BCUK Background Briefing | Alcohol & Breast Cancer

Introduction

Drinking alcoholic beverages increases the risk of many chronic diseases and illnesses, such as stroke and liver disease, as well as certain [a]cancers including breast cancer[1]. The International Agency for Research on Cancer (IARC) has concluded that consumption of alcohol is carcinogenic to humans[2]. Alcohol increases breast cancer risk in both pre- and post-menopausal women and heavy drinking increases risk in men[3,4,5].

Animal studies[b] demonstrate *in utero* exposure to alcohol increases the chances of female offspring developing mammary cancer[6,7]. This suggests that drinking alcohol during pregnancy may increase risk for daughters.

In the UK around 8% of female breast cancers may be linked to alcohol consumption[8]. This corresponds to around 4,400 cases each year[9].

Is the type of alcoholic beverage important?

All alcoholic drinks, whether beer, cider, wine or spirits, contain ethanol (commonly referred to as alcohol), therefore all alcoholic beverages increase breast cancer risk[10]. Alcoholic drinks vary in the amount of ethanol they contain. Table 1 provides details of percentages, units and grams of alcohol present in different types of alcoholic drinks.

Although bioactive molecules in grapes, especially those found in red wine (e.g. resveratrol), may offer some protection against breast cancer[11], both red and white wine consumption increase breast cancer risk[12].

How much alcohol increases breast cancer risk?

Female breast cancer risk increases linearly with total alcohol intake[13]. Risk is estimated to increase by between 4-11% for every 10g of alcohol per day consumed (10g is equivalent to 1.25 units or e.g. one 110ml glass of wine)[10,12]. Light or even very light consumption (one drink per week) increases breast cancer risk [14,15]. Binge drinking (defined as consuming > 60g of alcohol on one occasion, equivalent to 5 or more alcoholic drinks) may be especially harmful. One study found pre-menopausal women who binge drink have twice the risk of breast cancer compared to those who are non-binge drinkers[16].

Some studies suggest that the more alcohol a woman consumes, the more likely she will be diagnosed with a breast cancer recurrence after initial treatment[17,18].

SUMMARY

Drinking alcoholic beverages increases the risk of breast cancer in women and heavy drinking increases risk in men. The more alcohol a woman consumes the greater the risk, with no lower threshold. Alcohol (ethanol) is metabolised to acetaldehyde, a cancer-causing compound. This occurs in the liver primarily and in breast tissue. Alcohol increases levels of circulating hormones such as oestrogen; high levels of these increase breast cancer risk.

Timing and period of exposure to alcohol

The association of lifetime alcohol consumption with breast cancer risk may depend on when the alcohol was consumed. Some evidence suggests that consumption in adolescence and before a first pregnancy may increase risk more than when alcohol is consumed at a later age[10].

[a] Alcohol consumption increases risk of mouth, pharynx, larynx, oesophageal, colorectal, stomach, liver, kidney & breast cancer

[b] Breast Cancer UK does not support research projects which involve animal experiments.

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Does alcohol increase the risk of all types of breast cancer?

Some studies suggest alcohol consumption is more strongly associated with hormone receptor positive breast cancers, particularly oestrogen receptor positive (ER+) breast cancer, although others do not[10].

Alcohol and other risk factors

Alcohol consumption may be especially harmful when combined with other risk factors.

A study of Danish nurses found that compared to the risks associated with separate use, combined smoking and alcohol intake above moderate levels greatly increased the risk of breast cancer[19].

There is some evidence of a stronger association between alcohol consumption and breast cancer risk among women receiving hormone replacement therapy (HRT)[20]. This was particularly associated with increased ER+ breast cancer[21].

Other studies suggest alcohol may enhance the effects of carcinogens[22]. A Uruguay study[23] found women with a high dietary intake of benzo[a]pyrene (found in charred or grilled food and known to act as a breast carcinogen[24]) had a higher breast cancer risk compared to those with a low intake. Those who had a high benzo[a]pyrene intake and drank alcohol were at much higher risk.

Alcohol, breast density and benign breast disease

Most studies have found alcohol consumption increases breast density (mammographic density) in premenopausal and postmenopausal women[10,25,26]. Breast density is partly inherited and partly influenced by the environment. A high breast density (having a higher proportion of connective and glandular tissue, compared to fat tissue) is associated strongly with increased breast cancer risk[27].

Some studies also suggest alcohol increases the risk of benign breast disease (non-cancerous breast lumps) which is also a risk factor for breast cancer[28].

How does alcohol increase the risk of developing breast cancer?

The mechanisms by which alcohol increases breast cancer risk are not understood fully[1]. The most likely are associated with the effects of alcohol on hormones and growth factors and the production of metabolic products which are carcinogenic[28]. In addition, people who drink large quantities of alcohol often gain weight, which is a very significant risk factor for post-menopausal women and men[1].

Hormones and growth factors

Consumption of alcoholic drinks results in raised levels of circulating oestrogen (specifically, oestradiol). This may be due to increased activity of aromatase, an enzyme which converts testosterone to oestradiol, or to reduced breakdown of oestrogen[28]. Higher circulating oestrogen is a well-established breast cancer risk factor[29]. Alcohol also increases levels of oestrogen receptor proteins, which mediate effects of oestrogen[28]. It may also increase levels of insulin-like growth factor 1 (IGF-1), which in turn may increase levels of oestrogens, affect proliferation of breast cells and breast cancer cells and reduce levels of sex hormone binding globulin, which also increases breast cancer risk[15].

Alcohol metabolism

Alcohol is metabolised (broken down) in the liver to acetaldehyde, which is highly toxic and can cause DNA damage, and is classified as a carcinogen by the IARC[30]. Conversion of alcohol to acetaldehyde also occurs in breast tissue, potentially initiating breast cancer[2].

Acetaldehyde is further metabolised to acetate, which is non-toxic and non-carcinogenic[30]. Some bacteria in the mouth and gut can also convert alcohol to acetaldehyde and acetate[30,31].

Alcohol consumption can affect breast cancer risk differentially in certain ethnic populations[32]. For example studies suggest alcohol increases breast cancer risk less in Japanese women compared to Western women[33]. This may be associated with gene variants of alcohol degrading enzymes, which have different abilities to break down alcohol to acetaldehyde (alcohol dehydrogenase enzymes) or detoxify acetaldehyde to acetate (acetaldehyde dehydrogenase enzymes)[34].

Heavy alcohol consumption may also affect the body's ability to absorb nutrients, such as folate and vitamin B_{12}. Reduced levels of these may make an individual more susceptible to breast cancer[10].

Weight gain

Alcohol consumption may result in weight gain from "empty calories" (calories which provide little or no nutritional benefit). Heavy drinking often leads to weight gain; this is an established breast cancer risk factor for post-menopausal women and for men[35].

Other effects

Heavy drinking affects the body's immune system and its ability to fight off illnesses, including cancer. It can generate free radical oxygen species which can result in DNA damage and carcinogenesis[36]. Finally, alcohol can also cause changes to [c]DNA methylation, resulting in altered gene expression (whether genes are turned on or off), with potential to affect carcinogenesis[36].

Concluding remarks

Our ability to reduce our risk of breast cancer is determined by many modifiable factors such as physical activity, weight gain, synthetic hormone use, smoking and exposure to harmful chemicals. Certain combinations may exacerbate the damaging effects of alcohol, as is seen with smoking and drinking. In most cases how these factors interact with alcohol consumption in relation to breast cancer risk is unclear and needs further research.

Alcohol is a significant risk factor for breast cancer for both women and men. The UK government guidelines recommend consuming less than 14 units of alcohol/week. To reduce breast cancer risk further, women should consider drinking less than this, as studies demonstrate the more alcohol a woman drinks the greater the risk. There is no safe threshold.

Type of drink	Alcohol by volume (ABV)	Volume of alcohol	Grams of alcohol	Units of alcohol	kilocalories
Single small shot of spirits	40%	25ml	8g	1	61
Alcopop	4%	275ml	8.8g	1.1	170
Pint of lower-strength beer	4%	568ml	18.4	2.3	182
Small bottle higher-strength beer	5%	330ml	13.6	1.7	142
Standard glass of wine	13%	175ml	18.4	2.3	159
Pint of cider	4.5%	568ml	20.8	2.6	216
Small glass champagne	12%	125ml	12	1.5	89

Table 1: Units of alcohol for various alcoholic beverage types (https://www.drinkaware.co.uk/tools/unit-and-calorie-calculator)

[c] DNA methylation is the addition of methyl groups (CH_3) to DNA.

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About Breast Cancer UK

Who are we?

Breast Cancer UK aims to prevent breast cancer through scientific research, collaboration, education and policy change. We educate and raise awareness of the risk factors for breast cancer and provide practical information to help people reduce these risks. We campaign to ensure government policies support the prevention of breast cancer. And we fund scientific research that helps to better understand what risk factors contribute to breast cancer, and how to address them

For further information on breast cancer risk factors please visit our website www.breastcanceruk.org.uk
To view this information in a more accessible format or to provide feedback, please contact us.

Disclaimer

This brief is for information purposes only and does not cover all breast cancer risks. Nor does it constitute medical advice and should not be used as an alternative to professional care. If you detect a lump or have any concerns, seek advice from your GP. Breast Cancer UK has made every effort to ensure the content of this leaflet is correct at the time of publishing but no warranty is given to that effect nor any liability accepted for any loss or damage arising from its use.

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We welcome your feedback, if you have any comments or suggestions about this brief please contact us at info@breastcanceruk.org.uk or on 0845 680 1322

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