The injection of nutrients into eggs can improve the incubation process and the chick quality. The liver is an organ of extreme importance for body metabolism. Its various functions are as fundamental as storage of carbohydrates, fats, vitamins, and production of blood cells in the embryo. Because of the liver's importance, the aim of the study was to determine the its absolute and relative weight in broiler chicks that received a supplemental injection composed of glycosaminoglycans and vitamin C on the fourth day of incubation. Four hundred ninety fertile, broiler eggs (Cobb) from 43-week-old breeder hens were used. The eggs were 65.78 ± 1.16 g each. The experimental design was completely randomized with 5 treatments (non-injected eggs; eggs injected with milli-Q water; eggs injected with glycosaminoglycans and vitamin C at percentages of 2%, 4%, and 6%, diluted with 100 ul of milli-Q water), distributed in a single-stage, vertical CASP incubator, with 14 repetitions and 98 eggs per treatment. Each 100 g of the supplement were composed of the following: 30,000 mg of chondroitin sulfate, 30,000 mg of glucosamine, 5,000 mg of vitamin C, and vehicle q.s 100 g. The supplement was injected into the albumen, approximately 6 mm below the eggshell on the fourth day of incubation. The injection site was then covered with a label identifying the treatment and repetition. Statistical analyses were performed using the SAS (2002) program with the averages compared by Tukey test at 5% probability. There was no significant difference ($P < 0.05$) in the absolute weight and relative weight of the liver after hatching. The relative and absolute weight averages for the liver found in this study were 0.98 g and 2.05 g, respectively. This demonstrates that supplementation with glycosaminoglycans and vitamin C does not interfere with the liver weight. Therefore, the intra-egg injection of glycosaminoglycans and vitamin C supplement had no effect on the absolute and relative liver weight in the chicks in the study.

Key Words: ascorbic acid, chondroitin, nutrition in ovo

456P Lipidomic analysis of broiler hatching eggs reveals a distinct signature for breeder hen age. Gita Cherian*, *Oregon State University, Corvallis, OR.*

During incubation egg fat is the major source of energy and sole source of essential fatty acids to the chick embryo. In the current study, electrospray ionization mass spectrometry (ESI-MS) is used in quantification and mapping of lipid molecular species in hatching eggs collected at 2 different hen ages. Lipids were extracted from eggs (n = 24) (Cobb) collected at < 32 (early) or > 45 (late) weeks of hen age and were subjected to ESI-MS. As the hens aged, egg and yolk weight increased significantly ($P < 0.05$). Early eggs contained 7.5% lesser fat than late eggs ($P < 0.05$). A 2-fold increase in phosphatidylcholine (PC) and phosphatidylethanolamine (PE) was observed in late eggs ($P < 0.05$). Mapping of the phospholipid species revealed that 34:1, 34:2, 36:1, 36:2 and 38:4 constituted > 75% in PC. The dominant docosahexaenoic acid-containing molecular species in PE and PC of early and late eggs were 38:6 and 40:6 and were 1.5–2-fold higher in late than early eggs ($P < 0.05$). The most abundant arachinoid species in PE and PC was 38:4 and was higher in late than early eggs ($P < 0.05$). Early eggs contained higher 16:0, 18:1 and 18:2 than late eggs in tri and diacylglycerol ($P < 0.05$). Clustering the data through heat maps revealed that egg phospholipid species are more sensitive than triacylglycerol to hen age. These results demonstrate that hen age alters egg "lipid signature" causing a remodeling in fatty acid molecular species in the different lipid classes. Considering the role of egg fatty acids in embryo growth and eicosanoid metabolism, mapping the lipid profile may provide a better understanding of pre-hatch lipid metabolism as affected by hen age. This may prove to be beneficial in tackling problems related to hatchability and first week mortality in broiler chicks.

Key Words: egg, lipid, molecular species, polyunsaturated fatty acid

457P Influence of glycerin and lecithin inclusion in the diet on liver characteristics and lipid fraction in the serum of brown-egg laying hens at 55 week of age. H. A. Mandalawi[1], M. Redón[2], J. García[3], D. Menoyo[1], and G. G. Mateos*[1], *[1]Producción Agraria, Universidad Politécnica de Madrid, Madrid, Spain, [2]Lasenor Emul S. L., Olesa de Montserrat, Barcelona, Spain, [3]Camar Agroalimentaria S. L., Toledo, Spain.*

The effects of the inclusion of raw glycerin (GLYC) and raw lecithin, in the diet (23 to 55 wk) on liver characteristics and various serum lipid fractions were studied in brown egg-laying hens at 55 wk of age. The control diets were based on corn, soybean meal, and 4% supplemental fat and contained 2,750 kcal AME_n/kg, 16.5% CP, and 0.73% digestible Lys. The diets were arranged as a 2 × 3 factorial with 2 levels of GLYC (0 and 7%) and 3 animal fat to lecithin ratios (4:0, 2:2, and 0:4%). Each treatment was replicated 8 times and the experimental unit was a cage with 10 hens. At 55 wk of age, 2 hens per cage replicate were randomly selected, weighed individually, and slaughtered by CO2 inhalation. Liver was immediately removed and weighed and the color recorded by spectrophotometry. In addition, blood samples from one bird per replicate were collected from the wing vein and the concentration of total cholesterol, low and high density lipoprotein cholesterol, and triglycerides were determined. The data were analyzed as a completely randomized design and the main effects of GLYC and lecithin content of the diet and the interactions were determined. No interactions between GLYC and lecithin content of the diets were detected for any of the variables studied. Liver characteristics and serum lipid traits were not affected by the inclusion of GLYC in the diet. The substitution of animal fat by lecithin, however, reduced the redness (a* 14.9 to 13.8) and yellowness (b* 8.60 to 7.20) values of the liver ($P < 0.05$) but did not affect the content of serum lipid fractions. It is concluded that the inclusion of GLYC and lecithin in the diet did not affect liver size or serum lipid fraction. However, the inclusion of lecithin reduced the a* and b* value of the liver.

Key Words: glycerol, laying hen, lecithin, liver, serum

458P Effect of dietary sunflower hulls on nutrient digestibility, ileal morphology, and volatile fatty acid concentration in broilers and pullets fed a pullet diet from 1 to 21 days of age. M. V. Kimiaeitalab[1], L. Cámara[1], M. D. Carro[1], E. Jiménez-Moreno[2], S. Mirzaie Goudarzi[3], and G. G. Mateos*[1], *[1]Producción Agraria, Universidad Politécnica de Madrid, Madrid, Spain, [2]Cargill Animal Nutrition, Zaragoza, Spain, [3]Department of Animal Science, Buali Sina University, Hamedan, Iran.*

The effects of including 3% sunflower hulls (SFH) in the diet on performance, TTAR of nutrients, ileal mucosa morphology, and volatile fatty acid (VFA) concentration in the ceca were studied in birds from 1 to 21 d of age. There were 4 treatments organized as 2 × 2 factorial with 2 chicken lines (broilers vs. pullets) and 2 levels of SFH (0 vs. 3%). Each treatment was replicated 7 times (10 birds). The wheat-soybean meal control diet contained 2,900 kcal AME_n/kg, 0.96% digestible Lys, and 10.8% NDF. In the experimental diet, SFH was included at the expense (wt:wt) of the control diet. Diets were offered in mash form. No interactions between main effects were detected for any trait. ADFI, ADG, and feed conversion ratio (FCR) were better ($P < 0.001$) in broilers than in pullets. At 7 d of age SFH improved ADG ($P < 0.05$) and ADFI ($P < 0.001$) but did not affect FCR. The TTAR of DM, OM, and N was higher ($P < 0.001$) at 7 d and that of gross energy and the AME_n of the diet were higher at 7 and 21 d ($P < 0.01$) in broilers than in pullets. At 21 d, SFH