APPLYING HACCP SYSTEM AT AN ESTABLISHMENT PRODUCING PELLETED COMPOUND FEEDS. I. STUDY AND DEVELOPMENT OF HACCP PLAN

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The scope of the present study was to define a HACCP (Hazard Analysis Critical Control Points) system for an animal feed manufacturer establishment in Greece, producing pelleted compound feeds. This need originates from the fact that feeds influence animal health as well as the quality and safety of foods of animal origin through the presence of undesirable substances that they may contain. These include mycotoxins, heavy metals, pathogenic microorganisms such as salmonella and listeria. Two fundamental pieces of Community Legislation were recently issued: firstly, EU (European Union) Regulation 178/2002 on Food Safety which among others pays particular attention to the primary production sector as well as processing and introducing the concept of traceability and secondly, EU Regulation 183/2005 on animal feed hygiene which mandates that feed manufacturers must plan, apply and maintain permanent written procedures based on the HACCP principles.

In planning the present exercise, a medium scale, typical of average Greek feed manufacturing units, was chosen. The products of the enterprise were initially described. These included compound feeds corresponding to physiological stages of various farm animal species such as ewe lactation, sow lactation, calf fattening and pig fattening. These mixtures consisted of ingredients like maize, barley and wheat grain, soybean meal, wheat bran, dried citrus pulp, dried sugar-beet pulp, soya oil, fat and limestone whereas four premixes for vitamin and mineral supplementation of different compositions were used for each of the physiological stages mentioned above.

In addition, an attempt was made to describe the key stages (flow diagram) of compound feed production as well as the organization of a HACCP system and to

define the prerequisites programs under the conditions prevailing in the said feed manufacturers.

This work resulted in the definition of the key stages of pellet production, namely: the reception of raw materials and premixes, storage of the previous feedstuffs, weighing, grinding, addition of premixes, mixing, steaming, pelleting, cooling, storage of products and packaging-labeling.

The formed HACCP team consisted of four members, the HACCP coordinator and those responsible for a) production, b) reception and storage and c) distribution of the end products. As regards the potential prerequisites programs, these referred to the area where the feed unit was located, building constructions, rodent and insect control, hygiene practices (cleaning and disinfecting), efficient functioning of the equipment, securing accuracy of instrumental measurement, water quality, hygiene of storage facilities, as well as that covering personnel. Concerning hazard analysis, the potential hazards (biological, chemical, physical) were identified and, after evaluation, the CCPs (Critical Control Points) and corrective actions in case of deviations were determined. CCPs of the various steps within the flow diagram of a feed unit were determined as follows: reception and storage of raw materials, weighing, mixing, pelleting, cooling, packaging and labeling.

In conclusion, the present work contributes to the policy to be undertaken by the state with a view to developing traceability procedures and establishing a HACCP system as well as a GMP (Good Manufacturing Practice) program for the animal feed industry in Greece as dictated by EU legislation.

The Effect of Substituting Fishmeal with Alternative Protein Sources on the Growth and Survival of Tench Juveniles (*Tinca tinca* Linnaeus 1758).

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Extended Abstract

The present study aimed at investigating the effect of substituting fishmeal by plant proteins on the survival and growth of juvenile tench under intensive culture conditions. To this end, fishmeal in a purpose-made diet has been substituted by pea protein, wheat gluten and maize gluten and the effects of this substitution have been recorded on juvenile tench during a 75-day experiment in a water recirculated system. The control diet consisted mainly of fish meal, wheat and vegetable oil, while in the rest of three diets, fish meal has been substituted by corn gluten, pea protein and wheat gluten at 20% of the Dry Matter of the control diet.

Two hundred juvenile tench (av.weight = 19.16g±2.58 SD) where placed in twelve 200 L tanks and acclimatized for a month, fed the control diet consisting mainly by fishmeal. At the end of the acclimation period and after a 24h food deprivation period, fish have been anaesthetized, weighted, measured (SL = standard length) and randomly allocated to twelve tanks so that each diet treatment consisted of a triplicate. Each tank received an average flow rate of 4 L / min. Fish were stocked at a density of 1.5-2.0 kg / m^3. Photoperiod was kept at

12 h L: 12 h D by fluorescent lamps. Temperature was kept constant at 26.5^0C±0.7 by the use of immersion glass heaters. Oxygen levels were maintained at 60-70% saturation by continuous flow of compressed air. The use of gravel in the sump tank of the recirculation system has kept pH ≈8.5.

Fish were fed at satiation taking into account that diets were manually administered twice daily (at 09.00´ and 15.00´). At the end of the experiment, all experimental fish have been euthanized by immersion on ice, weighted, measured and processed for proximate carcass analysis. Fish carcass analysis and diet proximate analysis have been effected by the methods as described in AOAC 17th Ed. (2000).

Despite the difficulties arisen (poor growth of the initial experimental population during the adaptation period, initial difficulty in adapting to the control environment and inter-specific competition) and due to the long-lasting adaptation period in this experiment and the avoidance of interim samplings and unnecessary handling, tench in this experiment finally adapted to their controlled environment. Consumption has been recorded at 0.115% b.w. / day for fish fed the fish meal-control diet, at 0.13% b.w. / day for fish fed the corn gluten diet, at 0.118% b.w. / day for fish fed the wheat gluten diet and at 0.168% b.w. / day for fish fed the pea protein diet. It has been orally observed that juvenile tench have shown increased acceptability for the pea protein diet, possibly due to the increased palatability of this diet for the species.

Performance indices of this experiment cannot be directly compared to the respective ones of previous experiments mainly due to the different biological stage and evidently different physiological condition of the fish between experiments. However, values of Condition Factor (K) in this experiment (1.52-1.62) have been equal to or even higher than of previously observed ones. In addition, survival in all treatments of this experiment has been

quite high (95-100%), confirming the good physiological status of the experimental population at the end of the experiment.

Although food conversion (FCR = 3.88 - 4.84) has not indicated significant differences (except for the corn gluten diet), the rest of indices indicate a better performance of fish fed the pea protein diet (SGR = 0.18, % Weight Gain = 14.27, PER = 0.54, K= 1.61).

By the end of the experiment, fish of all treatments have lowered their carcass protein levels (66.35 %D.M.) and increased considerably their carcass lipid levels (10.42 %D.M.). However, the carcass profile of experimental fish at this experiment holds only an indicative value (for future reference) as most of the indices related to growth have been mediocre and the purpose of this experiment has not been the investigation of the optimum dietary Protein: Energy levels and the effect of these levels on the carcass profile of the species.

Comparison of physicochemical characteristics and consumers' acceptance of breast meat from retailed organic and conventional broiler chickens

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ABSTRACT

A comparison of the physicochemical characteristics and consumers' acceptance of breast meat from retailed organic and conventional broiler chickens is presented in this study.

Raw breast fillets (right and left *Pectoralis major*) were obtained from 15 organic and 15 conventional broiler carcasses that were purchased from local retailers. Total moisture of the meat was evaluated using the ISO 1442:1997 reference method. Crude protein and ash were determined according to Weende analytical procedure. Intramuscular fat (IMF) was measured by a cold extraction procedure. Shear force was evaluated as peak force values in Newtons per mm^2. Consumers' acceptance test was performed by a panel of sixty participants rating color, tenderness, juiciness, taste and overall acceptability. Consumers rated their acceptance for each of the samples on a five-point hedonic scale. Consumers were also asked to complete a questionnaire concerning their attitudes towards organic poultry meat.

Consumers' acceptance data and physicochemical attributes were submitted to one-way analysis of variance (ANOVA) fitting the production system (organic-conventional) as the fixed (factor) effect. Partial correlation coefficients among sensory as well as among physicochemical attributes, were computed. Pearson correlation coefficients between means of sensory scores and the physicochemical attributes were also calculated.

Conventional chicken breast had more ash (1.41 vs. 1.18 %), intramuscular fat (0.31 vs. 0.26 %; log-transformed values) and lower cooking loss (30.6 vs. 33.7 %) when compared to the organic ones ($P<0.05$). Meat moisture, crude protein and shear values did not discriminate between the two production systems ($P<0.05$). When compared

to organic, conventional poultry meat received statistically significant higher scores for tenderness (3.64 vs. 3.26) and juiciness (2.98 vs. 2.48) ($P<0.05$). There were no significant differences for color, taste and overall acceptance. Taste was found to be highly correlated with overall acceptance ($r= 0.72$, $P<0.001$) followed by juiciness ($r=0.62$, $P<0.001$) and tenderness ($r=0.49$, $P<0.001$). Positive correlations were also observed between the following pairs of attributes: tenderness - juiciness, tenderness - taste and juiciness - taste. For the physicochemical attributes, only moisture and cooking loss displayed a significant correlation ($r=0.68$, $P<0.01$). Furthermore, IMF was positively correlated with tenderness ($r=0.41$, $P<0.05$) and juiciness ($r=0.49$, $P<0.05$) while cooking loss was negatively correlated with juiciness ($r= -0.47$, $P<0.01$).

Conclusively, organic poultry meat displays higher cooking losses and lower IMF and ash content than the conventional one. As a result, consumers' panel acceptance test rated it lower for tenderness and juiciness. Greek consumers have generally positive attitudes towards organic production and they believe that it produces healthy poultry products which are environmentally friendly, but they also rate the premium prices as a very important issue.