Summary

Acyltransferases acyl-CoA:lysophospholipids (LPLATs) are important but still poorly characterised enzymes participating in membrane and storage lipid biosynthesis. These enzymes transfer the acyl group from acyl-CoA to lysophospholipids synthesising the appropriate phospholipids. Additionally, it was proposed that in the reverse reaction, they may transfer the fatty acids from sn-2 position of phosphatidylcholine (where they can be modified) into cytoplasmic acyl-CoAs pool. It is suggested that forward and backward reactions catalysed by LPLAT are two of the mechanisms, determining fatty acid remodelling of phospholipids. Acyl-CoA occurring in this process may be used as substrates in different syntheses including storage lipid synthesis (triacylglycerol).

In the presented study, *in vitro* assays of substrate specificity of the two LPLATs from *S. cerevisiae*: Ale1, Slc1 and three LPLATs from *A. thaliana*: LPCAT2, LPEAT1, LPEAT2 were conducted. In the experiments, microsomal fractions isolated from the wild type yeast (BY4742 strain), knockout line *ALE1*, knockout line *SLC1* and from yeast with knocked out *ALE1* expressing selected LPLATs from *S. cerevisiae* or *A. thaliana* were used. The results showed that the tested LPLATs have different substrate specificity both towards acyl donors (acyl-CoA) and acyl acceptors (lysophospholipids). Additionally, it was shown that *in vitro* Ale1, Slc1, AtLPCAT2 and AtLPEAT2 can remodel the acyl group of phosphatidylcholine (PC), phosphatidylethanolamin (PE) and phosphatidic acid (PA) as well as acyl-CoA pool *via* the backward reactions. Each of the tested acyltransferases differs from the others in substrate specificity both in the forward and backward reactions.

Physiological functions of selected acyl-CoA:lysophospholipids acyltransferases in baker yeast and *A. thaliana* were also studied.

Disruption of *ALE1* or *SLC1* genes (encoding Ale1 and Slc1 respectively) in yeast, results in a certain (not very pronounced) inhibition of cells growth (compared to control). Contrary, the overexpression of *ALE1*, *SLC1* and genes from *A. thaliana*: *At1g6305*0, *At1g8095*0, *At2g45670* in yeast with knocked out *ALE1* slightly increases the cell growth. Additionally, the transformations (both knocked out and overexpression) result in some alterations in total lipid content and composition in yeast cells.

The T-DNA insertion mutants of *A. thaliana* lacking the LPEATs activity and the mutants overexpressing one of the genes encoding acyltransferases: *At1g80950* (LPEAT1) and *At2g45670* (LPEAT2) have different phenotypes in comparison to control plants. Knockout of mentioned genes resulted in defects in plant development. These mutants were

dwarfish and produced fewer and smaller seeds. The total lipid content and composition of mutant seeds, leaves and roots were also changed (compared to control plants). The overexpression of genes encoding proteins with LPEAT activity triggered higher plant growth and seed set. The roots of these mutants possessed increased lipid content (mainly polar lipids).