開發以靈芝廢渣做為雞隻免疫調節飼料之研究

Studies on the develpoment of Ganoderma residues as chicken immunomodulatory feeds

中文摘要

本研究主要探討將靈芝廢渣（L）以及靈芝廢渣之木黴菌固態發酵物（F）混合於雞隻飼料中以提升雞隻非特異性免疫之可行性。一日齡愛拔益加肉雞以小雞飼料餵養一週後，將靈芝廢渣及其發酵物以 4%和 8%之比例混合於小雞飼料後餵養兩週，於雞隻滿三週齡時抽血測其週邊血吞噬活性以及自然殺手細胞活性，以確認先天性免疫之活性，並取糞便檢體測其腸道菌相，另一組為一日齡愛拔益加肉雞以小雞飼料餵養兩週後，將靈芝廢渣及其發酵物以 4%和 8%之比例混合於中雞飼料後餵養三週，於雞隻滿五週齡時抽血並取糞便檢體。另於體外試驗中，針對 RAW 264.7 細胞株進行細胞存活性、一氧化氮產生、與脂多醣之結合力以及吞噬活性試驗，並將靈芝廢渣及其發酵物和 LGG 乳酸桿菌、比菲德菌及大腸桿菌共同培養，看其對菌落增生之影響。體內實驗結果顯示，在吞噬活性方面，於三週齡時 8%添加量之實驗組活性優於僅餵食小雞飼料之控制組，而五週齡時，各實驗組之活性皆優於僅餵食中雞飼料之控制組；自然殺手細胞之活性實驗中，三週齡小雞及五週齡小雞於靈芝廢渣發酵物之添加下皆有較好的自然殺手細胞活性。體內腸道菌相檢測中實驗組可提升雞隻腸道內之益生菌數量，但不影響大腸桿菌數量。而在體外試驗中，靈芝廢渣及其發酵物亦可在不造成巨噬細胞毒性之濃度內（1 mg/mL 以下）有效活化巨噬細胞產生一氧化氮以及增進吞噬活性，並抑制巨噬細胞和脂多醣結合；靈芝廢渣及其發酵物和益生菌於體外共同培養，亦可促進益生菌增生。由此結果顯示，於雞隻飼料中混入靈芝添加物及其發酵物可提升雞隻之非特異性免疫，且 β-glucan 含量較高之發酵物於自然殺手細胞之毒殺活性較好，可知靈芝廢渣可開發為提升非特異性免疫之雞隻飼養添加，並可進一步測試是否可以取代抗生素之使用，且可對於提高靈芝廢渣之免疫調節指標成分 β-glucan 做進一步的研究。

英文摘要

. Ganoderma is known to have immunomodulatory activities by a series of in vitro and in vivo immune assay. In our study, we focus on the effect of supplemented Ganoderma residues and their fermented products (4% and 8%) on the phagocytosis activities, natural killer cell cytotoxicity and prebiotic effect on intestinal microflora of Arbor Acres chicks. One group was two-week supplemented Ganoderma residues and their fermented products of one-week-old chicks, the other was three-week supplemented of two-week-old chicks. The effect of Ganoderma residues and their fermented products on cell proliferation, NO production, LPS-binding affinity and phagocytosis activities on RAW 264.7 and in vitro probiotic bacteria proliferation were also investigated. The results of in vivo immunomodulatory assay showed that fermented products of Ganoderma residues can enhance natural killer cell cytotoxicity of chicks and both of Ganoderma residues and their fermented products can enhance the phagocytosis activities of chicks. In the in vitro assay, the results showed that Ganoderma residues and their fermented products can enhance NO production, phagocytosis activities and inhibit LPS-binding affinity on RAW 264.7. Ganoderma residues and their fermented products also enhance the probiotic bacteria proliferation in vitro and in vivo assay. In conclusion, Ganoderma residues and their fermented products are effective immunomodulatory products and can enhance the innate immune of chick.