

## Effects of Polymers – Phenylpropanoid Lignin – with Various Molecular Mass on Digestion and Metabolism

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**Introduction.** Under COST POSITIVE FA1403, set of experimental assays were made to ascertain the function of lignin on the concentration of glucose, triglycerides and cholesterol in blood serum. The alkaline lignin under investigation was isolated from the wood of black alder (*Alnus glutinosa*). The fractionation of lignin from black alder was done by sequential extraction with organic solvents of increasing polarity.

**Aim, Materials and Methods.** Blood testing for glucose was performed *in vitro* using blood samples of 16 volunteer patients. The patients of age 49–53 years old, BMI > 30 (obese) in metabolic syndrome. The blood sample was centrifuged at 1500 RPM (rounds per minute) and blood plasma was extracted. 50 u.l of lignin sample was added to 0.5 ml of the plasma and mixture was incubated for 5 minutes at 38 °C. The plasma-lignin mixture was put on cholesterol and glucose DT slides (ORTHO Clinical Diagnostics by Johnson & Johnson company) and respective values were obtained by basic biochemical assays.

The testing was done *in vitro* on blood samples of patients with BMI above 25 and with transitory hyperlipidemia. Total cholesterol levels were detected with a clinical analyser “Dayton” (Randox, UK). The lipid peroxidation marker malone dialdehyde (MDA) was measured using thiobarbituric acid. The lignin stock was prepared with concentration of 800 mg per liter of physiological solution.

Antioxidant properties of the lignin under study, evaluated using ABTS, DPPH and O<sub>2</sub>, was close or higher than corresponding characteristics for the reference antioxidant Trolox (water soluble analogue of Vitamin E).

**Results.** The addition of all lignin samples significantly influenced all parameters measured. Glucose levels decrease from  $6.1 \pm 0.09$  to  $3.5 \pm 0.08$  u.M per liter in hyperglycemia and from  $4.7 \pm 0.09$  to  $4.06 \pm 0.07$   $\mu$ M per liter in normal control.

The cholesterol levels decrease from  $6.4 \pm 0.09$  to  $4.06 \pm 0.07$  in pathological conditions and from  $4.8 \pm 0.08$  to  $\pm 0.06$  u.M/l in normal control.

MDA (lipid peroxidation marker) content in plasma lowered by 35% after 30–45 min lignin incubation. Previous research also showed that *in vitro* lignin function as strong activator of amylase and lipase  $15 \pm 1\%$  and  $20 \pm 2\%$ , respectively.

The content of protein carbonyl groups (oxidative stress marker) decreased by 20–40% in dose dependant manner.

Blood pH measured by “Hanna Instrumental” Ltd 370 pH Meter showed no change in acid-base balance treated with lignin.

**Conclusions.** The results of lignin influence on blood cholesterol and glucose levels show complex binding of these substances. The change and complex creation process does not influence blood homeostasis. The multisided activity of lignin on array of metabolic disorders found in this work show urgency of continuation into pre-clinical studies aimed at further exploring of lignin potential.

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