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Effects of Sunflower Meals Inclusion on Performance and Some Haematological Parameters in Broiler chicks

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A B S T R A C T

A total of two hundred twenty five one-day-old Indian river broiler chicks (IR) were distributed into five different treatment groups (A, B, C, D and E), of three replicates (15 chicks / replicate). The chicks in control group (A) were fed control diet with β- mannanase (Hemicell®), groups B and C were fed diets containing SFM (2.5 and 5%, respectively) without β-mannanase (Hemicell®). While groups D and E were fed diets containing SFM (2.5 and 5%, respectively) with β-mannanase (Hemicell®). Effects of inclusion Sunflower meals with or without β-mannanase (Hemicell®) on performance showed that groups containing Sunflower meals 2.5%with or without enzyme show improvements than other groups. Erythrogram profile showed a significant ($p \leq 0.05$) difference between control group and other groups in Hb, RBCs, PCV and MCV levels, while there was a significant ($p \leq 0.05$) increase in MCH and MCHC in group E (SFM 5%+Hemicell®) when compared with other groups. Leukogram showed non-significant changes between control group and other groups. It was concluded that inclusion of sunflower meals 2.5% had a positive role in improvement final body weight changes and final body weight gain. Partial replacement diet with sunflower meals (2.5 and 5% with or without Hemicell®) did not induce side effects on hematological parameters.

Keywords: Broiler chicks, Sunflower meals, β-mannanase (Hemicell®), Chick performance and hematological profile.

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1. INTRODUCTION

Sunflower meal is a by-product of sunflower oil industry. However, replacement of soybean meal (SBM) with SFM may affect dietary inclusions of essential amino acids, so synthetic lysine may need to be increased. The high levels of SFM in poultry diets can be used successfully with appropriate diet formulation adjustments for energy and amino acids particularly lysine and methionine (Mahmoud et al., 2015). Crude protein content of SFM is 29 to 45% depending on the dehulling and oil extraction process which has an inverse relation with its crude fiber (32 to 14%) contents (Mushtaq et al., 2006). SFM contain high levels of non-starch polysaccharides (NSP) and phytates it would be useful to investigate the effect of enzyme supplementation on diets containing these ingredients. The addition of exogenous enzymes (phytase, hemicellulase, cellulase, pectinase, protease, lipase, β-glucanase, etc.) offers a number of creative possibilities for breakdown and "liberation" of these nutrients, their easier digestion and absorption, and thus development of new nutritional standards and new diets formulation (Acamovic, 2001). The present work was conducted to evaluate the use of different levels of sunflower meal as a protein supplement for broiler with or without enzyme β-mannanase (Hemicell®) and their effects on performance and some hematological parameters.

2. MATERIAL AND METHODS

2.1. Birds, housing and management

The present study was carried out using 225 one-day old Indian river broiler chicks. The chicks reared at suitable environment using the bird house at the Faculty of Veterinary Medicine, Benha University. The chicks were randomly allocated into 5 groups, each group contain 3 replicates of 15 chicks each reared on a deep litter system. The different groups were maintained under good ventilation and continuous lightening program. Feed and water were offered ad-libitum. All birds were systematically vaccinated against Newcastle and other needed prophylactic measures.

2.2. Diets

The chicks were distributed in to 5 treatment groups (A, B, C, D and E). A considered as control group and fed basal diet with β- mannanase (Hemicell®), group B and C were fed diets containing SFM (2.5, 5%, respectively) without β-mannanase (Hemicell®). While groups D and E were fed on diets containing SFM (2.5, 5%, respectively) with β-mannanase (Hemicell®). Nutrient requirements with calculated analysis were determined according National Research Council NRC, (1994) as described in Tables 1, 2 and 3. The chemical composition of the sunflower meal used in this study was as follows: Dry matter (90.97%), Moisture (9.03%), Crude protein (34.58%), Ether extracts (1.05%), Crude fiber (11.65%) ash (5.603%) and Nitrogen-free extract (17.07%). The estimated Metabolizable energy of the used Sunflower meal was (1688kcal/kg).

2.3. Experimental procedure

Chicks had free access of feed and water and were vaccinated according to the sanitary programs. Feed consumption was recorded for each treatment. Live body weight in grams was measured for all birds at the beginning of the experiment and then weekly. At the end of experiment (35 days of age), 5 birds were chosen randomly from each group and fasted 12 hours for measurements of some hematological parameters.

2.4. Hematological parameters

Blood samples were collected by needle from jugular vein from chicks of different dietary supplemented groups then withdrawing the blood into container with proper anticoagulant ethylene diamine tetra-acetic acid (EDETA). Hematological studies included erythrogram and leukogram through manual counting.

2.5. Erythrogram included: -

Hemoglobin (Hb) concentration, packed cell volume (PCV), RBCs count, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC).

2.6. *Leukogram included: -*

Total leukocytic count (TLC) and differential leukocytic count (DLC).

2.7. Statistical analysis: -

Data obtained in this study were statistically analyzed for variance ANOVA with confidence limits set at 95 % (Significance at $P \leq 0.05$ probability level) and critical difference as described by (Duncan, SPSS Student Version 10.0.7, June 2000). The results were reported as the mean ± standard error (SE).

3. RESULTS

The effects of inclusion SFM 2.5 and 5% with or without Hemicell® enzyme on performance of growing broiler chickens are shown in Table(4).

Body weight gain showed non-significant changes between groups. Also, groups B and D showed high value when compared with other groups. Feed intake in groups (D and E) that received SFM 2.5, 5%

Table (1): The ingredients composition (%) of the starter diets (1- 10 days) of the experimental groups.

Ingredients	Units	Experimental Diets				
		A	B	C	D	E
Yellow corn	%	52.86	49.06	48.55	50.99	49.26
Soybean meal (44%)	%	35	33.8	31.8	35	35
Corn gluten meal	%	5.7	5.5	5.5	4.5	3.3
Sunflower meal	%	-	2.5	5.00	2.5	5.00
Vegetable oil	%	1.65	4.4	4.4	2.3	2.8
Dicalcium phosphate	%	1.7	1.7	1.7	1.68	1.65
Lime stone	%	1.4	1.38	1.36	1.38	1.35
Vitamin &mineral premix*	%	0.30	0.30	0.30	0.30	0.30
DL - Methionine	%	0.31	0.31	0.3	0.31	0.31
L - Lysine	%	0.28	0.29	0.33	0.26	0.24
L - Threonine	%	0.15	0.15	0.16	0.15	0.15
Sodium chloride	%	0.31	0.31	0.31	0.30	0.30
Sodium bicarbonate	%	0.15	0.15	0.15	0.15	0.15
Feed additives	%	0.15	0.15	0.15	0.15	0.15
Hemicell	%	0.035	-	-	0.035	0.035
Avemix P 5000**	%	0.01	0.01	0.01	0.01	0.01
Total	%	100	100	100	100	100
Chemical composition	**Units**	**A**	**B**	**C**	**D**	**E**
ME	Kcal/Kg	3049	3050	3047	3053	3049
CP	%	22.5	22.48	22.5	22.5	22.51
CF	%	3.58	3.98	4.4	4.09	4.61
Lysine	%	1.35	1.35	1.35	1.35	1.35
Methionine	%	0.67	0.67	0.66	0.66	0. 66
Methionine + cysteine	%	0.95	0.95	0.94	0.95	0.95
Threonine	%	0.96	0.96	0.96	0.96	0.97
Calcium	%	1.06	1.06	1.05	1.05	1.04
Available phosphorus	%	0.50	0.50	0.50	0. 50	0.50
Sodium	%	0.17	0.17	0.17	0.17	0.17
Chloride	%	0.23	0.22	0.22	0.22	0.22
Potassium	%	0.88	0.87	0.85	0.90	0.83

*Vitamin-mineral mixture was composed of: Each 3 kg contain: Vit. A 12000000 IU, vit. D3 2000000 IU, vit. E 10000 mg, vit. K3 2000 mg, vit B11000 mg, vit. B2 5000 mg, vit B6 1500 mg, vit. B12 10 mg, Biotin 50 mg, pantothenic acid 10000 mg, Nicotinic acid 30000 mg, Folic acid 1000 mg, Manganese 60000 mg, Zinc 50000 mg, Iron 30000 mg, Copper 10000 mg, Iodine 1000 mg, Selenium 100 mg, Cobalt 100 mg, carrier ($CaCo_3$) add to 3 kg. **Phytase: - (Avemix P5000) was used as feed additive for poultry at a rate of 0.10 g/Kg.

Table (2): The ingredients composition (%) of the grower diets (11 – 24 days) of the experimental groups.

Ingredients	Units	Experimental Diets				
		A	B	C	D	E
Yellow corn	%	53.66	52.46	52.04	51.82	49.96
Soybean meal (44%)	%	35	29.7	27.6	35	35
Corn gluten meal	%	3.3	5.5	5.5	2.1	0.9
Sunflower meal	%	-	2.5	5.00	2.5	5.00
Vegetable oil	%	4	5.7	5.7	4.6	5.2
Dicalcium phosphate	%	1.43	1.45	1.45	1.4	1.4
Lime stone	%	1.16	1.15	1.15	1.15	1.15
Vitamin &mineral premix*	%	0.3	0.30	0.30	0.30	0.30
DL - Methionine	%	0.26	0.24	0.23	0.26	0.26
L – Lysine	%	0.18	0.30	0.33	0.16	0.14
L - Threonine	%	0.09	0.10	0.10	0.08	0.08
Sodium chloride	%	0.30	0.30	0.30	0.30	0.30
Sodium bicarbonate	%	0.15	0.15	0.15	0.15	0.15
Feed additives	%	0. 15	0. 15	0. 15	0. 15	0. 15
Hemicell	%	0.035	-	-	0.035	0.035
Avemix P 5000**	%	0.01	0.01	0.01	0.01	0.01
Total	%	100	100	100	100	100
Chemical composition	Units	A	B	C	D	E
ME	Kcal/Kg	3174	3176	3175	3175	3175
CP	%	21	20.98	20.97	21	21
CF	%	3.57	3.76	4.17	4.08	4.59
Lysine	%	1.25	1.25	1.25	1.25	1.25
Methionine	%	0.58	0.58	0.58	0.58	0.58
Methionine + cysteine	%	0.84	0.84	0.84	0.84	0.84
Threonine	%	0.85	0.86	0.85	0.85	0.85
Calcium	%	0.91	0.90	0.91	0.90	0.90
Available phosphorus	%	0.45	0.45	0.45	0.45	0.45
Sodium	%	0.17	0.17	0.17	0.17	0.17
Chloride	%	0.22	0.22	0.22	0.22	0.22
Potassium	%	0.87	0.80	0.78	0.89	0.9

*Vitamin-mineral mixture was composed of: Each 3 kg contain: Vit. A 12000000 IU, vit. D3 2000000 IU, vit. E 10000 mg, vit. K3 2000 mg, vit B11000 mg, vit. B2 5000 mg, vit B6 1500 mg, vit. B12 10 mg, Biotin 50 mg, pantothenic acid 10000 mg, Nicotinic acid 30000 mg, Folic acid 1000 mg, Manganese 60000 mg, Zinc 50000 mg, Iron 30000 mg, Copper 10000 mg, Iodine 1000 mg, Selenium 100 mg, Cobalt 100 mg, carrier (CaCo3) add to 3 kg . **Phytase: - (Avemix P5000) was used as feed additive for poultry at a rate of 0.10 g/Kg.

Table (3): The ingredients composition (%) of the finisher diets (after 24 days) of the experimental groups:-

Ingredients	Units	Experimental Diets				
		A	B	C	D	E
Yellow corn	%	56.4	57.81	57.34	55.92	55.4
Soybean meal (44%)	%	34.8	25.6	23.5	32.7	30.7
Corn gluten meal	%	-	4.5	4.5	-	-
Sunflower meal	%	-	2.5	5.00	2.5	5.00
Vegetable oil	%	5.1	5.7	5.8	5.2	5.2
Dicalcium phosphate	%	1.27	1.30	1.30	1.28	1.28
Lime stone	%	1.15	1.15	1.10	1.10	1.10
Vitamin &mineral premix*	%	0.3	0.30	0.30	0.30	0.30
DL - Methionine	%	0.26	0.21	0.20	0.25	0.24
L - Lysine	%	0.02	0.25	0.28	0.06	0.09
L - Threonine	%	0.06	0.08	0.08	0.06	0.06
Sodium chloride	%	0.30	0.30	0.3	0.3	0.3
Sodium bicarbonate	%	0.15	0.15	0.15	0.15	0.15
Feed additives	%	0.15	0.15	0.15	0.15	0.15
Hemicell	%	0.035	-	-	0.035	0.35
Avemix P 5000**	%	0.01	0.01	0.01	0.01	0.01
Total	%	100	100	100	100	100
Chemical composition	**Units**	**A**	**B**	**C**	**D**	**E**
ME	(Kcal \ Kg diet	3223	3222	3228	3288	3224
CP	%	19	19	18.98	18.99	19
CF	%	3.56	3.57	3.98	3.97	4.39
Lysine	%	1.1	1.1	1.1	1.1	1.1
Methionine	%	0.53	0.53	0.52	0.53	0.53
Methionine + cysteine	%	0.78	0.77	0.77	0.78	0.77
Threonine	%	0.76	0.76	0.76	0.76	0.76
Calcium	%	0.86	0.86	0.84	0.85	0.85
Available phosphorus	%	0.42	0.42	0.42	0.42	0.42
Sodium	%	0.17	0.17	0.17	0.17	0.17
Chloride	%	0.22	0.22	0.22	0.22	0.22
Potassium	%	0.87	0.73	0.71	0.85	0.83

*Vitamin-mineral mixture was composed of: Each 3 kg contain: Vit. A 12000000 IU, vit. D3 2000000 IU, vit. E 10000 mg, vit. K3 2000 mg, vit B11000 mg, vit. B2 5000 mg, vit B6 1500 mg, vit. B12 10 mg, Biotin 50 mg, pantothenic acid 10000 mg, Nicotinic acid 30000 mg, Folic acid 1000 mg, Manganese 60000 mg, Zinc 50000 mg, Iron 30000 mg, Copper 10000 mg, Iodine 1000 mg, Selenium 100 mg, Cobalt 100 mg, carrier (CaCo3) add to 3 kg . **Phytase: - (Avemix P5000) was used as feed additive for poultry at a rate of 0.10 g/Kg.

containing enzyme showed high value when compared with groups (B and C) that received SFM 2.5, 5% without enzyme and control one. FCR from the obtained data showed that there was non-significant difference in feed conversion ratio (FCR) between all dietary treatment and control group during experimental period from (0-35) day. However, groups received SFM 2.5% with or without enzyme showed improvement than others. Hematological parameters included erythrogram was shown at Table (5). The results indicated that there was significant (P≤0.05) increase in Hb (g/dl) contents in groups B, C, D and E when compared with control group. Moreover, group C showed the highest value than other groups. RBCs count showed significant changes between groups when compared with control one, but there was non-significant difference between B and C that received (SFM 2.5, 5%, respectively). Also, there was non-significant difference between D and E that received (SFM2.5, 5% with Hemicell, respectively). PCV% and MCV (fl) showed significant (p≤0.05) increase in groups (B, C, D and E) that received (SFM 2.5, 5%, 2.5%+Hemicell and SFM 5%+Hemicell, respectively) when compared with control group. There were significant (p≤ 0.05) increase in MCH (pg) and MCHC (%) in group contain SFM 5%+Hemicell when compared with other groups and control one. The effect of dietary treatments on leukogram was shown at Table (6). WBCs count results indicated that there was non-significant difference between control group and other groups. While there was significant (p≤0.05) difference between B and E groups that received (SFM2.5, SFM5%+ Hemicell, respectively). While differential leukocytic count showed that there were non-significant difference in heterophile, lymphocyte, eosinophile and basophile percent between groups with the exception of monocyte % in which there was significant (p≤0.05) decrease in group received SFM5%+Hemicell when compared with group received SFM2.5%,While other groups showed non-significant changes.

4. DISCUSSION

Feed intake in SFM5%+Hemicell group recorded the highest value followed by SFM2.5% +Hemicell than other groups and controlled one. Generally, the statistical analysis indicates there was no any significant difference between all groups in total feed intake. This may be attributed to the balanced diet offered to all groups. These results were in agreement with those obtained by Horvatovic et al., (2015) who reported that neither SFM nor enzyme supplementation had any effect on feed consumption. Moreover, Furlan et al., (2001) found non-significant difference in feed intake for the starter and grower phases or total experimental period with the dietary addition of sunflower meal. Sunflower meal up to 15% can be included in broiler feeds with no effect on performance.

Data concerning BWG showed that the best weight gain obtained from groups B and D which fed on SFM 2.5%, SFM 2.5%+Hemicell, respectively. The addition of Hemicell® enzyme was not justified, because chickens in the treatments where enzymes were added did not show improvement in performance over chickens in treatments not contained enzymes. Generally, the only apparent disadvantage of sunflower meal is that it contains relatively high level of fiber and low level of metabolizable energy and lysine compared to soybean meal according to NRC (1994). This characteristic of sunflower meal may lead to bulky diets which may be a problem for young chicks, in particular, because their digestive system has a limited capacity. The sunflower meal incorporated at high inclusion rate (5%), nutrient and energy densities of the resulting diet may be significantly diluted and growth retarded. This finding agree with Arash (2013) who reported that supplementation diet with Hemicell at the

Table (4): Effects of different dietary SFM levels with or without (Hemicell®) enzyme supplementation on broiler chick performance (means ± SE).

Items	The experimental groups				
	A	B	C	D	E
Final body weight gain (g)	1765.9 ± 98.29^{a}	1953.5 ± 40.53^{a}	1833.5 ±122.38^{a}	1954.1 ±64.46^{a}	1777.6 ±23.6^{a}
Feed intake (g)	3052.3 ± 69.35^{a}	3189.2 ±46.99^{a}	3169.8 ±87.52^{a}	3215.7 ±49.12^{a}	3235.5 ±45.34^{a}
Feed conversion ratio	1.73 ± 0.06^{a}	1.64 ± 0.06^{a}	1.74 ±0.08^{a}	1.65 ±0.07^{a}	1.82 ± 0.01^{a}

Means with different letters at the same column differ significantly at (P≤0.05).

Table (5): The effects of different dietary SFM levels with or without (Hemicell®) enzyme supplementation on erythrogram of broiler chicks (mean ± SE).

Items	The experimental groups				
	A	B	C	D	E
Hb (g/dl)	9.14 ± 0.07^{c}	10.60 ± 0.11^{b}	11.00 ±0.04^{a}	10.44 ±0.05^{b}	10.60 ±0.07^{b}
RBCS ×10^{6} /µl)	2.17 ± 0.03^{c}	2.46 ± 0.04^{a}	2.44 ±0.02^{a}	2.29 ±0.02^{b}	2.26 ±0.02^{b}
PCV (%) `	28.00 ± 0.00^{e}	33.20 ±0.20^{b}	34.20 ±0.20^{a}	32.10 ±0.20^{c}	30.00 ±0.32^{d}
MCV (fl)	129.39 ± 1.95^{c}	135.22 ±2.27^{b}	140.21 ±1.67^{a}	140.63 ±0.69^{a}	132.76 ±1.37^{bc}
MCH (pg)	42.22 ± 0.39^{c}	43.15 ± 0.34^{c}	45.09 ±0.20^{b}	45.60 ±0.20^{b}	46.92 ± 0.63^{a}
MCHC (%)	32.64 ±0.27^{b}	31.93 ±0.34^{b}	32.17 ±0.28^{b}	32.42 ±0.12^{b}	35.34 ±0.34^{a}

Means with different letters at the same column differ significantly at (P≤0.05).

Table (6): The effects of different dietary SFM levels with or without (Hemicell®) enzyme supplementation on leukocytic and differential leukocytic parameters of broiler chicks (mean ± SE).

Items	The experimental groups				
	A	B	C	D	E
WBCS×10^{3}	1.92 ± 0.09^{ab}	2.06 ± 0.10^{a}	1.88 ±0.04^{ab}	2.02 ±0.04^{ab}	1.82 ±0.07^{b}
Heterophile %	26.40 ± 2.36^{a}	24.20 ± 4.67^{a}	33.60 ±6.93^{a}	24.80 ±2.48^{a}	33.00 ±2.61^{a}
Lymphocyte %	66.00 ± 1.76^{a}	66.40 ±4.93^{a}	59.00 ±7.12^{a}	69.60 ±2.77^{a}	61.60 ±2.32^{a}
Monocyte %	4.00 ± .84^{ab}	5.20 ±0.49^{a}	4.60 ±0.51^{ab}	3.80 ±0.58^{ab}	3.20 ±0.49^{b}
Eosinophile %	1.60 ± 0.40^{a}	2.20 ±0.37^{a}	2.80 ±0.73^{a}	1.40 ±0.51^{a}	2.20 ± 0.49^{a}
Basophile %	00.00 ±0.00^{a}	00.00 ±0.00^{a}	00.00 ±0.00^{a}	00.00 ±0.00^{a}	00.00 ±0.00^{a}

Means with different letters at the same column differ significantly at (*P*≤0.05).

levels 0.05 or 0.1 (g/kg) during the starter phase, grower phase and the course of study, body weight gain, feed intake and feed conversion ratio (FCR) did not significantly differ among the treatments. Also, the results was agreement with Ravindran et al., (1999) who did not find any beneficial effects on production performance of broiler chickens when they were fed with cereal-based diets (corn, wheat or barely) supplemented with xylanase. The results confirmed by Meng and Slominski (2005) and Tabook et al., (2006) who reported that the addition of commercially available multiactivity enzyme products did not result in improved broiler performance in diets especially having increased concentration of SFM. Results were in agreement with Mandal et al., (2003) who showed that inclusion of undecorticated SFM at 0, 50 and 100 g/kg in broiler chicken diets replacing part of SBM had no significant impact on weight gain. In contrast, Mutassim and Fuad (2007) and Peric et al., (2010) concluded that the inclusion of SFM resulted in worse broiler performance which discussed by Hesselman and Aman (1986) who stated that β-glucans adversely affect all nutrients, especially protein and starch utilization and are known to give rise to highly viscous conditions in the small intestine of the chicks. Data concerning FCR showed that groups received SFM 2.5% with or without enzyme showed improvement than others. This improvement may be attributed to the higher final body weight. These results supported by Mutassim and Fuad (2007) who reported that adding different levels of SFM; 0, 5, 10, and 15% with and without ß-Glucanase Enzyme (E) to broiler starter and finisher rations, had no significant effect on feed conversion ratio (FCR). Also, Ibrahim and El-Zubeir (1991) found that feed conversion efficiency of broiler chickens were similar in all investigated groups contained up to 30% SFM. Moreover, some researchers found that the highest level sunflower meal inclusion (20%) in the diet improved feed conversion ratio which was explained by the fact that the oil inclusion level was increased in order to supply birds' energy needs Tavernari et al., (2008).Data concerning erythrogram showed that groups received SFM at 2.5 and 5% with or without enzyme supplementation showed significant ($p \leq 0.05$) increase in Hb, RBCs and PCV levels when compared with control group, similar to finding of Haddadin et al., (1996) who found that addition of esterified glucomannan to broilers diet is significantly increases RBCs count. The most likely explanation was the improvement of bioavailability of essential nutrients. One of most powerful hypothesis about RBCs increase is due to beta- glucan existence. As revealed by Selvaraj et al., (2005) on common carp (*C. carpio*), beta-glucan (especially beta 1-3 glucan) is an immunity stimulant for animals Sinha et al., (2011). So glucan residues would cause the WBCs and maybe RBCs production. From obtained results that related to leukogram revealed that WBCs decrease by increase SFM level, and this finding agrees with Fasuyi et al., (2013) who found that the white blood cells (WBC) count values from blood samples of pigs were significantly ($p \leq 0.05$) increased by the increase levels of Tithonia diversifolia (wildsunflower) leaf meal (TDLM) reported that neutrophils and monocytes were not significant affected when the levels of TDLM increased in dietary treatments. While, Selvaraj et al., (2004) who stated that inclusion of different levels of full-fat SFS in broiler diets, not statistically effect on blood parameters of poultry.

From the results of current study we can conclude that the addition of Hemicell® enzyme at 0. 35kg/ton was not justified, because chickens in the treatments where enzymes were added did not show improvement in performance over chickens in treatments not contained enzymes. The inclusion level 2.5 % of sunflower meal had a positive a role in improved final body weight gain comparing with other treatment groups. Partial replacement diet with sunflower meals (2.5 and 5% with or without Hemicell®) did not induce side effects on hematological parameters.

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