>
<td>0.42</td>
<td>0.225</td>
<td>19.1%</td>
<td>0.42 [-0.02, 0.86]</td>
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</tr>
<tr>
<td>Masarei_1986</td>
<td>0.7</td>
<td>0.165</td>
<td>35.5%</td>
<td>0.70 [0.38, 1.02]</td>
<td></td>
</tr>
<tr>
<td>Puddey_1987</td>
<td>0.9</td>
<td>0.255</td>
<td>14.9%</td>
<td>0.90 [0.40, 1.40]</td>
<td></td>
</tr>
<tr>
<td>Puddey_1992</td>
<td>1.7</td>
<td>0.752</td>
<td>1.7%</td>
<td>1.70 [0.23, 3.17]</td>
<td></td>
</tr>
<tr>
<td>Zilkens_2003</td>
<td>0.9</td>
<td>0.244</td>
<td>16.2%</td>
<td>0.90 [0.42, 1.38]</td>
<td></td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td></td>
<td></td>
<td><strong>100.0%</strong></td>
<td></td>
<td><strong>0.73 [0.53, 0.92]</strong></td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.00; Chi² = 4.54, df = 5 (P = 0.48); I² = 0%
Test for overall effect: Z = 7.39 (P < 0.00001)

A **0.7 kg higher** body weight after alcoholic beer compared to low- or non-alcoholic beer
Conclusions

- Few studies have been conducted with the specific objective to assess whether beer intake is associated with body fatness.
- Results are inconsistently presented across studies.
- Most studies are of low quality.
- There is inconsistent scientific evidence to support that beer intake is responsible for the beer belly.
- Higher beer intakes (>4 L or 16 gl/wk) may be associated with a higher degree of fatness.
- There is a need for controlled intervention studies designed to answer the question of whether beer consumption promotes body fat deposition.
Wine, but not beer, stimulates total energy intake as compared to a soft drink.

A randomized, *ad libitum*, crossover trial in normal weight males

*Arne Astrup, Benjamin Buemann & Søren Toubro*
Beverages

- Red wine (Valpolicella) 3.00 kJ/ml, 13% alcohol
- Lager beer (Carlsberg Hof) 1.66 kJ/ml, 4.6% alcohol
- Carbonated soft-drink (Sprite Regular) 1.73 kJ/ml
Ad libitum beverage study

- 22 younger men
- Different beverages given *ad libitum* with a supper meal to subjects in a balanced randomized sequence
- Subjects instructed to eat of the food until they felt comfortable
- A time lag > 4 days between experiments
- Breakfast and lunch were fixed on the experimental days
Meal

- Pasta salad w/ ham, yoghurt, peas & paprika fruits
- Goullach w/ white bread
- Firm cake

- Courses were presented in excess on the table one by one.
- Subjects were separated by > than 2 m. and were not allowed to communicate.
Ad libitum beverage study

kJ

Beverage

carbonated soft drink  beer  wine

 Cake
 Bread
 Goulash
 Pasta salad
 Beverage

§  P < 0.05 vs. carbonated soft drink
*  P < 0.05 vs. beer and carbonated soft drink
Total energy intake was greater when wine was given *ad libitum* compared to beer and soft-drink. This was due both to a higher energy intake from food and beverage.

Both alcoholic beverages tended to increase food intake compared to the soft-drink when they were provided in fixed quantities.
• Overview of the literature on moderate beer consumption as part of a healthy lifestyle

• Scientific Committee reviewed and endorsed this leaflet

• Available online (half/end of June 2016):
  [www.beerandhealth.eu](http://www.beerandhealth.eu)

(Brewers of Europe)
Sensible drinking (men should not regularly drink more than 2-3 units a day, and women 1-2 units a day) is associated with:

- 25% lower risk of cardiovascular disease mortality
- 13% lower risk of all cause mortality
- 30% lower risk of type 2 diabetes
- 23% lower risk of all forms of dementia
- 33% - 41% lower risk of kidney stone (wine) - 41% - 54% lower risk of kidney stone (beer)
- 32% lower risk of gall stones
- 22% - 31% (beer) lower risk of rheumatoid arthritis
- 20% lower risk of hip fracture
- 29% higher risk of mouth and throat cancer (mainly in smokers)
- 7% - 12% higher risk of breast cancer per unit (mainly in women with low (<300 µg/d) folate intake)
BAC after drinking 0.5 g of alcohol per kg body weight as vodka/tonic (20% v/v), white wine (12.5% v/v or beer (5.1% v/v) over 20 minutes after an overnight fast. My size = 38 g alcohol.
DANSK GRYDEKYLLING
I FANØ VADEHAV BROWN ALE
Sprøde krummer og en hyldest til broccoli
4 PERSONER

DU SKAL BRUCE:

Kylinge:
1 god økologisk kylling (ca. 1,600 gram)
300 ml. Brown Ale
4 stikke rosmarin
8 fed hvidløg med skal
1 god sjæl olivenolie
2 laurbærblade
Skallen fra 1 økologisk citron
2 skraldede lag i grove tern
½ l. hensfond

Ristede brødkrummer
Revet daggammelt brød
Neutral olie
Terret rosmarin

Gryltet broccoli
1 broccoli delt i passende stykker
med stok
1 god sjæl neutral olie
Citronsaft
Karse

Broccolipure
1 broccoli inkl. stok skåret i små stykker
50 g. smør
1 lag i tern
2 fed hvidløg
Blade fra 2 timianhviste
400 ml. økologisk sødmeilk
Citronsaft

Skyos
Sigeet sly fra kylling
Maizena
En lille skive holdt smør
Citronsaft
Thank you for your attention: Salute