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Original article

Efficacy of feeding spray-dried porcine plasma to turkeys during brooding on performance to market age

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Abstract

The effect of feeding spray dried porcine plasma (SDPP) to male turkeys during the first 4 weeks of life was evaluated at 20 weeks of age. A total of 648 male Hybrid Converter day-old turkeys were divided into two groups of 9 replicate pens of 36 birds each, and fed a commercial-type program of 7 diet phases. In phase 1 birds were fed a corn-soybean meal Control diet for 4 weeks, or a diet with 2% SDPP of similar nutrient density. Thereafter, both groups were fed common diets until the end of the trial at 20 weeks of age. At 4 weeks of age, birds were subjected to heat stress and crowding for a period of 24 hrs to simulate the stress induced commercially when moved from the brooder house into a grow-out building. Poults fed SDPP had greater body weight (BW) and body weight gain at 6 ($p<0.05$) and at 9 weeks of age ($p<0.10$). At 20 weeks of age, BW of turkeys fed SDPP vs Control was not different. However, the European Productivity Index (EPI) that incorporates final body weight, feed conversion ratio and livability, tended to be higher ($p<0.10$) for the SDPP group (EPI = 545 vs 529, respectively) because of the higher livability trend exhibited in SDPP group (96.91 vs 94.75%, respectively). Likewise, birds fed SDPP showed significantly lower frequency of foot pad lesions vs Controls ($p<0.05$) by the end of the study. In conclusion, SDPP fed early in life can reduce stress, improve performance and reduce incidence of foot pad lesions in turkeys.

Keywords: early nutrition, foot pad lesions, performance, spray-dried porcine plasma, stress, turkeys

Introduction

Recently, the poultry industry has introduced many changes in management and feeding practices attempting to satisfy consumer demands. For example, there has been a sharp decrease in the use of growth promoting antibiotics (Gernat 2023) and a tendency to implement vegetarian feed programs (Ominski et al. 2021, Amato et al. 2023). While these practices may align with recent consumer demands, they may also result in health challenges and reduced production efficiency. Properly processed animal-derived feed ingredients are safe and represent nutritionally superior highly digestible ingredients with an excellent amino acid profile free of antinutritional factors (Sandström et al. 2022). Utilization of these animal by-products represents an efficient system of recycling, improving sustainability credentials in animal production through circularity, and minimizing potential environmental contamination (https://www.eapa.biz/headline/why-do-we-not-simply-dispose-blood-slaughtered-animals; Vallejos-Vidal et al. 2022).

Spray-dried plasma (SDP) is a functional ingredient primarily derived from porcine (SDPP) or bovine (SDBP) blood through a carefully controlled process involving hygienic collection, immediate chilling to prevent spoilage, centrifuge-based separation of plasma from red cells, concentration, and dehydration using high-temperature spray-drying (>80°C) resulting in a cream-colored, safe powder (Pérez-Bosque et al. 2016). Bioactive peptides, growth factors, amino acids, and vitamins found in raw plasma retain their biological activity in SDP (Pérez-Bosque et al. 2016). Traditionally, SDP is used in pig starter diets, calf milk replacers, and broiler feed (Torrallardona 2010, Campbell et al. 2019, Henrichs et al. 2021, Khadour et al. 2022). The functional components of SDP have been shown to improve intestinal integrity and modulate the immune system reducing the negative effects of inflammation and stress (Pérez-Bosque et al. 2016). In addition, SDP has been shown to have an effect on other mucosal tissues including the lung lymphoid tissue (Maijó et al. 2011). Furthermore, SDP has been shown to improve growth performance and reduce mortality in broilers especially when they are subjected to environmental or pathological stress (Campbell et al. 2019, Belote et al. 2021, Franco-Rosselló et al. 2022). As a result, SDP has been considered an alternative to antibiotics (Torrallardona 2010, Walters et al. 2019).

Brooding is a critical phase in turkey production, significantly influencing growth, health, and overall performance and laying the foundation for successful growth and development (Teeter and Skinner 1993). Factors such as temperature management, lighting, feed quality, disease management, and other stressors can significantly affect turkey performance. The composition of the feed during the brooding period must meet the specific nutritional requirements of young turkeys, and imbalances or deficiencies in nutrients, including amino acids, vitamins, and minerals, can lead to growth-related issues. Therefore, it is essential to use specially formulated starter feeds (Rowe et al. 2019, Gernat et al. 2023). Furthermore, unlike broilers, turkey poults are moved from a brooder to a grow-out barn at about 4 to 5 weeks of age representing a stressful phase in their early development. During this period, turkeys must adapt to a new environment and encounter changes in management practices, housing conditions, and new social dynamics. This transition can be particularly challenging for the birds, disrupting their established routines, and exposing them to novel stressors, such as transportation, unfamiliar surroundings, a new social order, variations in temperature, and potential exposure to new pathogens (Gernat et al. 2023). Management practices and diet formulation during the brooding period should aim at optimizing immune and gut development which in turn can reduce the stress associated with the transition to the grow-out barn and optimize performance (Martland 1984).

The objective of this study was to investigate the potential advantages on performance parameters, livability, footpad lesions and carcass composition of incorporating SDPP in starter diets from placement through the 28d brooding period. To simulate the stress of transition to the grow-out barn, heat stress and crowding were imposed for 24-hrs by inducing panting and by reducing floor space by 50% while the phase 2 feed was introduced. The nutritional density used throughout the trial was slightly lower than the currently recommended by the genetic company Hybrid Turkeys for the corresponding sex and genetic line, but still commercially relevant.

Materials and Methods

Animal ethics

Flock management practices followed the University of Warmia and Mazury (UWM) procedures and the Principles for Biomedical Research Involving Animals (EU2010/63). The protocol for the study was approved by the Local Ethics Committee (no 82/2017). The study was conducted on the UWM experimental farm in Baldy, Poland. Animal care personnel were trained in proper animal handling. Turkeys were observed a minimum of twice a day. Mortalities were removed, and body weight recorded. The weight of unused feed was recorded.

Birds management

A total of 648-day-old male turkey poults, Hybrid Converter, were obtained from a local commercial hatchery (Grelavi, Ketrzyn, Poland). After arrival they were randomly divided into eighteen pens. The birds were kept in pens with netting walls avoiding migration. The house was provided with artificial programmable lights and climate control including automated gas/electric heating and forced ventilation according to Hybrid Turkeys recommendations. The bedding material was pelleted straw.

Treatment groups consisted of nine 10 m^2 pens, with 36 poults in each (324 birds per treatment group). The length of the study was 140 days (20 weeks) between months of June to November. During the first 4 weeks of the study the temperature was decrease from the initial 31.2±1.2°C during first week to 25.38±0.9°C at week 4 and 19.4±0.9°C at week 8. The humidity was maintained during first 8 weeks at 66.8±1.0%.

Experimental diets

There were two treatment groups in this study. Treatment 1, the Control, was a typical corn, wheat, soybean meal diet while Treatment 2 included 2% SDPP primarily replacing soybean meal and balanced to provide similar energy, protein and amino acids as the control diet (Table 1).

These diets were fed for 4 weeks followed by common diets fed for the remainder of the study (Table 2). Poults consuming the SDPP diet were expected to consume about 32 g SDPP.

A 7-phase feeding program (0-4, 5-6, 7-9, 10-12, 13-15, 16-18 and 19-20 weeks) typical of Polish commercial turkey production was used. Diets in phase 1 were crumbled while diets in phases 2 through 7 were pelleted, like commercial practice. Diets were offered *ad libitum* throughout the study and the feeders were filled when needed.

Feed additives such as phytase (Ronozyme P, DSM, Netherland) and xylanase (Ronozyme WX, DSM, Netherland) were used consistent with industry standards. A commercial vitamin and mineral premixes were used.

Stress model imposed

Although difficult to assess, a stress model was used in an attempt to simulate a level of stress compatible with commercial production. The model consisted of:

Nutritional challenge. Throughout the experiment, digestible lysine and metabolizable energy were 8% and 100 kcal/kg lower than recommended by Hybrid Turkeys for this line of turkeys.

Restricted feeder space. More closely reflecting commercial production, feeder space was restricted by placing plastic covers over some of the feeder openings.

Transition stress. To simulate the stress of moving from brooder to grow-out facility, immediately after taking samples, weighing the poults and replacing the feed with phase 2 diet on day 28, the birds were subjected to a simulated transport stress. The stress consisted of two components:

a) increased room temperature to approximately 32°C to cause panting. Poults were observed a minimum of three times daily to insure they were panting but not enough to induce mortality.
b) stocking density was increased by reducing pen space 50%. During this period poults continued to have access to feed and water. Temperature and stocking density were returned to normal (thermo-neutral) following the 24 hr stress period.

Parameters measured

Body weight (BW) was determined on a pen basis on day 1, 14, 28, 42, 63, 84, 112 and 140. Feed weight and type of feed provided to each pen were recorded while birds were weighed, and the weight of uneaten feed was also recorded.

All pens were checked twice daily for mortality and morbidity. Birds were culled if they were showing clinical signs of illness or if they were injured such that access to feed or water was restricted. Body weight of all dead and culled turkeys was recorded on the day of removal. The likely causes of mortality and adverse events were recorded. Weight gain, feed intake and feed conversion were calculated for each period. In addition, the European Productivity Index (EPI) was also calculated according to the following equation: % livability × final BW (kg) × 100/feed conversion ratio × trial duration (d) (Huff et al. 2013).

Carcass yield

At the end of the experiment, 18 birds per treatment (two per pen with BW close to the mean value of each treatment), in total 36 birds, were selected and fasted for 4 hours. Body weight was determined before slaughter. Carcass weight, breast weight, fat pad, heart, gizzard and liver were weighed after slaughter (Hahn and Spindler 2002).

Footpad lesions

On day 140, footpad lesion score was determined on 2 turkeys/pen, the same birds used for carcass measurements, using a 5-point score (Hocking et al. 2008).

Table 1. Ingredient and nutrient density of turkey diets of the phase 1 diets (0-4 weeks), %.

Ingredients	Control	SDPP
Corn	18.73	21.07
Wheat	33.30	33.30
Soybean meal	37.10	33.64
Sunflower meal	4.00	4.00
Limestone	1.83	1.89
MCP	2.03	1.95
Salt	0.10	0.10
Na-Bicarbonate	0.32	0.17
Soya oil	1.34	0.77
L-methionine	0.30	0.26
L-lysine	0.48	0.42
L-threonine	0.09	0.05
Spray-dried porcine plasma (SDPP)	-	2.00
Choline chloride	0.10	0.10
Ronozyme P	0.01	0.01
Ronozyme WX	0.02	0.02
Vit.+Trace minerals [1]	0.25	0.25
Nutritional value	Control	SDPP
ME (kcal/kg)	2700	2700
Crude protein calculated (g/kg)	253.00	253.00
Crude protein analyzed (g/kg)	265.70	262.60
Fat analyzed (g/kg)	33.20	30.50
Av. lysine (g/kg)	15.20	15.20
Av. methionine (g/kg)	6.30	5.91
Av. met. + cys. (g/kg)	9.80	9.80
Av. threonine (g/kg)	8.80	8.80
Av. tryptophan (g/kg)	2.76	2.86
Av. arginine (g/kg)	15.33	15.24
Av. isoleucine (g/kg)	9.90	9.60
Av. valine (g/kg)	10.60	11.00
Total Ca (lab analytical) (g/kg)	12.50	12.50
Total P (g/kg)	8.70	8.64
Av. P [2] (g/kg)	6.80	6.80
Total sodium (g/kg)	1.50	1.50
Cl (g/kg)	2.62	2.71
K (g/kg)	9.05	8.57

[1] Premix Starter
[2] Including effect of phytase (1.20 g/kg)

Statistical analysis

The data of this study were checked for outliers (2.5 times SE) and analyzed using a complete randomized block design using T-student in Statistical for Windows Operating System (StatSoft Inc. 2016). Tukey's test was used to establish significant differences among means for parametric parameters such as performance and carcass. Kruskal-Wallis test was used for non-parametric values such as footpad lesion scores. The pen was the experimental unit for the performance data and the birds were the experimental unit for processing data. Significance was recognized at $p \leq 0.05$ while $0.05 < p \leq 0.1$ was considered a trend.

Table 2. Ingredient and nutrient density of turkey diets for following experimental periods, %.

Ingredients	Feeding periods, weeks					
	P-2	P-3	P-4	P-5	P-6	P-7
	5-6 wks	7-9 wks	10-12 wks	13-15 wks	16-18 wks	19-20 wks
Corn	22.25	26.13	33.40	36.30	39.48	40.77
Wheat	33.30	33.30	33.30	33.30	33.30	33.30
Soybean meal	32.85	27.67	21.82	15.37	8.60	5.48
Rapeseed meal	3.00	3.00	3.00	3.00	5.00	5.00
Rapeseeds	2.00	4.00	4.00	4.00	4.00	5.00
Sunflower meal	-	-	-	3.00	4.00	5.00
Limestone	1.72	1.45	1.31	1.02	1.01	1.02
MCP	1.89	1.66	1.22	0.77	0.54	0.53
Salt	0.26	0.26	0.27	0.27	0.28	0.28
Na-Bicarbonate	0.10	0.10	0.10	0.10	0.10	0.10
Soya oil	1.45	1.48	0.60	1.90	2.79	2.73
L-methionine	0.27	0.19	0.17	0.13	0.10	0.07
L-lysine	0.43	0.33	0.36	0.39	0.36	0.31
L-threonine	0.10	0.05	0.07	0.07	0.06	0.03
Choline chloride	0.10	0.10	0.10	0.10	0.10	0.10
Ronozyme P	0.01	0.01	0.01	0.01	0.01	0.01
Ronozyme WX	0.02	0.02	0.02	0.02	0.02	0.02
Vit.+Trace minerals [1]	0.25	0.25	0.25	0.25	0.25	0.25
Nutritional value	5-6 wks	7-9 wks	10-12 wks	13-15 wks	16-18wks	19-20 wks
ME (kcal/kg)	2810	2900	2920	3020	3090	3110
Crude protein calculated (g/kg)	235.00	216.00	194.00	176.00	156.00	147.00
Crude protein analyzed (g/kg)	233.80	219.40	198.00	175.10	158.00	153.00
Fat analyzed (g/kg)	42.10	47.40	53.10	54.50	58.60	59.30
Av. lysine (g/kg)	13.90	12.00	10.90	9.80	8.20	7.20
Av. methionine (g/kg)	5.81	4.78	4.40	3.91	3.39	3.07
Av. met. + cys. (g/kg)	9.20	8.00	7.40	6.70	6.00	5.60
Av. threonine (g/kg)	8.30	7.20	6.60	5.90	5.10	4.50
Av. tryptophan (g/kg)	2.54	2.32	2.02	1.78	1.53	1.42
Av. arginine (g/kg)	13.79	12.48	10.87	9.71	8.29	7.72
Av. isoleucine (g/kg)	9.00	8.40	7.30	6.50	5.60	5.20
Av. valine (g/kg)	9.70	9.00	8.00	7.20	6.40	6.00
Total Ca (lab analytical) (g/kg)	11.80	10.30	8.80	6.80	6.30	6.30
Total P (g/kg)	8.55	7.97	6.85	5.62	5.02	4.95
Av. P [2] (g/kg)	6.50	6.00	5.00	4.00	3.50	3.50
Total sodium (g/kg)	1.50	1.50	1.50	1.50	1.50	1.50
Cl (g/kg)	3.55	3.32	3.35	3.35	3.26	3.16
K (g/kg)	9.38	8.66	7.77	7.20	6.42	6.12

[1] Premix Starter - diets P2-P3, Premix Grower/Finisher – diets P4-P7
[2] Including effect of phytase (1.20 g/kg)

Results

Body weight and final body weight per square meter are presented in Table 3. Performance of the birds during the whole study per period is presented in Table 4.

In the initial two phases, when birds experienced minimal challenging conditions at 0-2 and 3-4 weeks,

Table 3. Body weight (kg) of turkeys during the study.

	Control	SDPP	SEM
2 weeks	0.450	0.459	0.004
4 weeks	1.337	1.352	0.007
6 weeks	2.784[a]	2.842[b]	0.019
9 weeks	6.179[x]	6.267[y]	0.034
12 weeks	10.520	10.489	0.071
16 weeks	16.003	16.046	0.131
20 weeks	22.106	22.039	0.120

[a, b] Means not sharing a common letter within a row differ significantly (p<0.05), and [x,y] is considered as a near-significant trend 0.05<p<0.10.
SDPP – spray-dried porcine plasma

Table 4. Performance of turkeys during the study per different periods.

	BWG, (kg)		Feed Intake, (kg)		FCR	
	Control	SDPP	Control	SDPP	Control	SDPP
0-2 wks	0.388	0.397	0.469	0.474	1.211[x]	1.195[y]
3-4 wks	0.887	0.893	1.444	1.465	1.641	1.655
5-6 wks	1.448	1.490	2.546	2.558	1.758	1.719
7-9 wks	3.395	3.425	6.734	6.732	1.983	1.967
10-12 wks	4.340	4.222	10.738	10.678	2.517	2.572
13-16 wks	5.483	5.557	17.661	17.489	3.263	3.202
17-20 wks	6.103	5.993	22.742[x]	22.213[y]	3.794	3.795
0-4 wks	1.274	1.289	1.922[x]	1.949[y]	1.509	1.512
0-6 wks	2.722[a]	2.780[b]	4.587	4.617	1.637	1.619
0-9 wks	6.117[x]	6.205[y]	11.332	11.390	1.826	1.809
0-12 wks	10.457	10.427	22.628	22.331	2.105	2.110
0-16 wks	15.941	15.983	40.709	41.172	2.488	2.475
0-20 wks	22.043	21.977	64.313	63.568	2.831	2.801

[a, b] Means not sharing a common letter within a row of each parameter differ significantly (p<0.05), and [x,y] is considered as a near-significant trend 0.05<p<0.10.
BWG: Body weight gain; FCR: Feed conversion rate; SDPP: spray-dried porcine plasma

there were no difference in body weight (BW), body weight gain (BWG), or feed intake (p>0.10). Nevertheless, in the initial period (0-2 weeks), there was a tendency for improved feed conversion ratio (FCR) with the inclusion of SDPP (p<0.10).

At 6 weeks, birds fed SDPP had higher BW (p<0.05) that was maintained as tendency (p<0.10) at 9 weeks (Table 3). In fact, for the initial 0-6 weeks period there was a higher BWG (p<0.05) that was also improved (p<0.10) when the period 0-9 weeks was analyzed. During the initial 4 weeks the birds in the SDPP also consumed higher amount of feed (p<0.10) compared to the Control group.

Dietary treatment did not influence carcass yield or breast meat yield (p>0.10). Likewise, gizzard and liver weights remained unaffected by the dietary treatment (p>0.10). However, there was a tendency (p<0.10) for larger hearts in birds fed with SDPP in their diet (Table 5). Livability and EPI showed a tendency for improvement (p<0.10) with the inclusion of SDPP in the diet.

Turkeys receiving the SDPP diet showed a tendency for a higher percentage of birds with lower footpad scores (p<0.10), whereas control turkeys exhibited a tendency for a higher percentage of birds with elevated footpad scores (p<0.10, Fig. 1).

Discussion

During the first two periods, where birds were subjected to virtually no challenging conditions, 0-2 and 3-4 weeks, there was no difference in BW, BWG per period or feed intake (p>0.10). However,

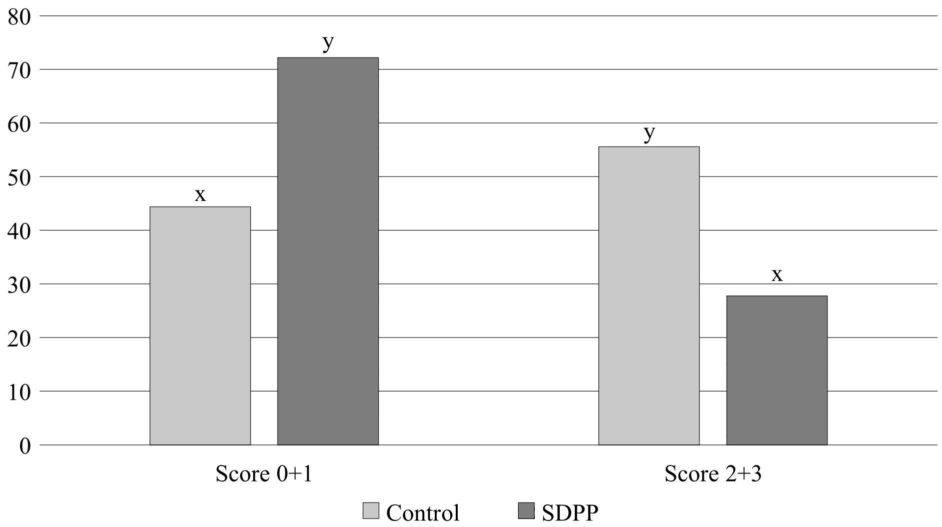

Fig. 1. Frequency Footpad Lesions Score (%) * in turkeys at the end of the study.
* A higher score value is indicative of greater tissue damage during visual inspection.
[a, b] Means not sharing a common letter within an evaluation score differ significantly (p<0.05), and x,y is considered as a near-significant trend 0.05<p<0.10; SDPP: spray-dried porcine plasma

Table 5. Slaughter analysis, livability and EPI of turkeys at the end of the study.

	Control	SDPP	SEM
BWbs, kg[1]	22.128	22.081	0.128
CW, kg	18.388	18.394	0.126
DP, %	83.10	83.13	0.241
Heart, %	0.315[x]	0.339[y]	0.009
Gizzard, %	0.481	0.483	0.015
Liver, %	0.902	0.901	0.021
Breast to BWbs, %	25.36	25.21	0.278
Breast to CW, %	30.51	30.26	0.309
Fat, %	1.50	1.30	0.097
Livability, %	94.75[x]	96.91[y]	0.859
EPI	529[x]	545[y]	5.643

[a, b] Means not sharing a common letter within a row differ significantly (p<0.05), and [x,y] is considered as a near-significant trend 0.05<p<0.10.
BWbs – Body weight before slaughter; CW: Carcass weight; DP: Dressing percentage; EPI: European Productivity Index; SDPP: spray-dried porcine plasma

during the first period SDPP tended to improve FCR (p<0.10). The effect of SDP on growth performance and feed intake of broiler chicks is not consistent. Some authors report improved performance, particularly in stressful conditions (Bregendahl et al. 2005) while others report that SDP did not affect performance (Henn et al. 2013, Beski et al. 2016).

To simulate the stress associated with moving from the brooder house to a grow-out barn, on day 28 the poults were subjected to a combination of heat stress, increased stocking density and a diet change (from phase 1 to phase 2 diet). Heat stress and increased stocking density were imposed for 24 hours and then returned to normal temperature and stocking density. Following the stress, turkeys consuming the SDPP diet were heavier at week 6 (p<0.05) and tended to be heavier at week 9 (p<0.10). In a recent report, the addition of SDBP (either 1% or 2%) improved feed conversion of Large White turkey hens in the period following a stress simulating movement from the brooder to a grow out facility (Gernat et al. 2023). Bregendahl et al. (2005) reported that SDP had no effect (p>0.10) on broiler growth performance when they were not subjected to stress but that when they were subjected to the stress of being raised on soiled litter SDP improved (p<0.05) growth performance. Other reports demonstrate that broilers fed SDP and subjected to environmental or pathological stress, had improved growth performance (Campbell et al. 2006, Beski et al. 2016, Fasina et al. 2021, Ruff et al. 2021). In the current study, SDPP was removed from the diet before the induced stress and for the remainder of the experiment. The ability of SDP to mitigate the effect of stress even after it has been removed from the diet has been reported in broilers infected with necrotic enteritis (Campbell et al. 2006) and in pigs challenged with Salmonella (Boyer et al. 2015). In the current experiment body weight, growth, feed intake and feed conversion were not affected during subsequent periods following the induced stress (p<0.10) except during the final period (17-20 weeks) when the Control turkeys tended to consume more feed (p<0.10). It is more common to observe improved feed conversion when SDP is included in the diets of broilers raised in challenging conditions (Beski et al. 2016, Belote et al. 2021, Gómez-Verduzco et al. 2024).

There was no treatment effect on final body weight (p>0.10). Control and SDPP fed turkeys weighed 22.11 kg and 22.04 kg, respectively. However, livability tended to be improved (p<0.10) when SDPP was included in the diet. This is consistent with other reports of reduced mortality and morbidity when SDP is included in the diet (Campbell et al. 2019). Consequently, EPI, a parameter that integrates body weight, FCR and livability, also trended higher for turkeys fed SDPP compared to Controls (545 vs 525, respectively; p<0.10).

Compared to Hybrid Converter nutritional recommendations, all experimental diets were formulated to be 8% low in digestible lysine and 100 kcal/kg lower in metabolizable energy. Despite this marginal nutritional deficiency, final BW in this experiment was greater than predicted BW for the male Hybrid Converter, 21.70 kg at 20 weeks. Others have reported that turkeys may increase feed intake to overcome the effects of a marginally deficient diet (Leeson et al. 1996, Classen 2017) which could explain why final BW of the turkeys in this experiment exceeded predicted growth standards.

In turkeys, footpad lesions are associated with poor litter quality (Martland 1985, Nagaraj et al. 2007, Shepherd and Fairchild 2010). In this experiment, turkeys fed the SDPP diet tended to have a greater percentage of birds with lower footpad scores (p<0.10) while control turkeys tended to have a greater percentage of birds with a higher (more severe) footpad score (p<0.10). Less locomotor system pathologies, including pododermatitis, were also observed in plasma fed broilers using ISI methodology (Belote et al. 2021). This is consistent with SDP improving diet digestibility and intestinal function leading to better litter quality (Campbell et al. 2019, Henrichs et al. 2021, Khadour et al. 2022, Gómez-Verduzco et al. 2024).

Neither carcass yield nor breast meat yield were affected by dietary treatment (p>0.10). Likewise, gizzard and liver weights were not affected by dietary treatment (p>0.10). However, there was an unexplained trend for SDPP to increase heart weight (p<0.10). In broilers, plasma has been shown to increase breast meat yield particularly when the broiler was subjected to stress (Bregendahl et al. 2005). Gómez-Verduzco et al. (2024) reported that SDP improved carcass yield when broilers were fed a diet containing mycotoxins. However, especially when there was minimal stress, SDP did not affect carcass yield (Gernat et al. 2023). Probably the stress that was induced at 28 days of life in this study was not enough to have an impact on carcass yield 112 days later at the end of the study at 20 weeks.

In conclusion, this study demonstrates that including SDPP in turkey poults' diets for the initial 4 weeks can improve performance during a subsequent challenge. These data contribute to the growing body of evidence on the positive impact of SDPP in poultry nutrition and especially of the ability to mitigate the effects of stress.

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