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The effect of extrusion screw speeds on molecular weight and immune responses of water soluble arabinoxylans from rice bran

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Arabinoxylans (AXs) are major non-starch polysaccharides (NSPs) in cereals. AXs have attracted attention due to their immunomodulatory activities[(1)], which may be related to the content of low molecular weight (Mw, < 32 kDa) AXs,[(1)]. Rice bran (RB) is a rich source of AXs[(1)] but water extraction of RB AXs is difficult giving a low yield. Extrusion technology has been used to increase the solubility, improve water extraction, and reduce the Mw of cereal dietary fibre[(1)] but further evidence is needed for RB.

The aim of this study was to measure the effect of extrusion on the extraction rate and molecular weight of rice bran arabinoxylans and their immunomodulatory potentials.

A twin-screw extruder was used to treat the RB at two screw speeds (80 and 180 rpm). Followed by extraction of the water-soluble fraction of arabinoxylan. The Mw of the AXs were measured using Size exclusion chromatography[(1)].

The low molecular weight fractions of AXs were used to treat U937 cells, with each treatment consisting of 12 replicates for 24 hours. The production of tumour necrosis factor α (TNF-α) was quantified using Sandwich ELISA[(3)].

Data were expressed as mean ± standard error of the mean (SEM). Significant differences between samples were determined by one-way analysis of variance ANOVA. A P value < 0.05 was considered statistically significant.

The results showed that the increasing screw speeds from 80 to 160 rpm led to a significant increase ($P < 0.05$) in the percentage of LMW of AXs (0.79–1.58 kDa) from 14.15 to 18.24% at screw speeds of 80 and 160 rpm, respectively. TNF-α production was also significantly increased ($P < 0.05$) from 270 pg/mL to 345 pg/ mL at 80 and 160 rpm, respectively. While these findings suggest a potential benefit in immunodeficiency diseases, caution should be exercised in making definitive claims and further research is warranted.

Extrusion technology was shown effective in reducing AX MW in RB and inducing TNF-α production in U937 treated cells. Further research is needed to identify the specific pattern recognition receptor (PRR) family activated following treatment with water-extractable arabinoxylans (WEAXs). This early work holds significant promise for public health nutrition, as the utilisation of extrusion technology to modify AX MW could potentially enhance the functional properties of RB and contribute to the development of nutritionally fortified food products with enhanced immunomodulatory effects.

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