Using Milk Thistle (Silybum marianum) Extract to Improve the Welfare, Growth Performance and Meat Quality of Broiler Chicken

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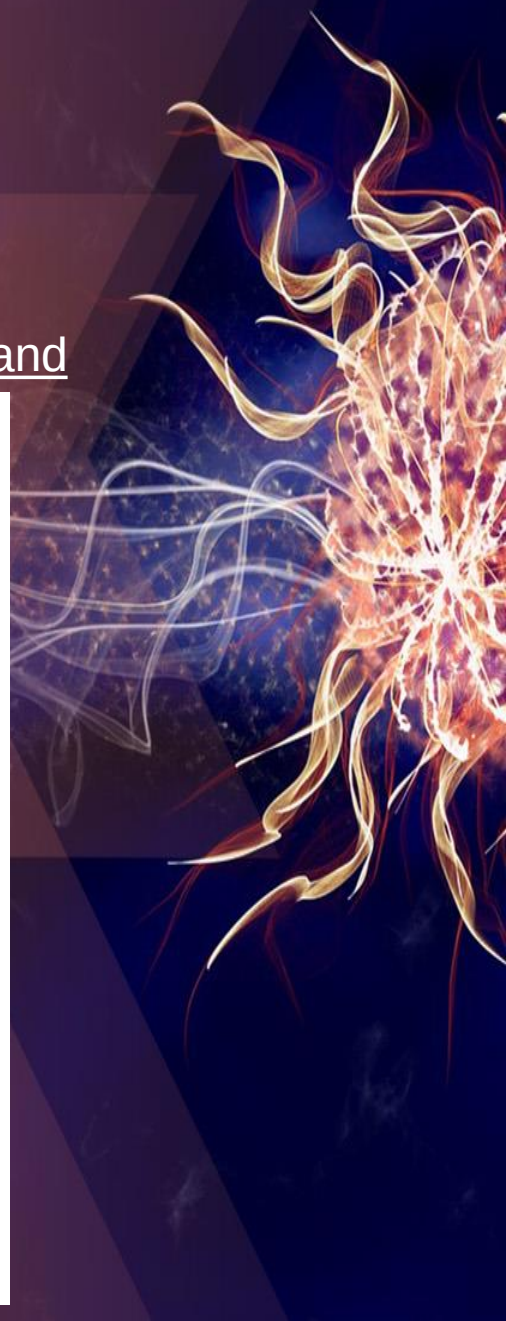

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Using Milk Thistle (*Silybum marianum*) Extract to Improve the Welfare, Growth Performance and Meat Quality of Broiler Chicken

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Simple Summary: The latest trends in livestock husbandry and breeding are directed towards

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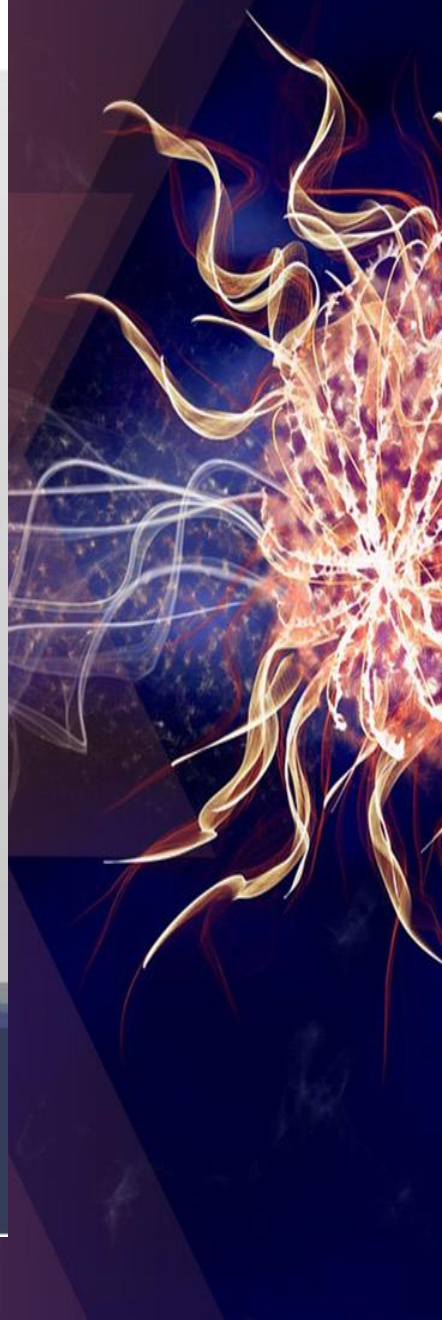


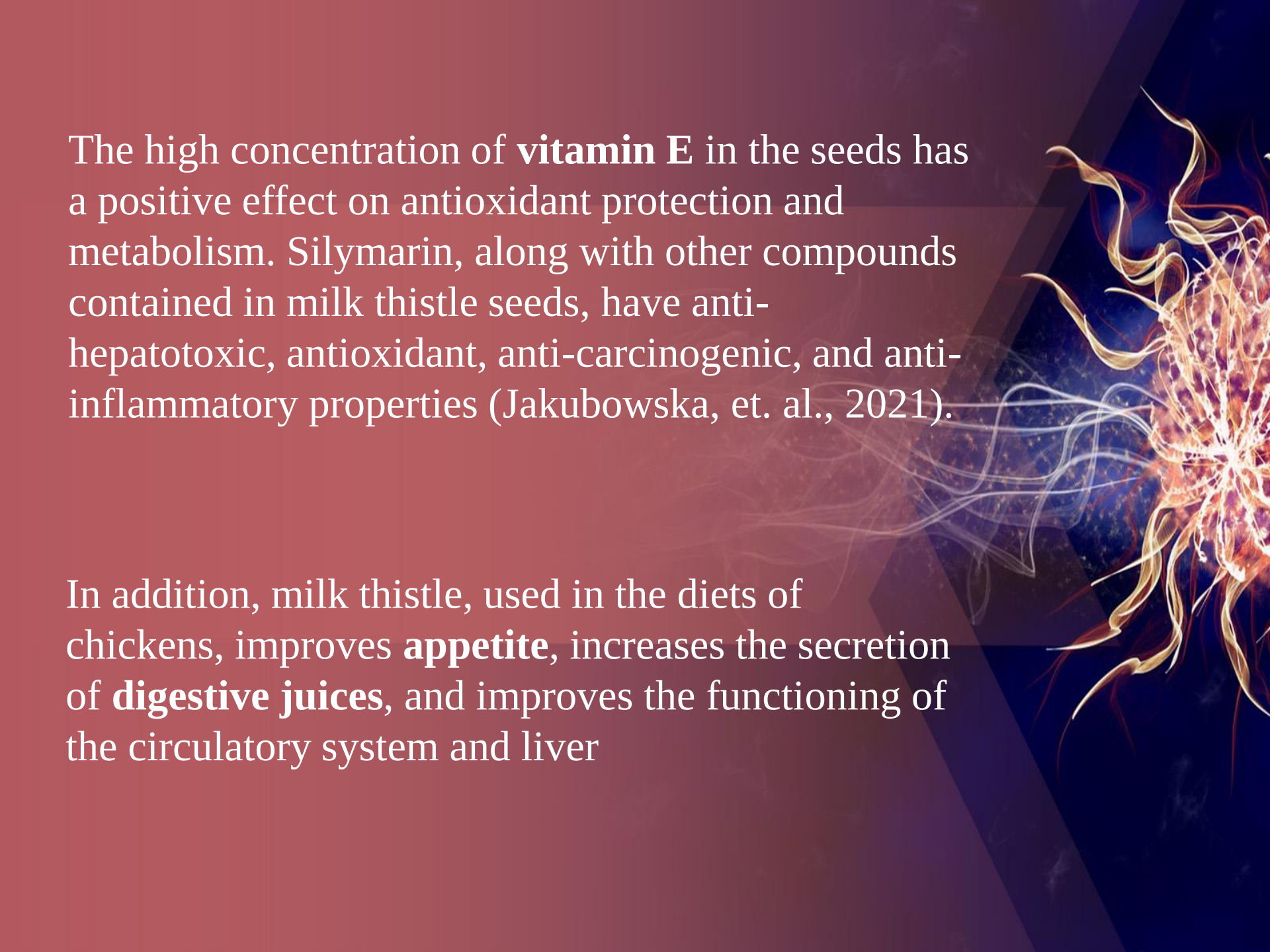
Introduction

- The utilization of herbs in animal production is in line with global trends for improving animal husbandry and breeding systems. The **phytobiotic** compounds present in herbs have a positive effect in improving health and increasing antioxidant potential, which contributes to the improvement of growth performance (Sasiadek *et al.*, 2019).

- Milk thistle (*Silybum marianum*) is a cosmopolitan plant native to the Mediterranean. This plant is rich in bioactive substances such as silymarin and taxifolin (Hlangothia *et al.*, 2016).

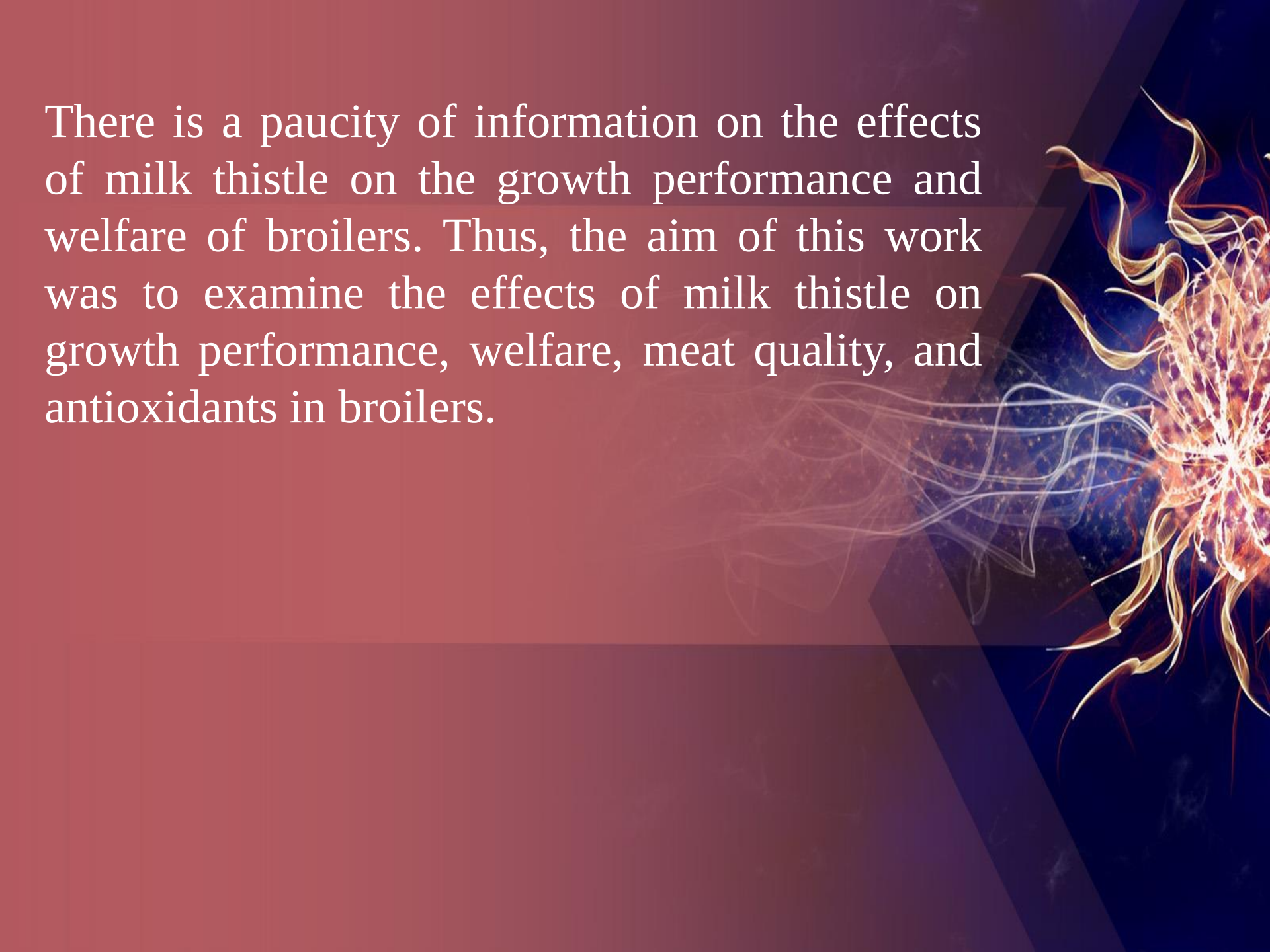
The high concentration of **vitamin E** in the seeds has a positive effect on antioxidant protection and metabolism. Silymarin, along with other compounds contained in milk thistle seeds, have anti-hepatotoxic, antioxidant, anti-carcinogenic, and anti-inflammatory properties (Jakubowska, et. al., 2021).

In addition, milk thistle, used in the diets of chickens, improves **appetite**, increases the secretion of **digestive juices**, and improves the functioning of the circulatory system and liver



The use of herbs in livestock therapy fits perfectly into the current direction of livestock production. The **price** of most easily available herbs for use in nutritional prophylaxis is definitely lower than most pharmacological substances.

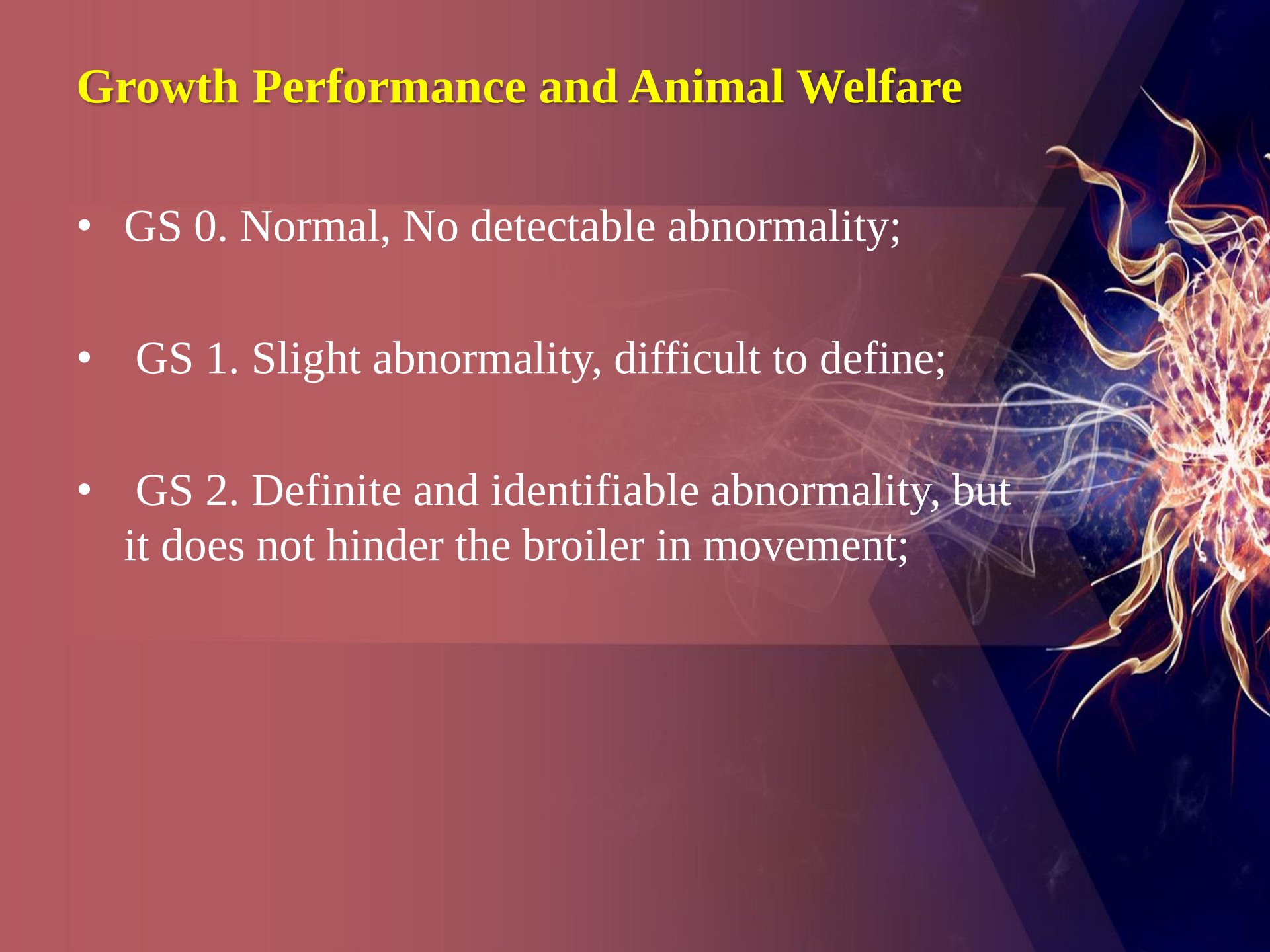
There is a paucity of information on the effects of milk thistle on the growth performance and welfare of broilers. Thus, the aim of this work was to examine the effects of milk thistle on growth performance, welfare, meat quality, and antioxidants in broilers.



Material and Method

Growth Performance and Animal Welfare

- GS 0. Normal, No detectable abnormality;
- GS 1. Slight abnormality, difficult to define;
- GS 2. Definite and identifiable abnormality, but it does not hinder the broiler in movement;

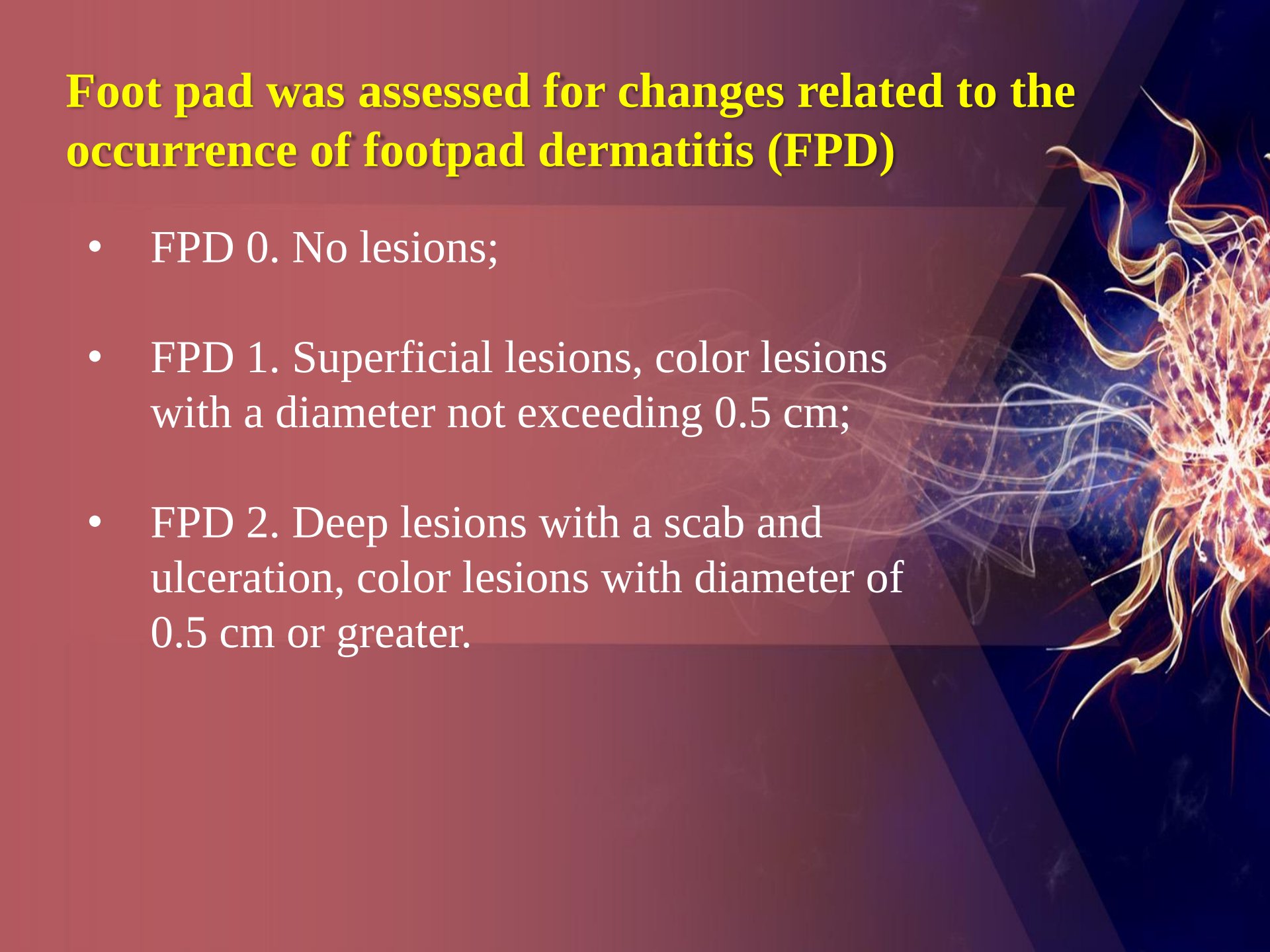


Growth Performance and Animal Welfare

- GS 3. An obvious gait defect, affects ability to move;
- GS 4. A severe gait defect, the broiler will walk only a couple of steps if driven before sitting down;
- GS 5. Complete lameness, either cannot walk or cannot support weight on the legs.

Foot pad was assessed for changes related to the occurrence of footpad dermatitis (FPD)

- FPD 0. No lesions;
- FPD 1. Superficial lesions, color lesions with a diameter not exceeding 0.5 cm;
- FPD 2. Deep lesions with a scab and ulceration, color lesions with diameter of 0.5 cm or greater.

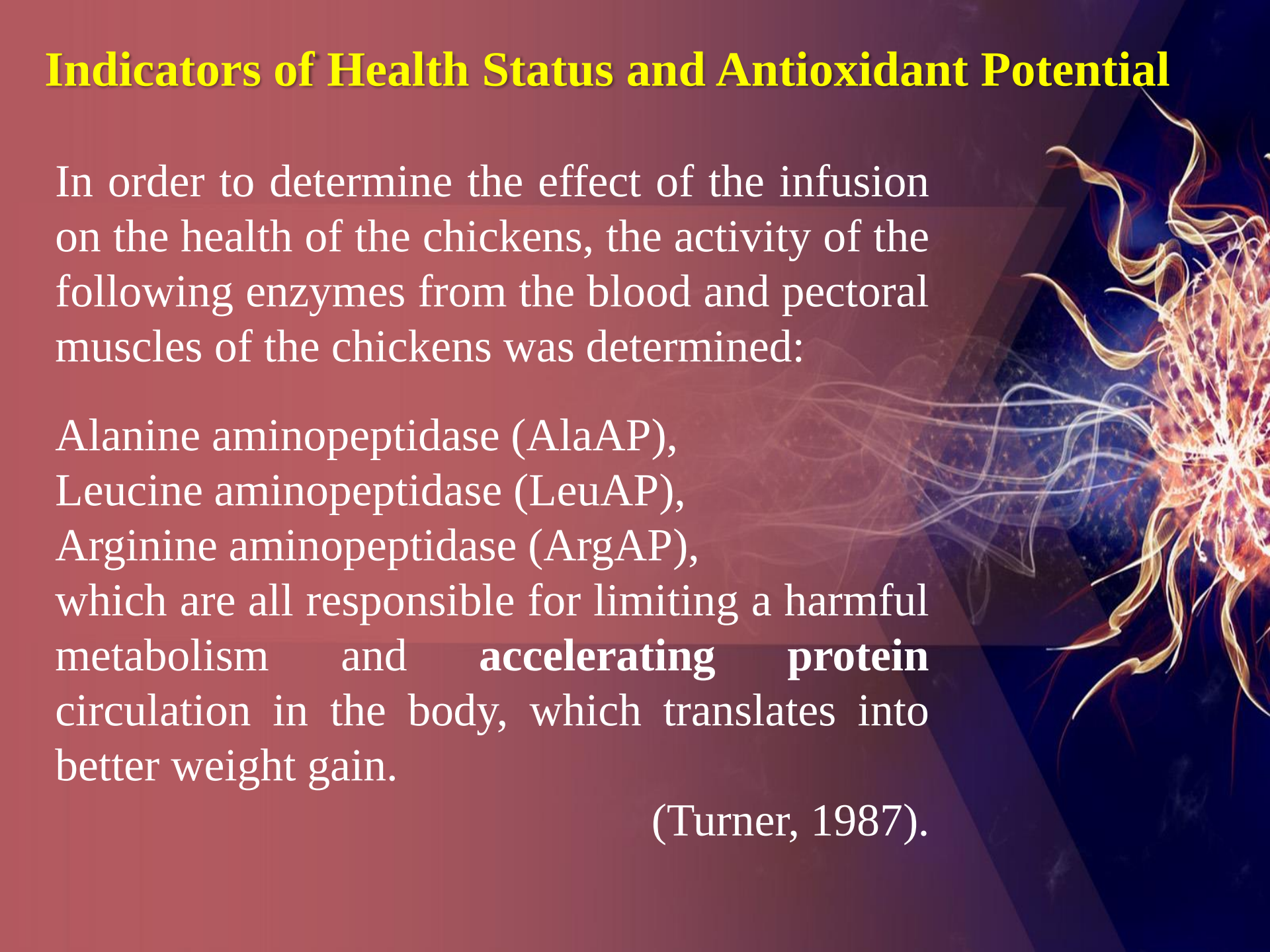


Indicators of Health Status and Antioxidant Potential

In order to determine the effect of the infusion on the health of the chickens, the activity of the following enzymes from the blood and pectoral muscles of the chickens was determined:

Alanine aminopeptidase (AlaAP),
Leucine aminopeptidase (LeuAP),
Arginine aminopeptidase (ArgAP),
which are all responsible for limiting a harmful metabolism and **accelerating protein** circulation in the body, which translates into better weight gain.

(Turner, 1987).



Results

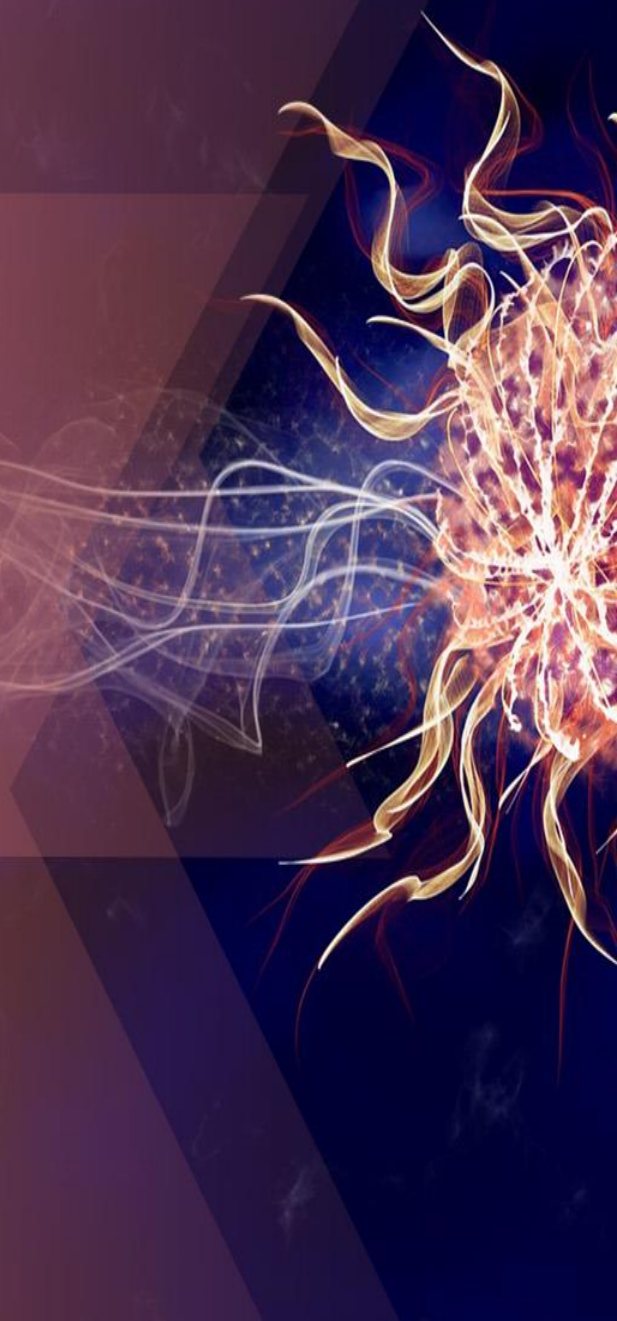


Table 1. Distribution of assessed animal-based welfare indicators gait score in the 3 groups, including significant differences (n = 99).

Indicator	Statistic	Score	Group					
			C		E1		E2	
			%	n	%	n	%	n
Gait score		0	15.15	5	48.48	16	45.45	15
		1	45.45	15	24.24	8	36.36	12
		2	33.33	11	27.27	9	18.18	6
		3	06.06	2	0.00	0	0.00	0
		4	0.00	0	0.00	0	0.00	0
		5	0.00	0	0.00	0	0.00	0
Kruskal-Wallis test	p=0.010		a		b		bc	

Different letters (a, b, c) indicate statistical difference ($p < 0.05$).

Table 2. Distribution of assessed animal-based welfare indicators in the 3 groups, including significant differences (n = 99).

Indicator	Statistic	Score	Group					
			C		E1		E2	
			%	n	%	n	%	n
Footpad dermatitis		0	54.55	18	69.70	23	84.85	28
		1	36.36	12	30.30	10	15.15	5
		2	09.09	3	0.00	0	0.00	0
Kruskal-Wallis test	p=0.010		A		AB		C	

Different letters (A, B, C) indicate statistical difference ($p < 0.01$).

Table 3. Broiler chicken production results, carcass yield, and the proportion of individual elements in chilled broiler carcasses (n = 18).

Item	C		E1		E2		p-Value
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	
Body weight (kg)	3.40 ^{c}	0.89	**3.71** ^{a}	0.20	3.68 ^{b}	0.11	0.004
Body weight gain (kg)	3.36 ^{c}	0.21	**3.67** ^{a}	0.20	3.64 ^{b}	0.17	0.033
Carcass weight (kg)	2.47 ^{b}	0.08	**2.62** ^{a}	0.14	2.62 ^{a}	0.10	0.045
Breast muscles (%)	31.2	1.39	30.93	1.84	31.07	2.2	0.969
Leg muscles (%)	19.61	1.93	18.63	3.33	19.73	1.66	0.613
Gizzard (%)	0.78	0.13	0.88	0.14	0.83	0.07	0.413
Heart (%)	0.58	0.07	0.59	0.04	0.59	0.11	0.501
Liver (%)	2.51	0.23	2.43	0.27	2.73	0.42	0.318
Abdominal fat (%)	0.74 ^{a}	0.19	0.63 ^{ab}	0.23	**0.49** ^{b}	0.16	0.039

$^{a, b,c}$ statistically significant differences at $p \leq 0.05$.

Table 4. Physicochemical properties and color of broiler breasts (n = 18).

Item	C		E1		E2		p-Value
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	
pH_{24}	5.56 ^{b}	0.04	5.74 ^{a}	0.03	5.71 ^{ab}	0.08	0.024
Drip loss (%)	4.67	2.07	4.67	2.42	5.83	2.71	0.636
WHC (cm^2/g)	2.82	0.69	3.25	0.53	3.50	0.70	0.210
L * brightness	60.33	1.93	61.26	4.53	61.70	1.47	0.719
a * redness	12.50	2.83	14.04	1.05	13.79	1.47	0.363
b * yellowness	10.27	3.99	9.64	0.88	11.05	1.07	0.615

Parameter L * (color brightness) can have values from 0 to 100. Parameters a * (redness) and b *(yellowness).

Table 5. Selected enzyme activity and antioxidant potential for chosen substances in broiler blood serum (n = 18).

Item	C		E1		E2		p-Value
	$\bar{X}$	SD	$\bar{X}$	SD	$\bar{X}$	SD	
AlaAP, nmol/mg protein/h	20.26 ^{B}	1.63	28.23 ^{A}	4.45	24.41 ^{AB}	4.16	0.006
LeuAP, nmol/mg protein/h	27.30 ^{B}	3.19	31.46 ^{A}	4.18	26.29 ^{B}	2.83	0.031
ArgAP, nmol/mg protein/h	18.11 ^{B}	1.90	21.90 ^{A}	3.56	18.13 ^{B}	1.88	0.018
AcP, nmol/mg protein/h	46.44	11.97	52.51	11.47	50.27	8.35	0.604
BGDR, nmol/mg protein/h	5.09	1.38	4.97	1.06	7.87	3.57	0.069
BGAL, nmol/mg protein/h	7.82 ^{b}	1.43	7.89 ^{ab}	1.45	10.69 ^{a}	3.86	0.025
BGLU, nmol/mg protein/h	4.49 ^{ab}	1.49	3.53 ^{b}	1.49	7.02 ^{a}	3.84	0.016
HEX, nmol/mg protein/h	13.46 ^{b}	2.10	11.50 ^{b}	2.05	17.05 ^{a}	6.14	0.014
aGlu, nmol/mg protein/h	4.63 ^{b}	0.88	5.36 ^{ab}	1.26	6.83 ^{a}	1.90	0.035
MAN, nmol/mg protein/h	6.36	2.10	5.65	1.23	8.20	3.42	0.184
Vit. C, mg/100 mL	8.09 ^{b}	1.84	10.19 ^{a}	1.07	8.85 ^{ab}	1.19	0.018
DPPH, % of free radical scavenging activity	80.01 ^{A}	2.87	74.43 ^{B}	2.91	79.63 ^{A}	3.56	0.011
GSH, uMol/L	1.11 ^{b}	0.14	1.16 ^{ab}	0.23	1.33 ^{a}	0.16	0.040

$^{A, B}$ statistically significant differences at $p \leq 0.01$; $^{a, b,}$ statistically significant differences at $p \leq 0.05$

Conclusion

The data obtained during the experiment show that the addition of milk thistle extract to drinking water for broiler chickens has a positive effect on the performance of the animals. In the case of both experimental groups, a higher level of welfare, greater production results, improved physicochemical properties of the breast muscles and the higher activity of selected enzymes, and the antioxidant potential of blood serum were found in comparison to chickens from the control group.

The addition of milk thistle reduced FPD incidence for the experimental groups and was significantly lower than the control group. The addition of milk thistle seed infusion for chickens can be used in poultry production to improve the growth performance and welfare of chickens.