COMBATING POULTRY STRESS:

Is Spray-Dried Plasma the best protein alternative?

By Dr Javier Polo, Victor Deike, APC Europe

A series of stress factors such as disease (necrotic enteritis, coccidiosis and others) or environmental and production conditions or factors (litter quality, heat stress, stocking density, etc.) can have negative impacts on poultry production. Depending on the nature and extent of the stress, various consequences such as increased mortality, higher feed/weight gain ratios, bodyweight reduction or reduced pigmentation can occur, which all influence the profitability of the system. Stress factors can have subclinical effects in the body, including, the overreaction of the immune system that can cause impairment of the intestinal barrier function and reduce utilisation of nutrients for productive functions.

As a result, nutrient uptake in the intestine is disturbed during the first days of life of the bird, when the digestive tract is still developing. This can lead to increased stress due to toxins or pathogens from the environment, unleashing the immune response of the animal, usually causing inflammation and other consequences. Producers try to manage diseases with coccidiostats, anti-microbials, and vaccines to control infections, and use good husbandry practices to reduce the environmental impact as much as possible. However, through innovative feeding practices, a grower can also target a better overall production performance and animal wellbeing in the first phases of life.

An alternative protein like spray-dried plasma (SDP) can be a critical feeding tool, especially during the first age of the animal. SDP is a varied mixture of functional components, including immunoglobulins, albumin, fibrinogen, lipids, growth factors, biologically active peptides (defensin, transferrin), enzymes and other proteins with a positive biological response when fed to the animal. Its production method is based on a careful and safe collection of the raw material, further processing and spray-drying of animal blood from healthy animals bound for human food consumption, sourced from approved abattoirs, monitored by the corresponding authorities. All this ensures that high value nutrients and functional substances are retained in a safe manner.

In pig feeding, administering spray-dried plasma has already been used extensively for a long time to improve uptake, growth and feed utilisation (Torrallardona et al., 2011; Coffey und Cromwell, 2001). The advantages of SDP are seen in a better gut health of the animal, with an improved response under commercial production conditions (Campbell et al., 2006, Coffey und Cromwell,

1994). A large number of studies conducted on stress infections with pathogenic bacteria, viruses or protozoa with different animal species such as pigs, calves, chicken, turkeys and shrimp have shown reduced mortality and morbidity when spray-dried animal plasma has been added to the feed (Russell and Campbell, 2000; Arthington et al., 2002; Hunt et al., 2002; Campbell et al., 2004; Torrallardona et al., 2011).

The multiple modes of action of SDP can be explained in different ways. In summary, the studies on this show that the intake of functional plasma proteins supports and maintains the immune system, thus preserving the gut barrier function and increasing the overall efficiency of the production systems (Moretó and Pérez-Bosque, 2009).

The present article examines the nutrients supply with SDP in poultry feeds, and the impact of these feeding practices on productive performance parameters, as well as on meat yield.

Spray-dried Plasma in poultry feeding

According to research results, growth and efficiency of broilers are improved with the feeding of SDP. The higher the general and specific stressors of the production environment and practices, the better the comparative performance will be (Campbell et al., 2003, Bregendahl et al., 2005). In a study, broilers were fed under typical production conditions and those fed with the addition of SDP displayed an increase in growth, homogeneity and breast meat yield (Bregendahl et al., 2005). The reaction was weaker in the case of broilers fed with SDP in an environment with lower stress factors or in a research environment.

In subsequent examinations conducted by Henn et al. (2013), broilers bred in research poultry houses under subtropical conditions and fed SDP in titrated concentrations displayed improvements in performance. In the initial phase the poultry were fed higher concentrations (up to 3.0% SDP), and in the final in lower concentrations (for example 0.5 to 0%).

Summarising multiple poultry studies encompassing approximately 3,000 broilers fed different SDP levels and housed under various environmental conditions or stress, resulted in 4.1, 0.7, and 2.6 percent improvement in ADG, ADFI, and feed efficiency in the first week of production. In a subset of studies that continued to market of approximately 42 days, improvements noted resulted in 10, 8, and 1.2 percent of ADG, ADFI, and feed efficiency.

Overall, nutrition provided by dietary inclusion of SDP improved performance of broilers reared in challenge or production type conditions, with the effect more pronounced in the first feeds or pre-starter period.

Pelleted poultry feed and spray-dried plasma

Most commercial broiler feeds are pelleted at approximately 80ºC or higher. Concern that pelleting conditions would denature functionality of SDP and diminish potential improvements in growth and efficiency, led to a series of experiments to evaluate the impact of pellet temperature on the beneficial effects of SDP when added to broiler feed before or after pelleting (Campbell et al., 2006). Two experiments evaluated the effect of pelleting temperature on growth and efficiency of broilers fed diets containing SDP.

Results of these broiler experiments reported an improved average daily gain and feed intake for broilers fed SDP during days 0 to 28. Overall results of these experiments indicate that pellet temperatures up to 95ºC do not limit the positive growth effects of SDP in broiler feed.

Feeding of Spray-Dried Plasma under pathogenic stress

Intestinal or respiratory diseases caused by viruses, bacteria, or protozoa have negative impacts on poultry performance and economics. Necrotic enteritis is a common intestinal disease experienced in commercial conditions. Campbell et al. (2006) evaluated functional SDP in feed from hatch to finish in broilers that had a veterinary confirmed natural occurrence of severe necrotic enteritis. Broilers consuming SDP diets had greater weight gain, improved feed efficiency, and improved survival during the necrotic enteritis challenge compared to broilers not consuming SDP.

Pasteurella multocida in turkeys (fowl cholera) is a respiratory disease that can result in increased morbidity and mortality in the flock. Campbell et al. (2004) evaluated the use of spray-dried serum proteins in the water system for turkey poults challenged with P. multocida. Survival of the poults given drinking water with or without spray-dried serum proteins was recorded for 14 d after challenge. Poults given the plasma serum proteins in drinking water during the respiratory challenge had improved survival (94% vs. 63%) compared to poults not consuming spray-dried serum proteins.

Feeding of Spray-Dried Plasma under pressure of typical production environment factors

The environment in which animals are reared can influence production parameters such as body weight gain and feed efficiency as previously demonstrated by Coffey and Cromwell (1995). Research in poultry has noted that the beneficial effects of functional proteins are more pronounced in production conditions with higher stress (ie. high pathogen exposure) than with lower stress (ie. low pathogen exposure). Campbell et al. (2003) simulated different environments in a series of experiments by housing broilers in battery cages, floors pens containing clean litter, or floor pens containing used litter. Within these different environments, broilers were fed titrated levels of functional plasma proteins.

The greatest magnitude of improved growth response to SDP addition was noted when broilers were housed in floor pens with used litter or litter in relatively poor condition, followed by floor pens with clean litter and battery pens.

Stocking density can also impact live performance and overall production efficiency (Dozier et al., 2006). Recently, use of dietary functional plasma proteins was evaluated as a management tool to reduce the negative effects of stocking density as another environmental stress model (ANECA reference). Broilers were challenged with coccidia vaccination at one day of age. Body weight, feed intake, and mortality were determined after each feeding phase. Productivity index and kilos of live broiler sold per square meter of floor space were calculated. Increasing stocking density reduced broiler performance and increased mortality. Inclusion of plasma in broiler feeds reduced the negative effects of increased stocking density resulting in an increased economical return.

Spray-Dried Plasma fed to Layers

Heat stress (HS) is another type of environmental stress experienced by poultry producers. Heat stress can disrupt the intestinal barrier function (Lambert, 2008). Koelkebeck et al. (2014) evaluated the use of functional plasma proteins in the diets of laying hens exposed to acute heat stress. Hens were exposed to heat stress or thermo-neutral conditions (21°C) from lay weeks one to five. Groups were fed plasma and the results indicate that HS negatively affected short term production, while feeding a control diet with 1.5 percent functional plasma protein positively affected egg production during this short-term HS exposure.

Recent Field Experiences

Recently, commercial farm trials have confirmed previous studies demonstrating the beneficial effect of SDAP on starter diets. In a European trial the use of SDAP in starter diets was evaluated in a commercial farm (source: APC, unpublished). Test diets contained 1.5 percent SDAP during the first 10 days of age, followed by common diets until reaching the market weight. The chicks consumed and average of about 4.5 g of SDAP / chicken during this initial 10-day period (Table 2).
Results of this commercial field test conducted on a farm under European management conditions confirm a better final weight of 60g and an improvement in feed conversion of more than seven points. An apparent greater resistance to digestive pathogens was observed in the groups fed with SDAP. The production improvement of 1.7kg/m2 improved yield by 0.07€/chicken.

Conclusions

Nutritional supply of SDP brings advantages in practical breeding of animals. The use of SDP can help to improve performance under the pressure connected with production, environmental

conditions, stress and illnesses by improving the barrier function and reducing the negative consequences connected with an over-reaction of the immune system. By supporting and maintaining the immune system, nutrition provided by SDP conserves nutrient utilisation and allows nutrients to be utilised for productive functions. The strategic use of SDP in the starter feeds or during stress periods can help producers to increase productivity, animal wellbeing and profitability.

References are available on request from rhiannonw@perendale.co.uk

Table 1. Percent improvement in performance in broilers fed spray-dried plasma.

	Percent Improvement		
	Average Daily Gain	Average Daily Feed Intake	Gain:Feed
D 0-7	4.1	0.7	2.6
To Market, D 0-42	10.0	8.0	1.2

Table 2: Productive results in a European commercial farm using SDAP during the first 10 days.

	Flock 1			Flock 2			Average
	Control	SDAP	Diff.	Control	SDAP	Diff.	Difference.
Final wt, g	2.168	2.242	74	2.242	2.289	47	60
FCR	1,650	1,591	-0,059	1,595	1,510	-0,085	-0,072
Mortality, %	4,24	2,94	-1,30	4,11	3,39	-0,72	-1,01
Commercial profit vs control (€)	0,008	0,085	0,078	0,115	0,175	0,060	0,069