

PIYARADTANA HOMYOK : ENHANCED ACCUMULATION OF OMEGA-3 FATTY ACIDS IN KORAT CHICKEN BY USING GLUCOSE TRANSPORTER-TARGETED NANOPARTICLES. THESIS ADVISOR : ASST. PROF. WITTAWAT MOLEE. Ph. D., 172 PP.

Keyword: LIPID-BASED NANOPARTICLES/n-3 PUFAs/PROTEOMICS/SLOW-GROWING CHICKEN

This research explored the application of lipid-based nanoparticles to enhance the utilization and bioavailability of n-3 polyunsaturated fatty acids (PUFAs) in slow-growing chickens, particularly Korat chickens. The studies focus on synthesizing and optimizing lipid nanoparticles, evaluating their physicochemical characteristics, biodistribution, meat quality, and the molecular mechanisms in muscle function.

Study 1 investigated the synthesis of lipid-based nanoparticles to improve n-3 PUFA delivery from tuna and algal oils. Four nanoparticle formulations were prepared: non-targeting nanoparticles with tuna oil (TO_NPs), non-targeting nanoparticles with algal oil (AO_NPs), targeting nanoparticles with tuna oil (TO_TNPs), and targeting nanoparticles with algal oil (AO_TNPs). Physicochemical properties, storage stability, and in vivo biodistribution were assessed in 33 slow-growing chickens over various time points (2, 4, 8, 12, and 24 hours). Physicochemical analysis revealed that the particle sizes of the TNPs groups were smaller and exhibited higher stability during storage at 4°C compared to NPs groups. Biodistribution studies demonstrated the effectiveness of the TNPs group in delivering n-3 PUFAs to chicken skeletal muscle.

Study 2 examined the impact of lipid-based nanoparticles on growth performance, meat quality, and blood health in chickens. A total of 375 female Korat chickens were divided into three experimental groups, with 5 replicates per group, were fed diets containing rice bran oil (control), tuna oil (3%TO), or tuna oil in lipid-based nanoparticles (3%TO_TNP). The results showed no significant differences in growth performance or meat quality among the groups. However, both tuna oil diets (3%TO and 3%TO_TNP) significantly increased the levels of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) in breast and thigh meat compared to the control group. The 3%TO_TNP group exhibited higher hemoglobin and hematocrit levels and favorable plasma biochemical parameters, such as reduced high-density lipoprotein (HDL) levels and

increased uric acid content. These results suggest lipid nanoparticles can improve the fatty acid profile of chicken meat while maintaining health parameters within normal ranges.

Study 3 investigated the molecular effects of supplementing omega-3 fatty acid-loaded nanoparticles on the functionality of muscle cells in Korat chickens using proteomics. Extracted protein samples from the Iliotibialis muscle (5 for negative control group, 6 each for the unencapsulated tuna oil (positive control, PC), and tuna oil-loaded lipid nanoparticle group (TNP), were analyzed for differential abundant proteins (DAPs). The DAPs analysis revealed that TNP promoted a shift toward aerobic energy metabolism, with increased β -oxidation and enhanced contractile activity supported by proteins such as PDLIM3, and MYH1A. The PC group experienced higher lipid peroxidation, activating antioxidant activity (PRDX1, GSTM2) and membrane repair proteins (ANXA2P2, ANXA4). The PC group showing upregulated calcium pumps (ATP2A2) and contractility stabilizing proteins (MYOM1, MYLK2). TNP, by contrast, minimized oxidative stress and enhanced vesicle trafficking (AHNAK2, TCP1) to support nutrient delivery and muscle function.

In summary, lipid-based nanoparticles offer a novel approach for enhancing n-3 PUFAs delivery, improving fatty acid profiles in chicken meat, and modulating cellular mechanisms to optimize muscle performance. These findings have implications for enhancing the nutritional value of poultry meat and set the stage for innovative feed advancements in poultry production.

School of Animal Technology and Innovation
Academic Year 2024

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