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Do probiotics affect the behavior of turkey poults?

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With the concept that measuring behavior is often the first step to take when studying how the brain operates, this study was conducted to investigate the effect of probiotic on turkey poult's behavior which will confirm the new concept that gut microbes can influence the brain. Ecobiol® probiotic, spores of *Bacillus amyloliquefaciens* and a carrier as serum of milk with a minimum guaranteed 1×10^{10} CFU/g was given with a dose of 0.01 g/day for each bird in the drinking water to group (P; n=350) and the other group (C; n=350) were kept as controls. Behavioral observations were carried out by direct personal observation without bird disturbance from outside the pen with a good view over the whole pen. Maintenance, comfort behavior, kinesis and agonestic behaviors were recorded. The obtained results indicated that probiotics increased the feeding frequency and duration and decreased distress call and aggressive behaviors in turkey poults.

Key words: Ecobiol®, turkey, probiotics, behavior, observation.

INTRODUCTION

Probiotics are live microbial feed supplements which beneficially affect the host animal by improving its intestinal balance (Gibson and Fuller, 2000) and are nowadays widely used as growth promoters in poultry production. Probiotic foods have been consumed for centuries. A food can be said to be functional if it contains a component (which may or may not be a nutrient) that affects one or a limited number of functions in the body in a targeted way so as to have positive effects on health or if it has a physiological or psychological effect beyond the traditional nutritional effect (Ahmad, 2006).

The stability of the gut micro biota is the key to control intestinal health. The use of probiotics as gut flora stabilizer is a recognized tool to achieve that objective, as the probiotics interact with other bacteria and control them. If these probiotics, besides, interact with the host by producing lactic acid, or enzymes, then the animal not only has a better intestinal health, but can digest better the feed, and hence, improve their feed conversion ratio.

Probiotic composed of spores of *Bacillus amyloliquefaciens* and it is easy to handle and they thought to act in the intestinal tract of poultry reducing the effect of pathogenic bacteria such as *Clostridium perfringens, Escherichia coli,* and *Yersinia*. In addition to enzyme production, such as amylases and proteases that make the feed more digestible, this favors the proliferation of lactic acid bacteria and produces lactic acid as by product of starch fermentation. In broiler chicken, trials of significant improvements in feed conversion rate have been observed for growing period when using supplemented diets with Ecobiol®. Numerical differences were also observed for feed intake; broilers fed with Ecobiol® took less feed, because they perform better with the diet. Mortality of broiler decreases with the inclusion of the probiotic (Diaz, 2007).

Several researchers studied the effect of probiotic administration on the feed conversion ratio (Silva et al., 2000; Opalinski et al., 2007), body weight, feed efficiency (Safalaoh, 2006; Timmerman et al., 2006; Mountzouris et al., 2007; Jouybari et al., 2009; Alkhalf et al., 2010), histology of the intestine (Mongkol and Kohen, 2002; Zhang

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et al., 2005) and also its effect on immunity (Ahmad, 2006). However, little is known about the effect of probiotics on the behavior of animals.Recently, Bravo et al. (2011) reported that 'ingestion of *Lactobacillus* strain regulates emotional behavior. Moreover, Sudo et al. (2004), Sudo (2006) and Messaoudi et al. (2011) found that the exposure to probiotic bacteria can reduce stress and depression related behaviors.

In addition, the fact that the brain regulates gut activity is well established in our minds; however, recent attention focused on the reverse pathway and the manner in which gut microbes can influence the brain (Grenham et al., 2011). There are open lines of communication between brains and bowels, these channels allow an individual's gut bacteria to steer their behavior (Yong, 2011). Indeed, measuring behavior is often the first step to take when studying how the brain operates (Tchernichovski and Saar, 2008). Therefore, this study was performed to answer the question; do probiotics affect the behavior of birds? And to confirm the concept that gut microbes can influence the brain.

MATERIALS AND METHODS

Accommodation and management of animals

This study was conducted on a private farm in Beni-Suef Governorate. A total number of 700 turkey poults aged 10 days old and each has average weight of 125 g, reared in a deep litter system conventional management conditions. Birds were randomly divided into two groups (n=350) and allocated to identical well ventilated pens, fed a mixed ration from 50 kg maize, 35 kg soya beans and 15 kg concentrates (soya, corn germ, vitamins and minerals) according to the farm system; water were provided *ad libitum*. Poults were vaccinated against influenza, Newcastle at 1, 5 and 19 days old, respectively.

Probiotic treatment and behavioral observation

Ecobiol® probiotic, spores of *B. amyloliquefaciens* and a carrier as serum of milk with a minimum guaranteed 1×10^{10} CFU/g was given with a dose of 0.01 g/day for each bird in the drinking water to group (P; n=350) and the other group (C; n=350) were kept as controls.

Behavioral observations were carried out by direct, blind personal observation without bird disturbance from outside the pen with a good view over the whole pen three times weekly, three times daily (once in the morning, another at afternoon and the last time in the evening); each observation lasted for 90 min (5 min observation and 5 min rest) using focal observation according to Martin and Bateson (1995). All the actions of one bird were recorded for a specified time period (5 min). This continues until the end of the specified time period (90 min). The behavioral patterns observed were as follows.

Behavior of maintenance

They are behaviors related to self-maintenance of the animal including eating, standing, drinking, resting and defecation behaviors.

Comfort behavior

Are heterogeneous groups of behavior related to body care including, scratching, preening and dust bathing behavior.

Kinesis

Locomotion in the domestic birds was classified into walking and running. Much kinetic activity was invested in pecking for food, but exercise activities were also common.

Agonistic behavior

Agonistic behavior refer to the complex of aggression, threat and avoidance behaviors that often occur during encounters between members of same species such as biting.

Statistical analysis

Results were statistically analyzed by the use of non-parametric independent test using Statistical Package for Social Sciences (SPSS) 20 together with least square analysis procedure.

RESULTS

The obtained results revealed that probiotic administration to turkey poults had variable effects on the different behavioral patterns.

It was observed from Table 1 and Figure 1 that probiotic Ecobiol administration had no prominent effect on the poult ingestive behavior except for feeding duration that was 15.8 min in the P group, while it was 10.7 min in C group during the observation period showing significant ($p<0.01$) difference between the two groups. However, other maintenance behavioral patterns (lying down, sleeping and standing or elimination) were not significantly affected by probiotics treatment. Table 2 revealed that probiotic administration to turkey poults had no significant effect on locomotion or comfort behavior; only slight increase in walking, preening and dust bathing frequency in P group in comparison with C group.

Concerning the effect of probiotics on the social and agonistic behaviors, Table 3 showed significant ($p<0.05$) effect of probiotic administration on distress call frequency since it was (0.2) in P group in comparison with 1.7 in C group, while it has no significant effect on the other studied social behavior pattern. Table 3 and Figure 2 demonstrated a significant ($p<0.001$) effect on biting frequency in poults as it reduced (0.2) in P group, although it was 2.2 in C group and also at $\alpha=0.05$ level of significance; there is enough evidence to conclude that there was a difference in the fighting frequency of the two groups.

DISCUSSION

The aim of the present study was to investigate the effect

Table 1. Effect of probiotics on maintenance behavior of turkey poults.

Bird group	Ingestive behavior				Rest and sleep					Elimination
	Eating		Drinking		Lying down		Sleeping		Standing idle	
	Frequency	Duration (min)	Frequency	Duration (min)	Frequency	Duration (min)	Frequency	Duration (min)	Frequency	Frequency
Control	4.8±0.6	10.7±1.3	2.9±0.4	1.1±0.4	4.3±0.5	2.9±0.5	3.1±0.4	6.7±1.2	1.7±0.3	0.5±0.2
Probiotic treated	5.9±0.4	15.8±1.3*	4.1±0.6	0.8±0.4	3.1±0.5	1.8±0.5	2.6±0.4	3.9±0.8	1.6±0.4	0.3±0.2

Results are expressed as means ± standard error (SE). *Superscripts within columns indicate significant difference at p<0.01 at df=34. Behavioral patterns were measured as a frequency and duration based on focal observation for each poult.

Table 2. Effect of probiotics on Kinesis and comfort behavior of turkey poults.

Bird group	Kinesis		Comfort behavior		
	Walking	Running	Preening	Dust bathing	Scratching
Control	20.3±2.3	2.1±0.7	5.1±0.8	0.5±0.3	1.4±0.5
Probiotic treated	22.9±2.6	1.3±0.5	5.7±0.8	2.0±0.7	1.3±0.4

Results are expressed as means ± standard error (SE) at df=34.

Table 3. Effect of probiotics on social and agonistic behavior of turkey poults.

Bird group	Social behavior			Agonistic behavior	
	Picking each other	Vocalization			
		Distress call	Alarm signal	Fighting	Biting
Control	8.4±1.4	1.7±0.5*	2.3±0.7	1.4±0.4*	2.2±0.5**
Probiotic treated	10.3±2.0	0.2±0.2	1.8±0.6	0.2±0.1	0.2±0.1

Results are expressed as means ± standard error (SE). *Superscripts within columns indicate significant difference at p<0.05 at df=34. **Superscripts within columns indicate significant difference at p<0.01 at df=34. Behavioral patterns were measured as a frequency and duration based on focal observation for each poult.

of probiotic Ecobiol administration on the turkey poults' behavior.

The results showed a significant effect of probiotic administration on feeding behavior especially with regard to its duration. Such finding coincides with that obtained by Verdu et al. (2008) who recorded similar effect of probiotic administration on the mice feeding behavior. These results may be explained in the light of published reports (Sudo et al., 2004; Sudo, 2006) observing that manipulations of bacteria found in the stomach and intestine can modify neural function and affect mood and behavior as there is an important link and interaction between gut microbes and the brain (Lee and Chua, 2011). However, it is not agreeable with Diaz (2007) who demonstrated that broilers fed with Ecobiol® take less feed, because they perform better the diet. With regard to effect of probiotic on social behavior, there was a significant reduction in the distress call incidence in P group in comparison

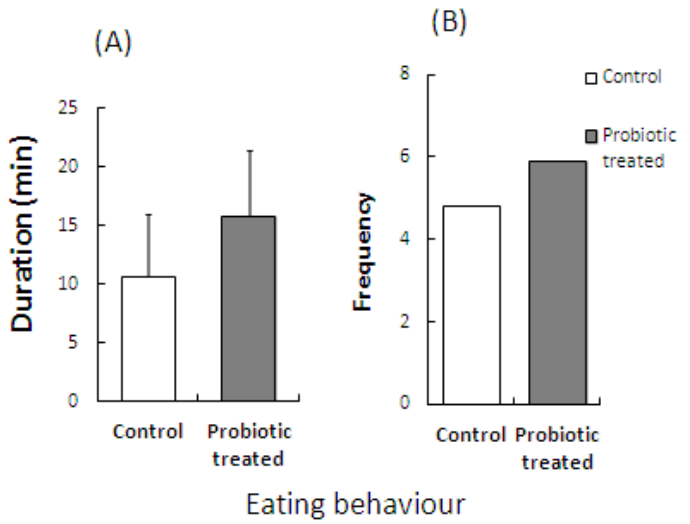

Figure 1. Effect of probiotics on eating behavior of turkey poults.

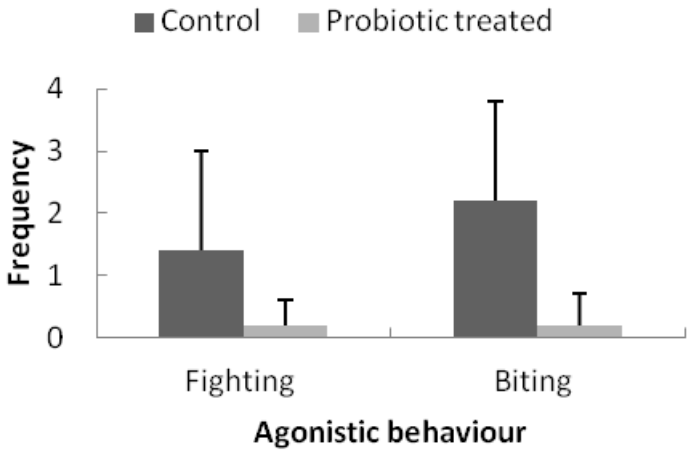

Figure 2. Effect of probiotics on agonistic behavior of turkey poults.

with C group of poults. The assumption of Bravo et al. (2011) that probiotics could have a direct effect on neurotransmitter receptors in the central nervous system (CNS) in normal, healthy animals. Gamma-aminobutyric acid (GABA) is the main CNS inhibitory neurotransmitter and is significantly involved in regulating many physiological and psychological processes.

Alterations in central GABA receptor expression are implicated in the pathogenesis of anxiety and depression and could explain the present data as the change in brain neurotransmitter GABA reduced the anxiety like behaviors such as distress calls.

Regarding the effect of probiotics on agonistic behavior, there was a significant decrease in biting and fighting frequency in P group. These results to some extent agree with that published by Emily (2012) who said that probiotics may modulate the activity of brain structures involved in the processing of emotions related to anxiety, mood and aggression, and added that probiotics cause a reduction of substance P in the stomach which is a neurotransmitter associated with pain and inflammation, and linked to anxious, depressive and aggressive behaviors, which may clarify the aforementioned results.

In view of the current results, it can be concluded that probiotics increased the feeding frequency and duration and decreased the aggressive behaviors in turkey poults that may explain the probiotic effect on growth performance and immunity.

Further studies should be made to know the exact mechanism by which the microbes influence the brain and which area of the brain is involved. In addition, further studies in probiotics and animal behavior of other animal species and other forms of probiotics should be done.

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