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Raw and extruded pea (*Pisum sativum*), faba bean (*Vicia faba* var. *minor*) and lupin (*Lupinus albus* var. *multitalia*) as alternative protein sources in broiler diets

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ABSTRACT

Research on vegetable-based protein sources has grown as a result of the European Union ban on the inclusion of meat and bone meal in diets of agricultural livestock. This together with recent concern over genetically modified soybeans, the protein source of choice for monogastric diets, has sparked research into the identification of some alternative protein sources. The objective of this study was to evaluate the effect of raw or extruded pea (RP and EP), faba beans (RFb and EFb) or lupin (RL and EL) in partial substitution of soybean meal and other starch sources in broiler diets. A total of 462-d-old male Ross chicks, Marek vaccinated, were randomly assigned to seven dietary treatments (3 pens/treatment). Chicks were floor housed, *ad libitum* fed isocaloric and isonitrogenous diets and had free access to water. Artificial light was provided 10 h/d. The amount of alternative proteins used as fed basis and for 1-10 d-old and 11-42 d-old growing periods were: RP and EP: 350 g/kg for all diets; RFb: 480 and 500 g/kg; EFb: 240 and 250 g/kg; RL: 360 and 300 g/kg; EL: 180 and 150 g/kg. Feeds were analyzed for tannins, polyphenol, genisteine, and daidzeine contents and the *in vitro* alpha-amilase starch digestibility was measured. At the end of the trial performance parameters were calculated, animals were processed and percentage yields (one per pen) of breast meat and leg quarters were quantified. The polyphenol concentrations and antitrypsin activity were reduced and the alpha-amylase digestibility increased in EP and EFb. The feed conversion ratio was not significantly affected, however, the feed intake was reduced ($P<0.01$) in EL diet compared to the control group and to the RL diet. The RP group had lower dressing percentage ($P<0.05$), whereas groups fed faba bean had higher breast yield ($P<0.01$) independent of processing. There were no statistical differences in percent yield of the leg quarters. Data support the utilization of these alternative proteins sources into broilers diets as a viable solution to counteract the current constraints of soybean meal. Partial improvement was seen with EFb and EP, which was not seen however for the lupin based diets.

Lipid characteristics in eggs produced in different housing systems

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ABSTRACT

The aim of the experiment was to study the effect of the housing system on the composition and the lipid characteristics of table eggs. The four laying farm systems considered in the Italian low n. 2052/2003 on table egg commercialization were studied: organic (0), with outside pen (1), on the floor (2), in battery cages (3). Six eggs were analysed for each laying system. Total egg, yolk, albumen and shell were weighted. The proportion of the yolk, albumen and shell were calculated. Then, the yolk and albumen were homogenised and 2 g were sampled for the following lipid analyses. Total lipid were extracted in excess of chloroform:methanol (2:1 v:v) and weighted after drying under nitrogen; the fatty acid composition of total lipid was detected by gas chromatography after trans-methylation. The amount of total cholesterol was measured by colorimetric procedure after saponification. Analysis of variance was performed by GLM procedure of SAS (release 8.2). Yolk weight and proportion were significantly higher in group 0 (18.2 g; 27.6%) compared to group 1 (16.3 g; 24.8%) and 2 (16.1 g; 24.6%), and the values measured in group 3 (16.8 g; 25.7%) did not differ from the other groups. Albumen and shell weight did not show any significant change according to the housing system. The total lipid content was about 9% and no significant differences were found among groups. The fatty acid composition of total egg lipid in group 2 was significantly different compared to the fatty acid composition found in group 0. The proportion of saturates (S) was significantly lower and the proportion of polyunsaturates (P) was significantly higher in group 2 compared to group 0. The P/S ratio was significantly higher in group 2 (0.92) compared to all other groups (0=0.66; 1=0.71; 3=0.75). The proportion of n-3 polyunsaturates was significantly lower in group 0 (1.51%) compared to all other groups (1=2.02%; 2=2.55%; 3=2.16%). The average content of cholesterol was 370 mg/100 g edible egg, and no significant changes were observed among groups. The qualitative changes found in egg lipid composition are suggested to be related to feed quality and not to the housing system.

Effects of vitamin E/PUFA's and dietary inorganic selenium on quality of broiler breeder males semen

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ABSTRACT

The aim of the present work was to compare the effects of a supplementation of PUFA/vit. E and selenium on the quality of poultry semen. The trial, was carried out from March to June in a breeding farm, employing 90 broiler breeder males, Cobb 500 type, housed in individual cages at 18 weeks of age in a controlled environment: 14L:10D, 18°C, humidity 65%. The broiler breeder males, fed with 130 g/bird/d of a basal diet (11.3 MJ ME/kg) until the introduction of micronutrient and PUFA/vit. E, at 22 weeks of age were split into three groups of 30 birds: Control group (A); Selenium group (S) with 100 ppm (2.5 mg/kg LW of sodium-selenite 1%); PUFA/vit. E group (P) (3% fish oil and 0.08% vitamin E). The collection of semen samples was made by abdominal massage method measuring the ejaculate volume at each collection. All the semen of the same bird group was pooled and was assessed for motility and viability (negrosin – eosin stain), concentration and HOS test. The concentration of semen samples was measured with the Spectrophotometer (Shimadzu UV-2401PC) at 530 nm, after a dilution 1:200 with NaCl 0.9‰ solution. The data were processed by variance analysis using the GLM/SAS. The results of the variations of the motility, the viability, the percentage of death and the concentration revealed that the treatment has statistically significant effects on the percentage of live spermatozoa ($P<0.01$) and on the concentration ($P<0.05$) and that the age was significant for the vitality ($P<0.01$). Besides, the ANOVA on the means, revealed a significant increment of the viability ($P<0.01$), of the concentration ($P<0.01$), of the motility ($P<0.05$) and of the percent of death ($P<0.05$) for group S. Group P also presents significant differences for vitality ($P<0.05$), concentration ($P<0.05$) and motility ($P<0.05$). In conclusion group S has the better values throughout the treatment period confirming that Se supplementation, is a crucial factor in maintaining the high reproductive characteristics of poultry, and pointing out its major benefits on fertility, at the chosen level, with respect to PUFA/vit. E supplementation.

Effect of reproductive period on the quality of stored semen of BUT and Hybrid toms

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ABSTRACT

It is difficult to maintain semen quality after *in vitro* liquid storage of turkey semen up to 24 h and the problem is enhanced with animal ageing. Little is currently known about the effects of tom strain on the qualitative characteristics of turkey semen. The purpose of this study was to investigate the effects of BUT and Hybrid toms during reproductive period on the quality of semen stored for 48 h at 5°C. Two different periods were considered: first period (1st period) from 32 to 40 weeks of age and the second one (2nd period) from 44 to 52 weeks. Semen pools (4 ejaculates) of each tom strain were used and diluted with Beltsville Poultry Semen Extender (BPSE) and stored at 5°C for 48 h. and then motility, viability and membrane integrity of sperm were evaluated at 3, 24 and 48 h of storage. The sperm concentration was significantly affected by period ($P<0.01$) and strain ($P<0.05$), with best values in 1st period and in the Hybrid semen. Besides also the motility, viability and membrane integrity during 48 h of storage were better ($P<0.05$) in the 1st period compared to 2nd period for both strains, particularly in Hybrid semen. During storage clearly showed in the period 1 that Hybrid sperm worsened more than the BUT one: in spite of the motility and viability values were at first (3 h) higher ($P<0.05$) in Hybrid semen, after 48 h of storage the motility did not show any significant difference between strains while the viability resulted even better ($P<0.05$) in BUT semen. In period 2nd although the semen quality decreased during the storage with a similar trend for both strains, better values were found in BUT semen ($P<0.05$). Our results indicated that BUT semen showed a better *in vitro* storage ability compared to Hybrid semen. Moreover the reproductive period affected the quality of turkey semen in a different manner according to the strain. However, further studies need to investigate the effects of strain and reproductive period on the semen quality during the storage by measures to evaluate the ageing of spermatozoa.

Lipid and α-tocopherol changes in n-3 rich turkey spermatozoa during liquid storage

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ABSTRACT

The aim of this trial was to study the changes in lipid and α-tocopherol (α-T) contents of turkey semen evaluated in commercial extender during liquid storage. Male turkeys received a control diet (CO) or an enriched diet (Omega3) supplemented with 2% of fish oil and 120 mg of dl-α-tocopheryl-acetate/kg of feed (CO diet: 60 mg) from 40 weeks of age. The fatty acids composition (GC Analysis) of total phospholipids (PL) in spermatozoa and seminal plasma, and the α-T content (HPLC Analysis) in spermatozoa were determined on time 0 and after 48h storage at 4°C. The Omega3 diet induced a significant increase in the proportion of n-3 polyunsaturated fatty acids (PUFA), mainly C22:6, in sperm (5.87 *vs* 1.37%) and plasma (6.08 *vs* 1.70%) PL and concomitant decrease in the proportion of n-6 PUFA, mainly C20:4 and C22:4. As a consequence, the n-3/n-6 ratio was significantly increased in both spermatozoa (0.25 *vs* 0.07) and seminal plasma (0.35 *vs* 0.11) of the Omega3 group. The proportion of n-9 PUFA (C22:3n-9 accounted for 8% of total fatty acids) in turkey spermatozoa was not modified by the diet. This suggests that a high proportion of C22:3n-9 in turkey sperm is not related to n-3 deficiency but could be species-specific characteristic to birds. The Omega3 diet also induced great increase in the sperm α-T content from 27.18 to 66.81 ng/10^9 cells. During 48h storage at 4°C, the sperm α-T content significantly decreased only in the Omega3 group, not in the CO group, from 89.2 to 44.4 ng/10^9 cells. The major changes in PL bound fatty acids during storage were found in spermatozoa and seminal plasma of the Omega3 group: the proportion of n-3 PUFA significantly increased in spermatozoa (6.55 *vs* 5.19%) and the decreased in seminal plasma (6.39 *vs* 9.75%) after 48 h storage at 4°C. In contrast, only the proportion of C18:2n-6 significantly decreased in seminal plasma during storage in CO group. The transfer of n-3 PUFA from seminal plasma to spermatozoa may occur during storage in n-3 rich gametes. Further investigations are suggested to study the role of seminal plasma and the substrates for spermatozoa metabolism during storage.

The SIQUALTECA project: poultry meat quality during further processing

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ABSTRACT

A study was conducted in order to evaluate the quality characteristics of: - raw meat (breast and legs) obtained from broiler chickens fed on two different diets containing animal fat (AF) or vegetable oil (VO) as lipid source; - further processed meat products (breaded patties) obtained by using grounded meat from AF or VO and processed using two different processing lines (Conventional *vs.* Innovative Technology). Conventional Technology (CT) is a multiphase process where the meat patties are first formed, coated with a starch-protein batter, breaded, flash-fried. The cooking process is completed in a convection oven. With Innovative Technology (IT) the meat patties are formed, dusted with a starch-protein powder, cooked in a steam oven, coated with a starch-protein batter, breaded, and subsequently flash-fried. The IT mainly differs in the inversion of cooking/frying phases and the use of a steam oven instead of a convection oven. As regard to raw meat, the results indicate that the dietary use of VO determined a lower water holding capacity (measured by cooking loss) and higher lipid susceptibility to oxidation of the meat with respect to the AF diet. Moreover, it was found that observed differences in the quality characteristics between broiler breast and legs meat suggesting that the breast and legs ratio during meat batter preparation can strongly affect the final characteristics of processed products. Concerning further processed meat products, it was observed that: - the differences in chemical characteristics of initial, intermediate and final products increase according to whether the products are raw (e.g. raw patties) or cooked (e.g. fully cooked breaded patties); - final products of CT and IT did not show significant differences in terms of texture properties evaluated by texture profile analysis and Warner-Bratzler. As expected, flash-frying was the key step in order to determine texture characteristics of fully cooked breaded patties for both processing lines.

The SIQUALTECA project: phenotypic and genotypic characterization of *Staphylococcus aureus* isolated from a poultry slaughterhouse

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ABSTRACT

Staphylococcus aureus is a common etiological agent of foodborne intoxication and is a significant marker of food quality and surface cleanliness. In this study, *S. aureus* was considered the target micro-organism to assess the sanitation plan effectiveness in a slaughterhouse for poultry, owing to its considerable resistance in the environment. The antimicrobial susceptibility of 38 staphylococcal strains was also monitored. RAPD-PCR and REA-PFGE were performed, in order to better investigate the characteristics of *S. aureus* recovered from the different sampling sites: 5.3% of the strains were resistant to ampicillin and to penicillin G, 7.9% to chloramphenicol, 28.9% to enrofloxacin, 13.1% to erythromycin. The highest percentage (42.1%) of strains was resistant to tetracycline. As to the genotypic characterisation, RAPD PCR technique produced 9 different pattern-types while the number of the patterns went up to 25 using REA-PFGE. These findings show the importance of correct application of disinfectants in the slaughterhouse environment where organic matter may be present. *S. aureus* shows a good resistance to some disinfectants so it should be considered a reliable marker to check the sanitation plan effectiveness in slaughterhouses. Appropriate antibiotic surveillance system should be also set up at national and international level. Our results confirm that REA-PFGE technique is more discriminatory than RAPD. A good discrimination among strains is a very important step for the contamination monitoring above all in the slaughterhouse environment where the microbial contamination levels are always high. These results underline the elevated differentiation percentage of the strains of *S. aureus* present in a poultry slaughterhouse.

Valorisation of poultry and rabbit local breeds: market organism and new saleable products

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ABSTRACT

The survival and rescue of local breeds, also for poultry and rabbits, have great interest for genetic as well as productive purposes, but the achievement of such objectives needs time and money to support breeders. At the present, in Piemonte (north-west of Italy) the rescue work has been carried on two poultry breeds: the Piemontese Fawn Hen and the Saluzzo White Hen (since 1999), and on one rabbit breed: the Carmagnola Grey Rabbit (since 1982). After years devoted to improve numbers and productive performances of such animals, now for all the involved breeds the objective is to improve the marketing strategies. So, after the setting of Slow Food Presidia, a producers' association collecting about 140 Piemontese Fawn (about 70,000 heads/year and 30% of breed's market), 50 Saluzzo White (about 5,000 heads/year and 70% of breed's market) and 9 Carmagnola Grey (5,000 heads/year and 80% of breed's market) breeders is going to be established. One of the first steps of the Consortium will be the brand name registration, to make easy distinguish the products on the market, followed by studies on possibility to improve the marketing strategies and the number of saleable products. In fact, for the development of the market it is important to be able to sell not only fresh meat, and not only the whole carcass, but also portioned products, vacuum or modified atmosphere packaging, ready-to-cook and ready-to-eat products. Particularly the latest ones have been tested, i.e. cooked meat (breast and leg) in oil obtained from the Saluzzo White hen, and meat sauce (meat and tomato) and pâté (meat and liver) obtained from the Carmagnola Grey rabbit. Different recipes have been tested and now the products are present on the market, showing an high acceptance rate in the consumers sensory evaluation test (hedonic rating scale: meat in oil 69.8%, meat sauce 81.1%, pâté 75.5% over the mean value in a 5 point scale), allowing producers to better utilise their production, without to be linked to productive cycles.