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Research Article

Effect of *Nigella Sativa* Additive on Growth Performance, Immunity Response, Diseases Infection and Mortality Rate of Suckling Zaraibi Kids

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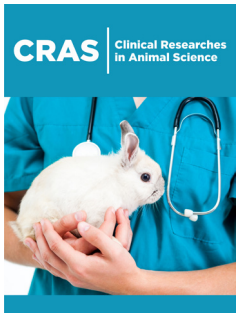

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Submission: September 03, 2024

Published: January 02, 2025

Volume 3 - Issue 4

How to cite this article: Hamed M Gaafar*, Mostafa M El-Nahrawy and Mohamed F Elkersh. Effect of *Nigella Sativa* Additive on Growth Performance, Immunity Response, Diseases Infection and Mortality Rate of Suckling Zaraibi Kids. Clin Res AnimSci. 3(4). CRAS. 000568. 2025
DOI: 10.31031/CRAS.2025.03.000568

Abstract

Sixty suckling zaraibi kids (33 males and 27 females) at 7 days after birth with average live body weight of 3.03 ± 0.02kg were allocated into three similar groups (11 males and 9 females in each group) according to live body weight and sex. All kids naturally suckled their dams. The 1st group was unsupplemented and served as control (G1), whereas the 2nd and 3rd groups orally supplemented with 0.5 and 1.0g *nigella sativa* (NS)/lamb/day for G2 and G3, respectively. The experiment continued for 84 days during the period from 7 days after birth until weaning at 90 days. Results showed that all types of plasma immunoglobulins were significantly (P<0.05) increased in treatment groups (G2 and G3) compared with the control (G1). The high NS level (G3) showed significantly (P<0.05) the highest values compared to low level in G2. The percentages of diarrhea, respiratory, septicemia, navel and general weakness diseases incidence of kids decreased significantly (P<0.05) with NS additive as well as with increasing the level of additive. Moreover, G3 received the high level of NS (1g/head/day) revealed the lowest percentages of various diseases followed by G2 (0.5 g/head/day), whereas control one G1 had the highest percentages (P<0.05). Mortality rate of suckling kids decreased significantly (P<0.05) with NS additive as well as with increasing the level of additive. Control group (G1) recorded significantly (P<0.05) the highest mortality rate 15% (3/20) followed by G2 10% (2/20), but G3 the lowest rate 5% (1/20). Kids were significantly (P<0.05) heavier in NS additive groups than in the control one, being the heaviest in G3. Also, total and average daily gain were significantly (P<0.05) higher in NS additive groups than in control group, with the highest in G3. NS additive recorded significant increase (P<0.05) in output of weaning weight compared to control one. Also, output of weaning weight increased significantly (P<0.05) with increasing NS level.

Keywords: Suckling lambs; *Nigella sativa*; Immunity; Diseases; Mortality; Growth performance

Introduction

Nigella sativa seeds contain more than 100 useful components. It is an important source of essential fatty acids, proteins, carbohydrates, vitamins A, B1, B2, C and niacin, minerals and carotene. Nutritional composition of black seed is crude protein 21%, carbohydrates 35% and fats 35-38%. *Nigella sativa* reduces the toxicity of cisplatin that induced fall in white blood cell count, hemoglobin levels and mean osmotic fragility of red blood cells [1]. Paarakh [2] remarked that NSS contains high amount of oil in it (35-42%). Figure 1 represents the beneficial biological effects of NS. As per the latest estimation Zanouny et al. [3] and Sadarman et al. [4], the proximate composition of NSS (on dry matter basis) includes dry matter 91.6% (range: 88.6-92.6%), Ash 3.84% (range: 2-8.43%), organic matter 96.2% (range: 91.6-98.0%), crude protein 23.3% (range: 7.5-33.1%), ether extract 9.67% (range: 4.7-12.7%), crude fiber 9.84 (range: 6.6-19.9%), nitrogen free extract 52.0% (range: 34.8-67.9%), neutral detergent fiber 42.7% (range: 22.8-55.1%), acid detergent fiber 23.7% (range: 11.4-29.3%), hemicellulose 19.0% (range: 11.4-25.8%).

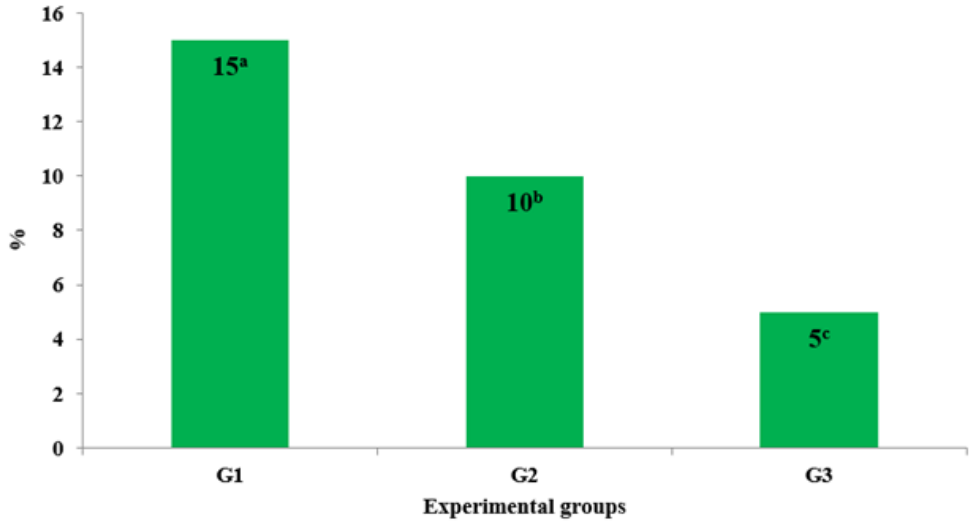

Figure 1: Mortality rate of suckling lambs in different experimental groups.

Black cumin (*Nigella sativa L*) seed (BCS) is among plant seeds that recently received a growing interest as a feed supplement because it is rich in oils and contains diverse phytochemical compositions [5,6]. The major constituent of BCS is thymoquinone (TQ) Sahak et al. [7] with considerable amounts of polyphenols and essential oil compounds such as p-cymene, thymoquinone, α-thujene, carvacrol, β-pinene, and many more [8,9]. As widely explained, phytochemical compounds are advantageous for ruminant productivity since they can positively modulate rumen metabolism, hence improve growth performance. A recent review described that active compounds of BCS possess many biological roles and perform as antioxidants, antidiabetic, antimicrobial, antitussive, anticancer, hepatoprotective, neuroprotective, anti-inflammatory, gastroprotective, immunomodulator, analgesic, spasmolytic, and bronchodilator [10,11].

NS shows many beneficial activities, which makes it a potentially strong candidate to be used as a feed supplement for enhancing the performances of small ruminants. The antioxidant activity of NS is mainly due to high phenolic compounds in it [11-15]. Singh et al. [16] investigated 38 different compounds showing antioxidant activity in which p-cymene (36.2%) was major fraction followed by thymoquinone in essential oils derived from NS. Recent studies considered that major pharmacological properties of NS were due to thymoquinone [7,15]. Thymoquinone has immuno-modulatory properties; it increases the working of neutrophils as a part of natural body defense mechanism against invading infections [17]. Majorly antimicrobial and antioxidants activities relieve the host animals from defense mechanism against invading pathogens through their secondary metabolites [18,19].

These days a great interest has been noted in animal scientists to utilize NS in two forms *viz*. seeds and its derived oil in animal feeding to achieve improved growth and other performances [20]. Many shreds of evidence from meta-analyses showed that essential oils are effective to improve growth performance and nutrient digestibility in cattle and small ruminants [21,22] and broiler chickens, and it was effective to replace antibiotics as growth promoters [23].

Black seed is high in nutritional values like monosaccharides and non-starch polysaccharide component which is a useful source of dietary fiber and also is high in fatty acids, unsaturated and essential fatty acids which cannot be manufactured by the body alone and therefore animals acquire these from food. Fifteen amino acids are an important part of the crude protein content of the black seed, including eight of the nine essential amino acids [24]. *Nigella sativa* seeds are grown in developing countries of the world [25] and more than 90% of the world goats are present in these countries [26]. Although, both sheep and goat are ruminants, their digestive physiology and feeding behavior are different [27]. The objective of this study was to investigate the effect of *nigella sativa* seed additive on the growth performance, immunity response, health status, mortality rate and economic efficiency of suckling zaraibi kids.

Materials and Methods

The current work was carried out at Sakha Animal Production Research Station belonging to Animal Production Research Institute (APRI), Agricultural Research Center, Ministry of Agriculture. The experiments were performed according to the guidelines of a local ethics committee for animal care and welfare (Number 08/2016 EC).

Experimental animals

Sixty suckling zaraibi kids (33 males and 27 females) at 7 days after birth with average live body weight of 3.03 ± 0.02kg were allocated into three similar groups (11 males and 9 females in each group) according to live body weight and sex. All kids naturally suckled their dams. The 1st group was unsupplemented and served as control (G1), whereas the 2nd and 3rd groups orally supplemented with 0.5 and 1.0g *nigella sativa* (NS)/kid/day for G2 and G3, respectively. The experiment continued for 84 days during the period from 7 days after birth until weaning at 90 days.

Management procedures

All kids were housed in a semi-shaded open yard for each group and kept under the same managerial and hygienic experimental conditions. Kids were weighed biweekly from the beginning of experiment at 7 days after birth until weaning at 90 days. Total weight gain and average daily gain were calculated for each kid.

Blood samples

Blood samples were taken at the last week of experiment from the jugular vein of each kid by clean sterile needle in clean dry glass tubs using heparin as an anticoagulant. Samples were centrifuged for 15 minutes at 4000 rotations per minute to obtain plasma. The concentrations of immunoglobulins IgG, IgM and IgA in the blood plasma samples were measured using the quantitative ELISA Bovine (IgG, IgM and IgA), ELISA Quantitation Kit, Bethyl laboratories, UK.

Diseases infection and mortality rate

The number of kids that were infected to diseases of diarrhea, respiratory, septicemia, navel and general weakness as well as mortality was recorded during the experimental period.

Statistical analysis

The data were analyzed using general linear model's procedure adapted by IBM SPSS Statistics [28] for user's guide with one-way ANOVA. Significant differences in the mean values among dietary treatments were analyzed by Duncan's tests within SPSS program set at the level of significance P<0.05 [29].

Result and Discussion

Immunity response

Table 1: Immunity response of suckling lambs in different experimental groups.

Item	Experimental Groups			SE	P-Value
	G1	G2	G3		
IgG, g/L	29.28^{c}	35.71^{b}	41.95^{a}	1.84	0.002
IgM, g/L	3.98^{c}	4.37^{b}	4.66^{a}	0.1	0.003
IgA, g/L	2.65^{c}	2.92^{b}	3.14^{a}	0.07	0.004

Note:a,b,c:Values in the same row with different superscripts differ significantly at P<0.05.

Table 1 shows significant effects of black seed (NS) on different types of serum immunoglobulins (IgG, IgM, and IgA) concentrations in plasma of kids at weaning. Results showed that all types of plasma immunoglobulins were significantly (P<0.05) increased in NS treatment groups (G2 and G3) compared with the control (G1). The high NS level (G3) showed significantly (P<0.05) the highest values compared to low level in G2. Similar to our results in pre- and post-weaning calves, NS additive at levels of 5 and 10 g/head/day significantly increased the concentrations of IgG, IgM and IgA in plasma at 3 and 6 months of age as well as with increasing NS level [30]. NS additive improving immunity status of small ruminants [20].

Diseases infection

The percentages of infection of suckling kids with various diseases are presented in Table 2. The percentages of diarrhea, respiratory, septicemia, navel and general weakness diseases of lambs decreased significantly (P<0.05) with NS additive as well as with increasing the level of additive. Moreover, G3 received the high level of NS (1g/head/day) revealed the lowest percentages of various diseases followed by G2 (0.5 g/head/day), whereas control one G1 had the highest percentages (P<0.05). These results might be due to the higher concentrations of immunoglobulins in plasma of kids with NS additive (Table 1) improving health status. The percentage of diarrhea incidence in Friesian calves during suckling and 1st post weaning periods decreased significantly with NS additive [29]. NS additive improving gut health of small ruminants [2**0].**

Table 2: Diseases infection of suckling lambs in different experimental groups.

Item	Experimental Groups			SE	P-Value
	G1	G2	G3		
Diarrhea, %	21.38	13.59	6.46	2.16	0.002
Respiratory, %	15.74	10.66	5.38	1.5	0.004
Septicemia, %	12.42	8.25	4.07	1.21	0.003
Navel, %	9.02	5.98	3.53	0.79	0.006
General weakness, %	7.94	5.49	3.23	0.68	0.005

Note: a, b, c: Values in the same row with different superscripts differ significantly at P<0.05.

Mortality rate

Mortality rate of suckling kids as affected by NS additive is presented in Figure 1. Mortality rate of suckling kids revealed similar trend to diseases infection, which decreased significantly (P<0.05) with NS additive as well as with increasing the level of additive. Control group (G1) recorded significantly (P<0.05) the highest mortality rate 15% (3/20) followed by G2 10% (2/20), but G3 the lowest rate 5% (1/20). Research works had been carried out to study the possible effect of using natural additives such as medicinal herbs (NS) in animals feeding for various purposes such as minimizing the mortality rate of the offspring [31,32].

Live bodyweight and weight gain

The live body weight of kids at the beginning of experiment was nearly similar in all groups, whereas, kid's weight was significantly (P<0.05) heavier in NS additive groups than in the control one, being the heaviest in G3. Also, total and average daily gain were significantly (P<0.05) higher in NS additive groups than in control group, being the highest in G3 (Table 3). The weaning weight of kids in G2 and G3 was higher by about 5.49 and 10.12% relative to the control lambs, respectively. Moreover, total weight gain and average daily gain increased by about 5.33 and 12.24% in G2 and G3 relative to control, respectively. These results agreed with the findings of Mahmoud et al. [33] reported that *Nigella sativa* seed meal can be used to improve live body weight of growing lambs and calves. Also, Mohsen et al. [34] noticed that NS additive resulted in significant increase in live body weight, total weight gain and average daily gain of growing Friesian calves. Ahmed et al. [10] who found that male Beetal goats fed diets supplemented with 5 and 10 NSS had 24 and 43% greater ADG and total body weight gain than the male Beetal goats fed unsupplemented diet.

Table 3: Growth performance of suckling lambs in different experimental groups.

Item	Experimental Groups			SE	P-Value
	G1	G2	G3		
Initial weight, kg	2.35	2.36	2.34	0.01	0.876
Final weight (weaning), kg	10.60^{c}	11.05^{b}	11.60^{a}	0.16	0.004
Total weight gain, kg	8.25^{c}	8.69^{b}	9.26^{a}	0.15	0.001
Average daily gain, g	91.67^{c}	96.56^{b}	102.89^{a}	1.72	0.001

Note: a, b, c: Values in the same row with different superscripts differ significantly at P<0.05. The price of 1kg live weight was 200 LE according to prices of 2024.

Output of weaning weight

The output of weaning weight of kids in Egyptian pound (LE) is shown in Figure 2. NS additive revealed significant increase (P<0.05) in output of weaning weight compared to control one. Also, output of weaning weight increased significantly (P<0.05) with an increasing NS level from 0.5 to 1.0g/lamb/day. The output of weaning weight increased by 90 LE (4.25%) in G2 and 200 LE (9.43%) in comparison with control G1. Consistent with the present results, Mahmoud et al. [33] found that using *Nigella sativa* seed can be used to improve the total revenue of growing lambs and calves. Mohsen et al. [34] reported that NS additive led to significant increase in total revenue of growing Friesian calves.

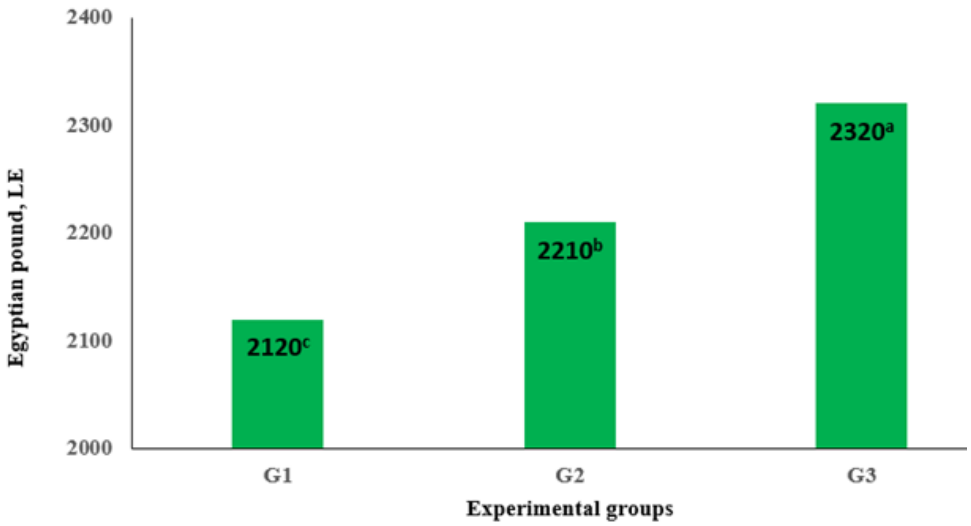

Figure 2: Output of weaning weight of lambs in different experimental groups.

Conclusion

From these results, it could be concluded that *nigella sativa* additive for suckling zaraibi kids at the level of 1g/kid/day improved immunity response, reduced diseases infection and mortality rate and increased weaning weight, total weight gain and average daily gain as well as the output of weaning weight.

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