Proteome analysis of Aspergillus niger: Lactate added in starch-containing medium can increase production of the mycotoxin fumonisin B2 by modifying acetyl-CoA metabolism

Background Aspergillus niger is a filamentous fungus found in the environment, on foods and feeds and is used as host for production of organic acids, enzymes and proteins. The mycotoxin fumonisin B2 was recently found to be produced by A. niger and hence very little is known about production and regulation of this metabolite. Proteome analysis was used with the purpose to reveal how fumonisin B2 production by A. niger is influenced by starch and lactate in the medium.

Results Fumonisin B2 production by A. niger was significantly increased when lactate and starch were combined in the medium. Production of a few other A. niger secondary metabolites was affected similarly by lactate and starch (fumonisin B4, orlandin, desmethylkotanin and pyranonigrin A), while production of others was not (ochratoxin A, ochratoxin alpha, malformin A, malformin C, kotanin, aurasperone B and tensidol B). The proteome of A. niger was clearly different during growth on media containing 3% starch, 3% starch + 3% lactate or 3% lactate. The identity of 59 spots was obtained, mainly those showing higher or lower expression levels on medium with starch and lactate. Many of them were enzymes in primary metabolism and other processes that affect the intracellular level of acetyl-CoA or NADPH. This included enzymes in the pentose phosphate pathway, pyruvate metabolism, the tricarboxylic acid cycle, ammonium assimilation, fatty acid biosynthesis and oxidative stress protection. Conclusions Lactate added in a medium containing nitrate and starch can increase fumonisin B2 production by A. niger as well as production of some other secondary metabolites. Changes in the balance of intracellular metabolites towards a higher level of carbon passing through acetyl-CoA and a high capacity to regenerate NADPH during growth on medium with starch and lactate were found to be the likely cause of this effect. The results lead to the hypothesis that fumonisin production by A. niger is regulated by acetyl-CoA.

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