

# The effects of two-stage fermented feather meal-soybean meal product on growth performance, blood biochemistry, and immunity of nursery pigs

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Although microbial fermentation provides biodegradation of poorly digestible feed ingredients increasing bioavailability, efficiently achieving fermentational production is often time-consuming. This study aims to improve fermentational quality in two-stage fermented feather meal-soybean meal product (TSFP) with five selected *Bacillus* strains and *Saccharomyces cerevisiae* Y10, as well as investigated the effects of TSFP on growth performance, blood biochemistry, and immunity of nursery pigs. In trial 1, one hundred hybrid piglets (Duroc x KHAPS black pig) with equal numbers of both barrows and females were randomly assigned into five dietary supplementation treatments, including 5% fish meal or 5% TSFP prepared with 0, 32, 40, or 48 hrs in the first-stage fermentation. The results showed that the body weight (BW), average daily gain (ADG), and feed conversion ratio (FCR) of fermented groups were significantly better than the unfermented group ( $P < 0.05$ ) at weeks 0 to 3 and 0 to 5. The ADG of 32-hr and 48-hr TSFP groups were better than unfermented group ( $P < 0.05$ ) at weeks 3 to 5. Blood biochemical analysis revealed no significant difference in each group ( $P > 0.05$ ). In trial 2, eighty hybrid piglets (Duroc x KHAPS black pig) with equal numbers of both barrows and females were randomly assigned into four dietary treatments, including 5% fish meal or three different supplementation levels of TSFP (32-hr first-stage fermented time) at 0, 2.5, or 5%. As the dietary levels of TSFP increased to 5%, this result of ADG was significantly better than 0% group ( $P < 0.05$ ) at weeks 0 to 3. Furthermore, 5% TSFP group had better BW, ADG, FCR, and production efficiency factor (PEF) than 0% group ( $P < 0.05$ ) at weeks 0 to 5. The *ex vivo* mitogen- induced lymphoblastogenesis and the interferon- $\gamma$  production of 5% TSFP group were higher than the fish meal group ( $P < 0.05$ ). Moreover, the oxidative burst activity and the IgG production of 5% TSFP group were higher than 0% group and fish meal group ( $P < 0.05$ ). In conclusion, the first-stage fermentational time can be shorten from 48 hrs to 32 hrs using selected *Bacillus* strains in TSFP production when it supplemented at 5% of diet for nursery pigs, that shows the best growth performance and immunity.

**Key words:** Nursery pig, Growth performance, Immunity, Blood biochemical, Feather meal