

直链支链淀粉比、膨化、储存时间和酶制剂对断奶仔猪玉米淀粉体内、体外消化率的影响

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本试验的目的在于研究直链支链淀粉比、膨化、储存时间和酶制剂对玉米淀粉消化率的影响。从 74 个玉米样品中选取 3 个有代表性的样品进行体外、体外消化试验，其直支链淀粉比分别为 0.60 (HA)、0.44 (MA)、0.39 (LA)。试验一，玉米经膨化后 4 周内，3 种玉米抗性淀粉含量每周都有显著提高 ($P < 0.05$)，并且淀粉的体外消化率随储存时间的增加显著降低 ($P < 0.05$)。直支链淀粉比影响了抗性淀粉的形成 ($P < 0.01$)。3 个玉米样品抗性淀粉的含量始终都是：LA < MA < HA ($P < 0.05$)。直支链淀粉比例和储存时间与抗性淀粉含量显著相关 ($P < 0.01$)。并且，三个样品的储存时间和抗性淀粉含量之间存在显著的二次线性相关关系，储存时间和淀粉消化率之间也存在类似相关关系。淀粉消化率与抗性淀粉含量呈负相关关系 ($P < 0.001$)。试验二，采用回肠瘘管法测定样品的消化率，猪只初始体重为 $13.2 \pm 0.94 \text{kg}$ 。与酶制剂组相比，膨化增加了 HA 和 LA 淀粉以及总能回肠消化率 ($P < 0.001$)。酶制剂不能改善淀粉和能量的回肠消化率。LA 组淀粉和总能回肠消化率显著高于 HA 组 ($P < 0.05$)。试验结果表明直支链淀粉比例和膨化后的储存时间是抗性淀粉形成和淀粉消化率的决定性因素。此外，抗性淀粉含量是膨化玉米淀粉消化率的重要指标。选用低直支链淀粉比玉米或者减少玉米膨化后的储存时间能有助于减少抗性淀粉的形成，并改善小猪对玉米淀粉的利用率。

In vitro and in vivo digestibility of corn starch for weaned pigs: Effects of amylose:amylopectin ratio, extrusion, storage duration, and enzyme supplementation

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The objective of this study was to investigate the effects of amylose (AM):amylopectin (AP) ratio, extrusion, storage duration, and enzyme supplementation on starch digestibility of corn. Three corn varieties with high (0.60; HA), medium (0.44; MA), and low (0.39; LA) AM:AP ratios, respectively, were selected from 74 corn samples to evaluate the in vitro and in vivo digestibility of starch. In Exp. 1, during wk 4 after extrusion, resistant starch (RS) content of the 3 selected corn varieties (LA, MA, and HA) increased ($P < 0.05$) each week and starch digestibility in vitro decreased as storage time increased ($P < 0.05$). The AM:AP ratio affected the formation of RS ($P < 0.01$). The RS content of the 3 corn varieties was ranked as LA < MA < HA in each week ($P < 0.05$). Correlation analysis showed that AM:AP ratio and storage duration were both positively correlated with RS content ($P < 0.01$). Furthermore, a significant quadratic relation was found between storage duration and RS content in each corn variety as well as storage duration and digestibility. Starch digestibility was negatively correlated with RS content ($P < 0.001$). In Exp. 2, digestion trials were performed on cannulated pigs with BW of $13.20 \pm 0.94 \text{ kg}$. Extrusion increased ileal digestibility of GE and starch of either HA or LA compared with the enzyme-supplemented diets ($P < 0.001$). Enzyme supplementation did not improve ileal energy and starch digestibility. The ileal digestibility of starch and GE of LA varieties was greater than HA samples ($P < 0.05$). The results implied that AM:AP ratio and storage duration after extrusion may be important determinants of RS formation and digestibility of starch for corn. In addition, RS content could be an important indicator of digestibility of starch in extruded corn. Using a lower AM:AP ratio corn or reducing the storage duration of

extruded corn would help to reduce the formation of RS and improve the starch bioavailability of corn for piglets.