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Review Article

Organic Gratis Laying Hens' Habitat and Egg Microbiology are affected by Organic Dairy Cattle Dung

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Abstract

Demand from consumers has led to an increase in the popularity of free-range and organic poultry in recent years. A study was done to see how organic dairy cow manure might affect the environment and the microbiology of eggs in organic free-range laying flocks. A flock of brown egg hens was divided up and kept in a rotational paddock grazing schedule that did not include or expose them to organic dairy manure. Between 20 and 44 weeks of age, environmental samples and eggs were taken in order to count the number of Enterobacteriaceae and check for the presence of Listeria, Campylobacter, and Salmonella spp. There was no discernible difference between integrated and control grazing in the prevalence of Listeria spp., Campylobacter spp., and Salmonella spp. in environmental and egg samples. 211 viable isolates from Enterobacteriaceae colonies were obtained using a random sample and biochemical characterization. There were 17 taxa, species, or serotypes found (John et al., 1997). The prevalence of total coliforms was higher (P 0.05) in integrated organic free-range flocks compared to control organic free-range flocks in the samples of shell emulsion, egg contents, nest box straw, and forage. The microbial levels retrieved from ambient and egg samples were altered by the seasons, with the summer having the greatest level of all populations under observation. To fully comprehend the impact of mixed production rotational grazing on the prevalence of pathogens and Enterobacteriaceae on organic nest-run eggs and the grazing environment, additional research is required (Goldman et al., 1996).

Keywords: Enterobacteriaceae, Pathogens

INTRODUCTION

Due to their accessibility, nutrient density, and usefulness as food, eggs are a significant agricultural commodity in the United States. The American Egg Board reports that in 2017, close to 159.8 million cases of eggs were produced in the country. 18.4% of the table eggs (shell eggs) made in the United States come from cage-free and organic layer flocks. Due to consumer perceptions of improved animal welfare, free-range and organic poultry has grown in popularity. Chickens raised in the open air are known as free-range (Kothari et al., 2014). Access to nature can affect exposure to a range of microbes that pose a risk to human health, including Salmonella and Campylobacter. These risks may be decreased with the use of appropriate biosecurity procedures. In contrast, sheep, goats, swine, beef and dairy cattle, as well as pets, are frequently found on poultry farms (Schiff et al., 2009). These creatures might store pathogens and release them into the environment. This study's objective was to assess the effects of organic dairy cattle manure on the environment and the egg microbiology of organic, free-range laying flocks. A flock of organic brown egg layers was divided into two rotational paddocks: one with organic dairy cattle manure present, the other without (Baron et al., 2011).

Management of Housing and Birds

For this experiment, 138 brown LLeghorn hens (Hy-Line Brown) were employed. The North Carolina Department of Agriculture and Consumer Services Piedmont Research

Station is where the chicks were hatched before being transported to the Cherry Research Farm, where the study was carried out. The pullet brood-grow husbandry followed the procedure described by Anderson (2010), which was altered to satisfy the requirements of the National Organic Program for floor brood and rearing using two range houses. At all stages of the flock's life, unlimited access to water and organic food was provided. Starter diet, with a CP content of 20.1%, was given during the brood-grow period from 0 to 12 weeks, while Developer diet, with a CP content of 16.3%, was given from 11 to 16 weeks (Blaschke et al., 2015). The following system was used to manage the rotation of integrated treatment range houses and paddock pens: Fresh cow manure was collected from the on-site organic dairy herd; 2 days before paddock rotation, 5 cow patties were placed there (i.e., 1 cow patty/6 hens using a #1 scoop shovel to form the volume of the patty); 3 horn fly maggots developed; and, 4 range houses and paddock pens were moved to a new location. The procedure was repeated every four days. The control range houses and paddock pens were rotated to fresh forage on the same schedule as the treatment range houses and paddock pens, but they lacked organic dairy cow manure (Fournier et al., 2013).

Egg Sample Collection

By cutting a handful of fodder 2.5 cm from the ground using sterile blades, septa are gathered. The forage samples were put into sterile sample bags and shipped on ice to the lab. Aseptically obtained nest box straw samples (n = 3 treatments each sample period) were put in sterile sample bags and transported as previously mentioned (Funke et al., 1997). The following morning, straw samples from the foraging and nest boxes were aseptically divided into smaller pieces using sterile shears. Weighing separate samples of forage and nest box straw allowed for the addition of sterile PBS at a ratio of 1:10 to the samples. After that, samples were stomacher-blended for one minute at 230 rpm using the Stomacher 400 Circulator, Seward Limited London, UK (Archibald et al., 2001).

Microbial Analyses

It was done to count all the aerobic populations, Enterobacteriaceae, yeasts, and moulds. In a nutshell, the total aerobic populations were calculated by duplicate spread plating either 250 mL of egg content or 100 mL of appropriate dilutions from environmental samples and shell emulsions onto standard method agar (SMA) (Acumedia Manufacturers, Lansing, MI). Before counting, plates were incubated for 48 hours at 37°C. By adding 1 mL of the proper dilutions of all sample types to duplicate violet red bile glucose (VRBG) agar plates with an overlay, enterobacteriaceae were counted. Before counting, the plate was incubated at 37°C for 24 hours. For isolation on SMA Acumedia Manufacturers, up to 5 typical colonies per positive sample were chosen at random from VRBG plates. To guarantee the purity of the isolates, two further runs on SMA were made (Buchan et al., 2014). The API20E bioMerieux, Inc., Marcy-l'Étoile, FR multitest strips were used to identify up to 30 isolates from each treatment (control and integrated), from each sample (shell emulsions, egg contents, nest box straw, and forage grass), and then single colonies were tested in accordance with the manufacturer's instructions. To begin Listeria pre-enrichment, a 10 mL aliquot of the material was added to 90 mL of UVM modified Listeria enrichment broth (Acumedia Manufacturers) and incubated there for 24 hours at 37°C. Then, 100 L of pre-enrichment was added to 10 mL of Fraser broth enrichment, which was then incubated at 30°C for 24 to 48 hours with supplements from Becton Dickinson in Sparks, Maryland. Fraser tubes that tested positive were adhered to modified Oxford agar and cultured for 24 hours at 37°C (Becton Dickinson). Presumptive positive colonies were added to motility agar from Acumedia Manufacturers, and they were then cultured there for 48 hours at room temperature. Then, using a Microbiology International's Microgen Listeria ID kit, presumptive positive colonies were biochemically identified (Lagier et al., 2015).

DISCUSSION

In this investigation, treatment-related changes in the levels of aerobic contamination (Table 1) were not seen; however, changes in the levels of aerobic contamination were seen as the flocks aged. The degree of aerobic contamination in the egg shells and membranes at 44 weeks of age was higher (5.88 log cfu/mL) than it was at 20 weeks (3.58 log cfu/mL), 27 weeks (3.58 log cfu/mL), and 36 weeks (3.40 log cfu/mL) of age (P 0.001). Eggs from flocks that were 44 weeks old (1.90 log cfu/mL) had higher levels of total aerobic contamination than eggs that were 20 weeks old (0.20 log cfu/mL), 27 weeks old (0.72 log cfu/mL), and 36 weeks old (0.75 log cfu/mL) (P 0.01). The amount of total aerobic contamination in nest box straws from flocks that were 44 weeks old (8.08 log cfu/mL) was higher (P 0.001) than it was in samples from flocks that were 20 weeks old (6.55 log cfu/mL), 27 weeks old (7.60 log cfu/mL), and 36 weeks old (7.96 log cfu/mL). Microbial levels within 1 log cfu/mL are equivalent in terms of food safety. Although the counts at 44 wk were statistically different, the total aerobes found in the nest box straw at 27, 36, and 44 wk are comparable. When compared to the pasture fodder at 20 (7.58 log cfu/mL) and 27 (7.56 log cfu/mL) wk of age, total aerobic contamination levels were higher (P 0.0001) at 36 (8.42 log cfu/mL) and 44 (8.49 log cfu/mL). In contrast to other research, the overall prevalence of Campylobacter spp. was low (21.4%, control and 20.0%, integrated). the spring and fall samples of organic egg farms in Finland. 84% of the samples taken in the fall were positive for Campylobacter, compared to 76% of the samples collected in the spring. Campylobacter spp. was frequently recovered from the environmental samples at a higher rate (30%) than the shell emulsion and egg content samples at a respective rate of 12.1 and 1.4%, despite the fact that faecal samples were not collected in the current study (data not shown).

In the present study, campylobacter contamination of nest box eggs was unaffected by the presence of dairy cattle manure in the free-range housing system. Escherichia coli (42.7%) was the most common Enterobacteriaceae isolated from the samples that were collected; a sizable portion of the Escherichia coli was recovered from the egg shell, while a little portion was recovered from the egg content. The fact that the control free-range group had more Enterobacteriaceae isolated from shell emulsions and nest box straw than the integrated free-range group does suggests that nest box straw may have an impact on how many Enterobacteriaceae are discovered on the egg's shell surface. In earlier studies on free-range production, faecal contamination has been linked to several of the detected species, which are frequently found in nature. This study sheds light on the impact of organic free-range dairy cattle dung on microbial communities.

CONCLUSION

Hens in a free-range paddock were exposed to organic dairy cow manure, but the exposure had no effect on microbial populations compared to hens in organic free-range paddocks that were not exposed. Increases in aerobic population levels were seen as the flocks grew older in the areas of shell emulsion, egg content, nest box straw, and pasture forage. At 44 weeks (September), rising levels of yeasts, molds, and Enterobacteriaceae were found in shell emulsions. These findings may be seasonally related.

The potential microbial effects of mixed production rotational grazing with organic dairy cattle on the production of organic eggs require further study.

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