

Effect of Brewers' spent grain (BSG) phenolic extracts on cell viability and protective effect against oxidant-induced DNA single strand breaks in U937 cells

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Brewers' spent grain (BSG) is the solid portion of barley malt which remains following wort production for the brewing industry. Black barley (roasted to 200 °C) or pale barley (unroasted) is used for the brewing process, resulting in black or pale BSG⁽¹⁾. BSG is a potentially useful source of phenolic acids following a published extraction procedure⁽²⁾. The alkaline-extracted phenolic acids have been shown to possess antioxidant activity⁽²⁾. The aim of this research was to determine antioxidant effects of BSG phenolic extracts following an enzymatic extraction process.

The BSG extracts were derived from either dry or wet BSG and were either black (labelled A-F) or pale (labelled G-J). The 3-(4,5-dimethylthiazol-2-yl)-2, 5-diphenyltetrazolium bromide (MTT) assay was used to assess the effect of extracts on U937 cell proliferation at concentrations ranging from 0–20 % (v/v). The antioxidant effect of the extracts was measured by determining the DNA protective effects of the extracts in U937 cells exposed to H₂O₂, using the Comet assay.

	DNA damage (% tail DNA)			DNA damage (% tail DNA)	
	Mean	SD		Mean	SD
Control	6.8*	1.7	F	35.4*	3.6
H ₂ O ₂	60.8	5.0	G	36.0*	15.9
A	36.5	13.4	H	38.9*	9.7
B	23.0*	4.0	I	45.2	15.4
C	37.0	12.7	J	36.8*	14.1
D	39.0	14.6	FA	31.3*	4.1
E	31.4*	0.3			

DNA damage in U937 cells exposed to 75 μM H₂O₂ for 30 minutes following 24 hour incubation with brewers' spent grain extracts (0.1 % or 2.5 % v/v black extracts; 4 % v/v pale extracts) or Ferulic acid (FA) (1 μg/ml). Values are mean of at least two independent experiments. Statistical analysis by ANOVA followed by Dunnett's test. *Denotes significant difference (P < 0.05) in DNA damage relative to H₂O₂ control.

In general, pale BSG phenolic extracts (G-J) (IC₅₀ values 19.60–45.02 % v/v) were less cytotoxic than black BSG extracts (A-F) (IC₅₀ values 0.06–7.01 % v/v) in U937 cells (data not shown). Preliminary results suggest that phenolic extracts can reduce H₂O₂-induced DNA damage in U937 cells. Previous research suggested that black BSG phenolic extracts had a greater DNA protective effect compared to pale BSG phenolic extracts⁽²⁾, however, results presented here demonstrated that there were no marked differences between black and pale extracts. This may be due to the lower concentration of black BSG phenolic extracts used in the present study (0.1 % v/v). In conclusion, these results suggest that phenolic extracts when prepared from BSG using enzymatic procedures possess good antioxidant activity in U937 cells.

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1. McCarthy AL, O' Callaghan YC, Neugart S, *et al.* (2013) *Food Chem* **141**, 2567–74.
2. McCarthy AL, O' Callaghan YC, Connolly A, *et al.* (2012) *Food Chem* **134**, 641–646