Mansoura Journal of Biology, Vol. 35 (1), June 2008

ADVERSE EFFECTS OF SOME FOOD ADDITIVES ON GROWTH RATE AND SOME BIOCHEMICAL AND HEMATOLOGICAL PARAMETERS IN MALE ALBINO RATS: ROLE OF BLACK SEED AND BEES HONEY AS PROTECTIVE AGENTS

H. A. Hassan – W. M. El-Kholy – S. E. Nour
Zoology Department, Faculty of Science, Mansoura University

ABSTRACT

Food additives are substances internationally added to food, this may be natural or synthetic. The safety of repeated use to permitted synthetic food additives (colorants or preservatives) has been questioned. So the aim of the present study was to investigate the impact of the administration of sodium nitrite ($NaNO_2$, as a food preservative agent) and sunset yellow (as a colorant agent) on growth rate and some hematological parameters in rats. In addition, the study extended to evaluate the role of both black seed and bees honey as protective agents. $NaNo_2$ was orally administered to the rats at a dose of 10 mg/kg/day, while sunset yellow was supplemented with diet at a dose equal 0.6% w/w for 30 days. The present data reported that the ingestion of $NaNO_2$ plus sunset yellow causes growth retardation in rats. Also, a significant decrease in serum and liver total protein content was recorded in these rats. Meanwhile, thyroid hormones (T_3 and T_4) were significantly elevated indicating development of hyperthyroidism. The hematological analysis recorded a significant decrease in RBCs and platlets count accompanied by significant increase in WBCs count. Moreover, a decrease in Hb content as well as Hct, MCV and MCH values was suggested in food additive ingested rats. Fortunately, the administration of black seed (4% w/w in diet) and/ or bees honey (orally 2.5g/kg b.w/day) ameliorated the disturbances observed, indicating remarkable protection against the adverse effects of these food additives on growth rate and the estimated biochemical and hematological parameters. Overall, the most pronounced effect was achieved by the combined treatment with black seed and bees honey, in addition the treatment by honey was more effective than black seed.

Key words: Food additives – growth rate – thyroid hormones - hematological indices.

INTRODUCTION

Nowadays, food additives are considered to be one of the difficult problems in food industry. All food additives whether actually in use or being proposed for use should be subjected to appropriate toxicological testing and evaluation [**Park and Lewis, (1992)**].

Sodium nitrite is an inorganic salt used in the manufacture of dyes and as a food additive that has been used for decades to preserve meats, poultry and fish. More than 85 percent of a person's daily intake of nitrite comes from nitrate in green, leafy vegetables or root vegetables, such as lettuce, spinach and carrots and drinking water [**Furukawa *et al.*, (2000)**]. Nitrites could potentially react in the stomach with certain chemicals that are released during protein digestion to produce a chemical known as N-nitrosamine which has been associated with different pathological changes including growth retardation [**Prasad, (1983)**], methaemoglobinaemia accompanied with hematological changes [**Miasoedova & Nazarov (2004) and Helal & Elsaid (2006)**], impairment of certain defense mechanisms like the inflammatory response and tissue injury [**Désaint-Blanquot *et al.*, (1983)**], carcinogenesis [**Choi (1985)**], endocrine disturbance [**Jahries *et al.*, (1986)**] and tumors of the liver, esophagus, kidney, nasal, stomach, small intestine and nervous system as well as lymphoid system [**Anthony *et al.*, (1994) and Hassan (2007)**].

Moreover, synthetic food colorants are an important characteristic and selection criterion for food choice. Among these colors is sunset yellow which is used in the textile, printing, paper manufacturing, pharmaceutical and food industries [**Chung *et al.*, (1992)**]. These food colorants have side effects, including urticaria, genotoxic, clastogenic and carcinogenic [**Combes & Haveland–Smith, (1982)**], hyperactivity (**Wender, 1980**) and behavioral disorders in children [**Pollock & Warner (1990)**], endocrinal disturbances [**Jennings *et al.*, (1990)**].

On the other hand, interest in medicinal plants has burgeoned due to increased efficiency of new plant–derived drugs and the growing interest in natural products. Black seed *(Nigella sativa)* is an amazing herb with a rich historical and religious background. It exhibits hypotensive, bronchodilator and immuno potentiating properties [Al-

Hader *et al.*, (1993)] in addition to antibacterial, anti-inflammatory and analgesic activities **[Khanna *et al.*, (1993)] as well as** hypoglycemic effects **[Bamosa *et al.*, (1997)]**. Interestingly, it contains components with strong antioxidant activity **[Burits & Bucar, (2000)]**.

Alternatively, honey is one of the oldest medicines known **[Zumla & Lulat, (1989)]**. Honey is a by-product of bees comprised of monosaccharides (glucose and fructose), vitamins A, B-complex, C, D, E, K and beta-carotene, as well as minerals and enzymes **[Leigh-Broadhurst, (1999)]**. The use of honey as a therapeutic substance has been rediscovered by the medical profession and is gaining acceptance as an antibacterial treatment of topical infections resulting from burns and wounds **[Abuharfeil *et al.*, (1999)]**. It has also been found to be effective in treating bacterial gastroenteritis in infants **[Hodgson (1989)]**. Furthermore, honey has antioxidative and radical scavenging properties **[Aljadi & Kamaruddin (2004)]**.

Therefore, the present study tried to throw the light on the adverse effects of some food additives such as sodium nitrite (as preservative) and sunset yellow (as color) on growth rate and some haematological parameters in rats. Furthermore, the study extended to show if black seeds and honey can counteract the proposed toxic effects of these additives, and hence offer more safety health.

MATERIAL AND METHODS

Materials:

Food additives [sodium nitrite ($NaNO_2$) and sunset yellow (SSY)] were purchased from Sigma Chemical Company. Black seed (BS) and bees honey (BH) were obtained from local herb market. Food additives were given concomitantly in the form of freshly prepared aqueous solution of $NaNO_2$ in a dose equal 10 mg $NaNO_2$/kg /day according to **[Helal & Abdel Rahman (2005)]** using the stomach tube, while sunset yellow was supplemented in diet at a dose equal 0.6% w/w according to **[Tanaka (1996)]**.

Regarding black seed powder, it was given to the rats with diet in a dose equal 4% w/w according to **[Ghanem *et al.* (2000)]**. Meanwhile, honey was administrated to rats as an aqueous solution at a dose of 2.5g/kg /day according to **[Yamada *et al.* (1999)]** using stomach tube. Both black seed and honey were freshly prepared daily and given each alone or in combination, simultaneously with the food additives for 30 days.

Experimental design:

Forty eight male albino rats weighing about 100-140g were used in this study. Animals were housed in stainless steel cages, fed on commercial rat chew and offered water. The animals were divided into eight groups 6 rats each, as follows:

Group 1: Control group: the animals received basal diet.

Group 2: Black seed treated group: the animals received black seed powder.

Group 3: Honey treated group: the animals received bees honey.

Group 4: Black seed and honey treated group: the animals received black seed powder in addition to bees honey.

Group 5: Sodium nitrite and sunset yellow treated group: the animals received sodium nitrite plus sunset yellow.

Group 6: Sodium nitrite and sunset yellow + black seed treated group: The animals received sodium nitrite plus sunset yellow and black seed powder.

Group 7: Sodium nitrite and sunset yellow + honey treated group: The animals received sodium nitrite plus sunset yellow and bees honey.

Group 8: Sodium nitrite and sunset yellow + black seed + honey treated group: The animals received sodium nitrite plus sunset yellow and black seed powder, in addition to bees honey.

Sampling:

Animals in each group were weekly weighed and the percent of change in the mean total body weight relative to that recorded at the beginning of the experiment (zero time) was calculated. At the end of the experimental period, overnight fasted animals were sacrificed and two blood samples were collected. The first blood sample was collected in non heparinized glass centrifuge tubes, and centrifuged for 15 min at 1000xg. Serum was then separated and stored in deep freezer till further biochemical analysis. Total protein was estimated according to the method of Henry (1964) using diamond diagnostic kit. In addition thyroid hormones [triiodothyronin (T_3) and thyroxine (T_4)] levels were measured according to the methods of Hollander and Shenkman (1974) ; Prince and Ramsden (1977), respectively, using total T_3 and T_4 kits obtained from United States, contact DPC's. The second blood sample was collected on EDTA as anticoagulant for the determination of some hematological parameters, including red blood cells (RBCs), white blood cells (WBCs) and blood platelets (PLTs) as well as the determination of hematocrit percent (Hct%), hemoglobin content (Hb), mean corpuscular volume (MCV) and mean corpuscular haemoglobin (MCH). These parameters were determined using an automated hematological analyzer (Hemocel 1600) [**Dacie and Lewis, (1991)**]. In addition, the liver was separated, cleaned as rapidly as possible; then, small pieces of liver were weighed, homogenized in ice cold saline solution and frozen at –20°C for subsequent biochemical analysis.

Statistical analysis:

The results obtained in the present study were evaluated by One Way ANOVA (analysis of variance) test and post comparison was carried out with *Tukey test*. The results were expressed as means ± standard error (SE). The values of $p \leq 0.05$ were considered statistically significant [**Snedecor & Cochran, (1989)**].

RESULTS

The present data (Figure 1) showed gradual increase in percent of change in body weight gain in all rat groups. However, the ascending percent of change in body weight gain was greater in normal rats treated with black seeds or honey in single or in combination than that recorded in the control one. Meanwhile, there was growth retardation in $NaNO_2$ + sunset yellow group where the percent of change in body weight gain was lower than the control group. Conversely, there was pronounced improvement in percent of change in body weight gain in groups treated with $NaNO_2$ + sunset yellow and fed on black seeds or honey alone or in combination.

The data (Table 1) illustrated also significant decline in serum and liver total protein content by -32.5% and -57.6%, respectively in $NaNO_2$ + sunset yellow rats group if compared with control group. However, there was no change in serum total protein, but significant increase in liver total protein content in normal rats fed on black seeds or honey only or both of them. On the other hand, feeding the rats treated with $NaNO_2$ + sunset yellow on black seed or honey each alone or in combination caused significant increases in serum total protein content by +25.7%, +21.4% and +33.9%, respectively and liver total protein content by +91.1%, +87.2% and +99%. respectively compared to $NaNO_2$ + sunset yellow group.

Concerning thyroid hormones, the data showed that serum T_3 and T_4 levels increased significantly by +56.3% and +151% in $NaNO_2$ + sunset yellow group comparing to control group. However, for normal rats fed on black seed or honey only or both, there was no change in both T_3 and T_4 expect for T_4 in rats treated with black seed only. On the other hand, when $NaNO_2$ + sunset yellow treated rats fed on black seeds or honey each alone or both of them, the data showed significant reduction in T_3 by-24%, -25.9% and -25.9% and T_4 by -33.3%, -34.9% and -39%, respectively comparing to $NaNO_2$ + sunset yellow group.

Regarding the hematological parameters recorded (Table 3), there were marked decrease in both RBCs and platelets count with percent of change -18.3% and –34.7 %, respectively in $NaNO_2$ + sunset yellow treated group, while, WBCs count was significantly increased by + 55.8% comparing with control one. The count of RBCs, WBCs and platelets was higher than the control group in normal rats treated with black seed or honey in single or in combination. On the other hand, when $NaNO_2$ + sunset yellow treated rats fed on black seed and honey each alone or both of them the result recorded a pronounced improvement in RBCs count (significant increase by +12.1%, +22.4% and +24.1% respectively), WBCs count (significant decrease by –27.6%, –28.3% and –29.5% respectively) and platelets count (significant increase by +36.8%, +38.3% and +43.5% respectively) comparing to $NaNO_2$ + sunset yellow group.

Furthermore, the data recorded in Table 4 showed significant decrease in Hb content, Hct % and MCH, as well as non significant decrease in MCV value in rats recieved $NaNO_2$ + sunset yellow by -30.8%, -20.8%, -15.3% and -3.1% respectively, comparing with control group. Whereas, non significant increase was seen in normal rats treated with black seed or honey in single or in combination expect for Hb content in honey group as well as Hb content and Hct% in the black seed plus honey treated group comparing to control group. Also the data indicated pronounced improvement in Hb content (+25.3%, +38.5% and +40.9%), Hct % (+16.7%, +26.3% and +29.4), MCV value (+4.3%, +3.2% and +4.4%) and MCH value (+11.8%, +12.5% and +13.2%) in rats treated with $NaNO_2$ + sunset yellow and fed on black seed or honey or both of them, respectively, comparing with $NaNO_2$ + sunset yellow group. However, t improvement was non significant regarding MCV.

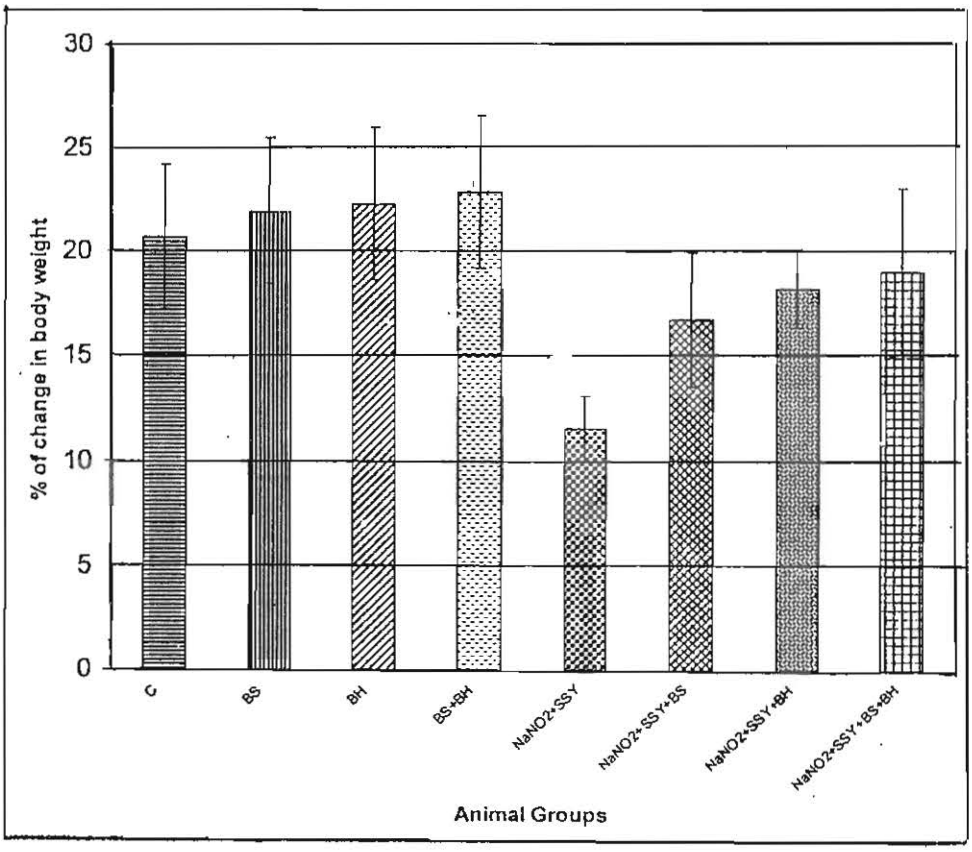

Fig. (1): Percent of Change in Body Weight Gain in Control and Different Treated Rat Groups.

C: Control BS: Black seed
BH: Bees honey SSY: Sunset yellow $NaNO_2$: Sodium nitrite

Table (1): Serum and Liver Total Protein (TP) in Control and Different Treated Rat Groups.

			Animal Groups								ANOVA
			C	BS	BH	BS+ BH	$NaNO_2$ + SSY	$NaNO_2$ + SSY + BS	$NaNO_2$ + SSY + BH	$NaNO_2$ + SSY + BS + BH	P
Serum TP (g/dl)	Mean ±SE		8.3 ±0.19	8.9 ±0.22	8.4 ±0.16	8.9 ±0.27	5.6 ±0.12 [a]	7 ±0.10 [ab]	6.8 ±0.08 [ab]	7.5 ±0.25 [b]	P<0.05
	% of change	*		+7.2	+1.2	+7.2	-32.5	-15.1	-18.1	-9.6	S
		**						+25.7	+21.4	+33.9	
Liver TP (mg/g)	Mean ±SE		24.1 ±0.11	26.2 ±0.04 [a]	25.7 ±0.07 [a]	26.8 ±0.14 [a]	10.2 ±0.04 [a]	19.5 ±0.11 [ab]	19.1 ±0.09 [ab]	20.3 ±0.13 [ab]	P<0.05
	% of change	*		+8.7	+6.6	+11.2	-57.6	-19.1	-20.7	-15.7	S
		**						+91.1	+87.2	+99	

Results are presented as means ±SE and % of change (n=6 for each group).
% of change compared to control group (*) or compared to $NaNO_2$ + SSY group (**).
Significant change at $p \leq 0.05$ compared to control group ([a]) or compared to $NaNO_2$ + SSY group ([b]). S: Significant
C: Control. BS: Black seed. BH: Bees honey. SSY: Sunset yellow.

Table (2): Serum Triiodothyronin (T_3) and Thyroxine (T_4) levels in Control and Different Treated Rat Groups.

			Animal Groups								ANOVA
			C	BS	BH	BS+ BH	$NaNO_2$ + SSY	$NaNO_2$ + SSY + BS	$NaNO_2$ + SSY + BH	$NaNO_2$ + SSY + BS + BH	P
T_3 (ng/dl)	Mean ±SE		114 ±3.1	113.7 ±1.5	113.1 ±2.8	107.5 ±1.7	178.2 ±0.45 [a]	135.4 ±0.48 [ab]	131.9 ±1.3 [ab]	131.9 ±1.5 [ab]	P<0.05
	% of change	*		-0.26	-0.78	-5.7	+56.3	+18.7	+15.7	+15.7	S
		**						-24	-25.9	-25.9	
T_4 (µg/dl)	Mean ±SE		4.9 ±0.17	4.9 ±0.20	4.6 ±0.06	4.5 ±0.05	12.3 ±0.50 [a]	8.2 ±0.32 [ab]	8.0 ±0.12 [ab]	7.5 ±0.27 [ab]	P<0.05
	% of change	*		0	-6.1	-8.1	+151	+67.3	+63.2	+53	S
		**						-33.3	-34.9	-39	

Results are presented as means ±SE and % of change (n=6 for each group).
% of change compared to control group (*) or compared to $NaNO_2$ + SSY group (**).
Significant change at $p \leq 0.05$ compared to control group ([a]) or compared to $NaNO_2$ + SSY group ([b]). S: Significant
C: Control. BS: Black seed. BH: Bees honey. SSY: Sunset yellow.

Table (3): Red Blood Cells (RBCs), White Blood Cells (WBCs) and Platelets Counts in Control and Different Treated Rat Groups.

			Animal Groups								ANOVA
			C	BS	BH	BS+ BH	$NaNO_2$ + SSY	$NaNO_2$ + SSY + BS	$NaNO_2$ + SSY + BH	$NaNO_2$ + SSY + BS + BH	P
RBCs ($10^6/\mu L$)	Mean ±SE		7.1 ±0.16	7.2 ±0.15	7.4 ±0.13	7.6 ±0.15	5.8 ±0.13 [a]	6.5 ±0.18 [b]	7.1 ±0.10 [b]	7.2 ±0.14 [b]	P<0.05
	% of change	*		+1.4	+4.2	+7	-18.3	-8.4	0	+1.4	S
		**						+12.1	+22.4	+24.1	
WBCs ($10^3/\mu L$)	Mean ±SE		10.2 ±0.16	10.4 ±0.15	10.4 ±0.15	10.5 ±0.10	15.9 ±0.11 [a]	11.5 ±0.06 [ab]	11.4 ±0.06 [ab]	11.2 ±0.07 [ab]	P<0.05
	% of change	*		+1.9	+1.9	+2.9	+55.8	+12.7	+11.7	+9.8	S
		**						-27.6	-28.3	-29.5	
Platelets ($10^3/\mu L$)	Mean ±SE		230.5 ±2.4	247.2 ±1.6 [a]	252.7 ±2.1 [a]	272.5 ±1.4 [a]	150.5 ±	206.0 ±1.3 [ab]	208.2 ±1.3 [ab]	216 ±0.93 [ab]	P<0.05
	% of change	*		+7.2	+9.6	+18.2	-34.7	-10.6	-9.6	-6.2	S
		**						+36.8	+38.3	+43.5	

Results are presented as means ±SE and % of change (n=6 for each group).
% of change compared to control group (*) or compared to $NaNO_2$ + SSY group (**).
Significant change at $p \leq 0.05$ compared to control group ([a]) or compared to $NaNO_2$ + SSY group ([b]). S: Significant
C: Control. BS: Black seed. BH: Bees honey. SSY: Sunset yellow.

Table (4): Hemoglobin (Hb) Content, Haematocrit Percent (Hct %), Mean Corpuscular Volume (MCV) and Mean Corpuscular Hemoglobin (MCH) in Control and Different Treated Rat Groups.

			Animal Groups								ANOVA
			C	BS	BH	BS+ BH	$NaNO_2$ + SSY	$NaNO_2$ + SSY + BS	$NaNO_2$ + SSY + BH	$NaNO_2$ + SSY + BS + BH	P
Hb (g/dl)	Mean ±SE		12.0 ±0.07	12.2 ±0.08	12.6 ±0.07 [a]	13.0 ±0.12 [a]	8.3 ±0.09 [a]	10.4 ±0.14 [ab]	11.5 ±0.15 [b]	11.7 ±0.16 [b]	P<0.05
	% of change	*		+1.6	+5	+8.3	-30.8	-13.3	-4.1	-2.5	S
		**						+25.3	+38.5	+40.9	
Hct %	Mean ±SE		40.8 ±0.60	41.8 ±0.95	42.9 ±0.73	44.3 ±0.43 [a]	32.3 ±0.72 [a]	37.7 ±0.64 [b]	40.8 ±0.60 [b]	41.8 ±1.1 [b]	P<0.05
	% of change	*		+2.4	+5.1	+8.5	-20.8	-7.5	0	+2.4	S
		**						+16.7	+26.3	+29.4	
MCV (fL)	Mean ±SE		57.4 ±0.94	58.1 ±1.5	57.9 ±1.4	58.2 ±1.4	55.6 ±0.69	58.0 ±1.3	57.4 ±1.4	58.1 ±1.6	P>0.05
	% of change	*		+1.1	+0.87	+1.3	-3.1	+1	0	+1.1	NS
		**						+4.3	+3.2	+4.4	
MCH (pg)	Mean ±SE		16.9 ±0.41	16.9 ±0.27	17.0 ±0.25	17.1 ±0.33	14.3 ±0.20 [a]	16.0 ±0.47 [b]	16.1 ±0.40 [b]	16.2 ±0.31 [b]	P<0.05
	% of change	*		0	+0.76	+1.1	-15.3	-5.3	-4.7	-4.1	S
		**						+11.8	+12.5	+13.2	

Results are presented as means ±SE and % of change (n=6 for each group).
% of change compared to control group (*) or compared to $NaNO_2$ + SSY group (**).
Significant change at $p \leq 0.05$ compared to control group ([a]) or compared to $NaNO_2$+ SSY group ([b]). S: Significant
C: Control. BS: Black seed. BH: Bees honey. SSY: Sunset yellow.

DISCUSSION

Recently the use of synthetic food additives was increased and the levels of human exposure to such agents are very broad, thus feeding over long period may continually possess potential hazards to the human health through two entirely separate aspects; the direct toxicity and the formation of carcinogenic N-nitrosocompounds **[Krula *et al.*, (2004) and Yamagishi *et al.*, (2006)]**. On the other hand, there is good evidence that the dietary factors play a key role in alleviating the hazard effects of these toxic compounds, maintaining the human health.

In the present study, the results recorded growth retardation in rats treated with $NaNO_2$ plus sunset yellow. This reduction in body weight gain may be attributed to the decrease of food consumption [**Grant & Bulter, (1989)**] or may be due to the increased catabolic processes [**Helal *et al.*, (2003)**]. Furthermore, this observation may be due to abnormal regulation of enzymes prompting the digestion of the main nutrients in the small intestine **[Park *et al.*, (1999)]** or a reduction in the activity of the digestive enzymes due to $NaNO_2$ administration **[Timofeeva *et al.*, (1995)]**, this is in addition to the possible alteration of gastric mucosal absorption **[Bruning–Fann & Kaneene, (1993)]**. However, the observed hyperthyroidism indicated by the elevation of thyroid hormones (T_3 nd T_4) and the deficiency in total protein content recorded in the present study are more likely to explain the reduction in the body weight gain in rats fed on the food additives.

On the other hand, the administration of black seed caused an improvement in body weight gain. This result is in accordance with the findings of [**Nair *et al.* (1996) and Kanter *et al.* (2005)**] who reported that the substitution of black seeds in diet raise the growth rate of rats. The observed increase in body weight gain may indicate an increase in food consumption **[Harris & Jones, (1991)]** indicating the appetizer action of black seeds **[Nadkarni (1976)]** and reflects the ameliorative properties of black seeds for the catabolic effects of both $NaNO_2$ and sunset yellow **[Helal *et al.*, (2003)]**.

An improvement in the body weight gain was also observed after honey administration. This result is in harmony with **[Borhany (2006)]** who found that the patients given 100 to 150 g/day of honey exhibited a considerable improvement in body weight gain. This finding may be due to the appetizer action of honey **[Yan *et al.*, (2002)]** and the beneficial effects of honey on gastro intestinal tract **[Williams (2004) and Borhany (2006)]**.

The current results indicated significant reduction in serum and liver total protein contents in rats treated by $NaNO_2$ plus sunset yellow. These results is in agreement with other previous studies **[Helal *et al.* (2003) and Helal & Abdel Rahman (2005)]**. The harmful effect of nitrite on the biosynthesis of protein could be attributed to the stimulatory effect of nitrite on the thyroid and adrenal glands leading to the block of protein synthesis while fast breakdown occur. This leads to an increase of free amino acids and a decrease of protein turnover **[Eremin & Yocharina (1981) and Yanni *et al.*, (1991)]**. Another suggestions is that sodium nitrite decreased total serum protein mainly through its direct effect on the liver only or through inhibiting oxidative phosphorylation process and hence the availability of the energy source for protein synthesis and other metabolic processes **[Anthony *et al.*, (1994)]**, or through the necrotic changes especially of the plasma membranes **[Guler *et al.*, (1994)]**. Furthermore, lowered serum total protein levels may be attributed to the toxic effect of N-nitroso compounds. Nitrosamines are electrophilic substances join to the nucleic acids and to the nucleophilic atoms that are found in proteins and may be inhibit protein synthesis **[Ahmed & Mannaa (2000)]**.

On the other hand, administration of black seeds caused marked elevation in serum and liver total proteins. These results is similar to the finding of **[Abdel-Salam (2002)]** who reported that the supplementation of black seed in diet to rats revealed remarkable protection in the total protein content. Similar findings were, also, obtained by other investigators **[Badary *et al.*, (2000) and Helal *et al.*, (2003)]**. The elevation in total protein may be due to that black seeds are good source of protein **[Takruri & Dameh (1998)]**. This effect reflected the ability of black seeds to protect protein manufacturing machinery from $NaNO_2$ and sunset yellow- induced cellular damage **[Helal *et al.*, (2003)]**.

The administration of honey elevated serum and liver total protein contents. These results is in harmony with **[El- Khayat & Ahmed**

(2000)] who recorded elevated serum protein level in normal mice and healthy sheep after administration of honey. This effect may be due to that honey is a good source of proteins and amino acids **[Nasuti *et al.*, (2006)]**. However, honey contains about 0.2% proteins as enzymes (α-amylase, glucose oxidase and phosphatase) especially catalase which act as a good antioxidant **[Anklam (1998)]**.

Additionally, the present results showed a variable degree of stimulation of thyroid gland function as indicated by significant increase in serum thyroid hormones (T_3 and T_4) in rats treated by $NaNO_2$ plus sunset yellow. Similar results obtained by **[Al-Ayed (2000) and Helal & Abdel Rahman (2005)]** who showed that $NaNO_2$ ingestion increased thyroid T_3 and T_4 hormones. However, the mechanism by which sodium nitrite altered thyroid function need further investigation. It could be proposed that nitrite may enhance intrathyroidal synthesis of thyroid hormones and increase the extra thyroidal conversion of T_3 and T_4. Also, nitrites may attenuate the binding capacity of thyroid binding proteins for thyroid hormones **[Heibashy & Abd El- Moncim, (1999)]**. Elsewhere, the interaction between $NaNO_2$ and sunset yellow, in the present study, may give a new chemical component, which has a stimulatory effect on thyroid gland. This effect could be attributed to its chemical structure than can compete with thyroxin-binding globulin leading to its deficiency and to hyperthyroidism by feed-back mechanism **[Gold & Vladutin (1994)]**. Other suggestion is that both T_3 and T_4 are significantly increased because nitrate ion is one of the principal causative of thyroid hypertrophy. The degenerative nitrate ions attack the thyroid and this result in inflammatory action leading to hypertrophy, a states of thyrotoxicity **[Johannes *et al.*, (1994)]**. However, the administration of black seed revealed remarkable protection of thyroid gland function as achieved by the inhibition of T_3 and T_4 hormones. This result is in consistent with **[Helal *et al.* (2003) and Ismail *et al.* (2003)]** who showed that T_3 hormone is improved in rabbits after black seeds administration. This positive effect may be due to the antioxidant property of black seeds through blocking the generation and propagation steps of free radicals and/ or the suppression of lipid peroxidation by beta-carotene content of black seeds **[Al-Jassir, (1992) and Lyama *et al.*, (1996)]**. Also the formation of beta-carotene peroxyl radical may increase the antioxidant activity of beta-carotene **[Tsuchihashi *et al.*, (1995)]**. Simillarly, honey administration showed marked amelioration in T_3 and T_4 hormones level. This result is in accordance with **[Chen *et al.* (1990)]** who found that L-Tyrosine (one of the amino acids in honey) is a building block of the body's proteins and the foundation of the thyroid hormones: T_3 and T_4. Also, the ameliorative effect of honey may be due to its antioxidant action through its zinc and selenium contents **[Jamoussi *et al.*, (1996)]**. Selenium is needed in the process of converting T_4 hormone to T_3 in the liver and kidney **[Schrauzer & Sacher, (1994)]**. Zinc, also, is an essential enzyme cofactor in several metabolic pathways, and it affects the formation of thyroid hormones **[Kralike, (1996)]**. Honey may possibly protect thyroid hormones through increasing glutathione and N-acetylcysteine since, glutathione like other free radical scavengers, offers protection in the body's process of converting T_4 to T_3 and N-acetylcysteine is a precursor of glutathione that assists the optimization of this metabolite **[Brzezinska-Slebodzinska & Pietras, (1997)]**.

The obtained results also indicated numerous changes in the hematological parameters in rats treated with $NaNO_2$ plus sunset yellow, reflecting the adverse effects of these materials. Similar results were obtained by **[Helal (2001) and Helal *et al.* (2003)]** who found significant decrease in RBCs count, Hb content and Hct % in rats fed on mixture of $NaNO_2$ and sunset yellow. The disturbed hematological parameters suggested that there is an etiologic relationship between nitrosamine (resulted from nitrite) and anemia through different suggested mechanisms such as bone marrow cells destruction and decrease or delay in mitosis **[Hall, (2001)]**. The disturbances in RBCs count often reflect an imbalance between its production and loss, non regenerative anemia arises from reduced erythrocyte production. However, nitrite- induced dysfunction of the kidney **[Sidney (1986); Hassan (2007)**; liver **Park *et al.*, (1999) and Helal & Elsaid, 2006)]** and endocrine system **[Jahries *et al.*, (1986)]** may have a negative effect on erythropoiesis and erythrocyte survival, and can be associated with anemia characterized by a low RBCs count but normal mean corpuscular volume (MCV). Non regenerative anemia is often a feature of leukemia because of competition between proliferating neoplastic and normal hematopoietic cells for nutrients and space in bone marrow [**Derelanko & Hollinger** (1995)].

Moreover, the obtained reduction of Hb content, Hct% and MCH may be due to that nitrites convert the ferrous ions of Hb to ferric ions [**Ganong (1997)**]. In other words, administration of both nitrite and sunset yellow may lead to hematopoietic tissue hypoxia resulting in a decrease of RBCs production and, hence, to reduction of Hb content [**Helal** *et al.*, **(2003)**].

Also, the obtained disorders occurred in blood corpuscles and other blood indices in rats treated with $NaNO_2$ and sunset yellow may be attributed to induction of blood disorders as methemoglobinemia. This suggestion was supported by [**Dmitrenko** ***et al.*** **(1998)**] who reported that the injection of $NaNO_2$ increased the level of methemoglobin (metHb) and hemoglobin- NO complex in blood and liver of rats. In addition, at high nitrite exposure, the reductase system becomes saturated and can no longer cope with metHb formation, leading to ischemia in tissues, cyanosis, irreversible damage to tissues and ultimately to mortality [**Dudley & Solomon, (1993)**]. However, the observed decrease in Hct% may be related to the decreased RBCs count.

Nitrite enters cells via a charge sensitive mechanism. It appears to cross the erythrocyte membrane by more than one mechanism. Simple transmembrane diffusion of NO_2 is probably minimal because of the negative charge of nitrite. However, nitrite initiation and propagation of free radical chain may be considered as the main cause of anaemia and other hematological disturbance [**May** ***et al.*****, (2000) and Michael** ***et al.*****, (2002)**].

Concerning the observed decrease in platelets count, [**Ogur** ***et al.*** **(2000)**] suggested that, this is may be due to nitrate inhibiting bone marrow activity or may be due to decreased production or increased consumption of platelets. Meanwhile the observed increase in WBCs count may be attributed to carcinogenic effects of nitrosamine [**Abdel-Gawad, (2004) and El-Nagar, (2006)**].

The present study illustrated that the administration of black seed caused an improvement in all the studied hematological parameters. Similar findings were reported by [**Meral** ***et al.*** **(2004)**]. The recorded ameliorative effects of black seed for the hematological disturbance could be due to the lowered lipid peroxidation level in cell membranes leading to decreased susceptibility of RBCs to hemolysis [**Meral** *et al.*, **(2004)**]. Black seeds inhibited the elevated count in WBCs in $NaNO_2$ plus sunset yellow treated rats possibly due to the presence of fixed oil of black seeds and derived thymoquinone which were found to inhibit ecosanoid generation in leukocytes and the carcinogenic effect of nitrite through its antioxidant properties [**Badary** *et al.*, **(2000)**].

The obtained improvement in hematological parameters by honey administration is in accordance with [**Al-Waili (2003)**] and [**Borhany (2006)**]. This improvement may be due to that honey prevent free radicals induced damage through its antioxidant activity achieved by its various phytochemical contents [**Frankel** *et al.*, **(1998)**]. Ascorbic acid content in honey displays a high antioxidative activity and has a powerful reducing ability particularly for nitrite [**Mirvish** *et al.*, **(1972)**]. Furthermore, vitamin E (α-tocopherol) from honey acts as powerful antioxidant that provides protection against carcinogenicity of nitrosamines [**Kolaja & Klaunig (1997)**].

In conclusion, the results obtained in the present study revealed a highly adverse action of the co-administration of nitrite and sunset yellow on growth rate and the hemato-biochemical parameters in rats However, the dietary black seeds or honey have an effective role in protecting these harmful effects through their natural antioxidants and essential nutrient components. The treatment by honey seems more effective than black seed treatment and the most interesting effect was induced by the combined treatment.

REFERENCES

Abdel-Gawad, M.R.M. (2004): Physiological studies on hepatocellular carcinoma (HCC) in mammls using nuclear techniques. PhD. Thesis. Fac. of Sci., Mansoura Univ.

Abdel-Salam, F.K. (2002): Histochemical and biochemical studies on the influence of an organophosphorus insectiside and *Nigella sativa* on some organs of albino rats. MSc Thesis. Fac. of Sci., Zagazigu Univ.

Abuharfeil, N.; Al–Oran, R. and Abo-Dhehada, M. (1999): The effect of bee honey on the proliferative activity of human B- and T-Lymphocytes and the activity of phagocytosis. Food Agric. Immunol., 11: 169 – 177.

Ahmed, H.H. and Mannaa, F. (2000): Protective effect of vitamins C and E against the toxic action of drinking sodium nitrate contaminated water in adult male rats. J. Egypt. Ger. Soc. Zool., Comparative Physiology, 32(A): 165-185.

Al-Ayed, M.I. (2000): Toxicity of drinking water with different nitrate levels. J. Egypt. Ger. Soc. Zool., Comparative Physiology, 31(A): 197-209.

Al-Hader, A.; Aquel, M. and Hassan, Z. (1993): Hypoglycemic effects of the volatile oil of *Nigella sativa* seeds. Inter. J. Pharm., 31(2): 96 – 100.

Aljadi, A.M. and Kamaruddin, M.Y. (2004): Evaluation of the phenolic content and antioxidant capacities of two Malaysian floral honey. Food Chem., 85: 513 – 518.

Al–Jassir, M.S. (1992): Chemical composition and microflora of black cumin (*Nigella sativa L.*) seeds growing in Saudi Arabia. Food Chem., 45: 239 – 242.

Al-Waili, N.S. (2003): Effects of daily consumption of honey solution on hematological indices and levels of minerals and enzymes in normal individuals. J. Med. Food, 6(2): 135 – 140.

Anklam, E. (1998): A review of the analytical methods to determine the geographical and botanical origin of honey. Food Chem., 63: 549 – 562.

Anthony, M.L.; Gartland, K.P.; Beddell, C.R.; and Lindon, J.K. (1994): Studies on the biochemical toxicology of uranyl nitrate in the rat. Arch. Toxicol., 68(1): 43-53.

Badary, O.A.; Abdel–Naim, A.B.; Abdel–Wahab, M.H. and Hamada, F.M. (2000): The influence of thymoquinone on doxorubicin – induced hyperlipidemic nephropathway in rats. Toxicol., 143(3): 219-226.

Bamosa A.O.; Ali, B.A. and Sowayan, S.A. (1997): Effect of oral ingestion of *Nigella sativa* seed on some blood parameters. Saudi Pharm. J., 5(2-3): 126 – 129.

Borhany, Q. S.A. (2006): Honey: Medicine of the Qur'an for all Diseases (part 2 of 2). Issue: (932), Vol. 14: 1 - 6.

Bruning–Fann, C.S. and Kancene, J.B. (1993): The effects of nitrate, nitrite and N-nitroso compounds on animal health. Vet. Hum. Toxicol., 35: 237 – 253.

Brzezinska-Slebodzinska, E. and Pietras, B. (1997): The protective role of some antioxidants and scavengers on the free radicals-induced inhibition of liver iodothyronine 5'-monodeiodinase activity and thiol content. J. Physiol. Pharm., 48: 451-459.

Burits, M. and Bucar, F. (2000): Antioxidant activity of *Nigella sativa* essential oil. Phytotherapy Res., 14: 323 – 328.

Chen, T.S.; Currier, G.J.; Wabner, C.L. and Gerontol, J. (1990): Intestinal transport during the life span of the mouse. J. Gerantol., 45: 129-133.

Choi, B.C.K. (1985): N-Nitroso compounds and human cancer. a molecular epidemiologic approach. Am. J. Epidermol., 121: 734 - 737.

Chung, K.T.; Stevens, S.E. and Cerniglia; C.E. (1992): The reduction of azo dyes by the intestinal microflora. Crit. Rev. Microbiol., 18(3): 175-190.

Combes, R.D. and Haveland–Smith, R.B. (1982): A review of genotoxicity of food, drug and cosmetic colours and other azotriphenyl methane and xanthene dyes. Mutat. Res.. 98: 101-248.

Dacie, J.V. and lewis, S.M. (1991): Practical Haematology 7th Ed. Basic Haematology Technique Estimation of Red Cell. 41: 47.

Derelanko, M.J.; and Hollinger, M.A. (1995): CRC Handbook of Toxicology. CRC Press, Boca Raton, Fla. Pp. 940 – 948.

Desaint-Blanquot, G.; Fritsch, F. and Cazotles, C. (1983): Effect of dietary nitrate and nitrite on experimentally induced inflammation in the rat. Intern. J. Tissue Reaction, 27: 173-180.

Dmitrenko, N.P.; Ivanitsky, V.A.; Varich, V.Y. and Snoz, S.V. (1998): A combined effect of the nitrogen dioxide and sodium nitrite on the rat organism. Toxicol. Lett., 95 (1): 220 – 221.

Dudley, M. J. and Solomon, T. (1993): A case of methaemoglobinaemia. Arch. Emergency Med., 10: 117 – 119.

El-Khayat, Z. and Ahmed, H.H. (2000): Antitumor efficacy of edible *Portulaca oleracea* and bees honey in mice inoculated with Ehrlich ascites tumor cells. Union. Arab. Biol., Cairo (13A): 583 – 605.

El-Nagar, S.K.M. (2006): Physiological studies on the protective effects of spirulina in dibutylnitrosamine experimentally induced cancer. MSc. thesis. Fac. of Sci., Mansoura Univ. 79 – 93.

Eremin, Y.N.; and Yochorina, M.G. (1981): Effect of nitrites on the thyroid gland of rats in response to different diets of iodine deficiency. Vopr. Pitan., 5: 50-62.

Frankel, S.; Robinson, G.E. and Berenbaum, M.R. (1998): Antioxidant capacity and correlated characteristics of 14 unifloral honeys. J. Apic.Res., 37 (1): 27-31.

Furukawa, F.; Nishikawa, A.; Ishiwata, H.; Takahashi, M.; Hayashi, Y. and Hiros, M. (2000): Renal carcinogenicity of concurrently administrated fish meal and sodium nitrite in F344 rats. J. Can. Res., 91: 139-147.

Ganong, W.F. (1997): Review of Medical physiology. 8th Ed. Libraure Duliban, Appelton of Lone. Lebanon, California, Pp. 296 – 311.

Ghanem, N.F.; Bakr, S.M.E. and Mira, N.M. (2000): The preventive effect of the black seed powder on some pathological changes of the blood cells – induced in rats by a chemical carcinogen. J. Union. Arab. Biol., 14(A): 177 – 195.

Gold, E. and Vladutin, A. (1994): Latrogenic hyperthyroidism of long duration in an individual with thyroxin– binding globulin deficiency. Clin. Chem., 40(12): 2323 – 2324.

Grant, D. and Butler, W.H. (1989): Chronic toxicity of sodium nitrite in the male F 344 rat. Food Chem. Toxicol., 27: 565–571.

Guler, A.H.; Sapan, N.; Ediz, B.; Genc, Z. and Ozkan, K. (1994): Effect of copper on liver and bone metabolism in malnutrition. Turkish, J. pediat., 36(3): 205 – 213.

Hall , R.L. (2001): Principles of Clinical Pathology for Toxicology Studies. In : Hayes , A .W Taylor and Francis , Philadelphia , Principles and Methods of Toxicology , 4th ed , Ch . 21 , Pp . 1001 – 1038.

Harris, R.S. and Jones, W.K. (1991): Physiological response of mature rats to replacement of dietary fat with fat substituted. J. Nutr., 121: 1109 – 1116.

Hassan, H. A. (2007): The possible protective role of bees honey against hazard effects of some synthetic food additives on the kidney functions of male rats. J. Egypt. Soc. Toxicol., 36:13-21.

Heibashy, M.A.; and Abd El–Moneim, A.E. (1999): Blood lipid profile and serum free thyroidal hormone concentrations in growing rats fed diets enriched with sodium nitrite for short and long terms. J. Egypt. Ger. Soc., 30 (A): 93-103.

Helal, E.G.E. (2001): Progressive effects of the interaction of sodium nitrite and sunset yellow on different physiological parameters in albino rats. Egypt. J. Hosp. Med., 2: 23-46.

Helal, E.G.E. and Abdel-Rahman M. (2005): Interaction of sodium nitrite and sunset yellow and its effect on some biochemical parameters in albino rats. Egypt. J. Hosp. Med., 19: 156-167.

Helal, E.G.E. and Abdel-Rahman M. (2005): Interaction of sodium nitrite and sunset yellow and its effect on some biochemical parameters in albino rats. Egypt. J. Hosp. Med., 19: 156-167.

Helal, E. G. E. and Elsaid, F. G. G. (2006): Management the action of sodium nitrite on albino rats by aqueous garlic extract. Res. J. Medic. and Med. Sci., 1(3): 85-89.

Helal, E.G.E.; Zaahkouk, S.A.M. and Rashed, S.Z.A. (2003): Progressive effects of *Nigella sativa* against the interaction of sodium nitrite and sunset yellow in albino rats. Egypt. J. Hosp. Med., 10: 109 – 129.

Henry, R.J. (1964): Determination of Total Protein by Colorimetric Method. Clinical Chemistry, Harper and Row publishers New York . P. 181.

Hodgson, M.J. (1989): Investigation of antibacterial action spectrum of some honeys. MSc thesis, Univ. of Waikato, Newzealand, 83.

Hollander, C.S. and Shenkman, L. (1974): Radio-immunoassays for Triiodothyronnine and Thyroxine. In: Rothfeld B, Ed. Nuclear Medicine in vitro. Philadelphia: Loppincott: 136 – 149.

Ismail, A.E.M.; Abdallah, A.G. and Sedki, A.A. (2003): Influence of black seed, garlic and onion supplementation on reproductive performance in rabbits. Egypt. J. Agric. Res., 81(3): 1193-1207.

Jahries, G.; Hesse, V.I.; Schone, L.H. and Mehnert, E. (1986): Influence of nitrates and plant goitrgens on thyroid hormone, somated in status and growth of swine. J. Vet. Med., 41(15): 528-530.

Jamoussi, B.; Zafaouf., M.; Benand Hassine, B. (1996): Hydride generation/ condensation system with an inductively coupled organ plasma polychromator for sitmultaneous determination of arsenic, antimony, selenium, lead, mercury and tin in honey. Int. J. Environ. Anal. Chem., 61 (3): 249 – 256.

Jennings, A.S.; Schwartz, S.L.; Batter, N.J.; Gardner, D. and Witorsch, T. (1990): Effects of oral erythrosine (2',4',5',7'– tetraiodo-fluorescein) on the pituitary thyroid axis in rats. Toxicol. Appl. Pharmacol., 103: 549-556.

Johannes, M.S.; Van Maanen, J.M.; Van Dijk, A.; Mulder, K.; Mark, H. ; De-Baets, M.H.; Paul, C.A.M.; Van-Der-Heide, D.; Paul, L.; Mertens, J.M. and Kleinnijans, J.C. (1994): Consumption of drinking water with high nitrate levels causes hypertrophy of the thyroid. Toxicol. Lett., 72: 365-374.

Kanter, M.; Coskun, O. and Gurel, A. (2005): Effect of black cumin *(Nigella sativa)* on cadmium oxidative stress in blood of rats. Biol. Trace Elem. Res., 107 (3): 277 – 287.

Khanna, T.; Zaidi, F.A. and Dandiya, P.C. (1993): Cancer and analgesic studies on *Nigella sativa*. Fitoterapia, 64(5): 407 – 410.

Kolaja, K.L.; and Klaunig, J.E. (1997): Vitamin E modulation of hepatic focal lesion growth in mice. Toxicol. Appl. Pharmacol., 143(2): 380 - 387.

Kralike, A.; Eder, K. and Kirchgessner, M. (1996): Influence of zinc and selenium deficiency on parameters relating to thyroid hormone metabolism. Horm. Metabol. Res., 28: 223-226.

Krula, C.A.M.; Marco, J.; Zeilmakerb, R.C.; and Schothorstb, R.H. (2004): Intragastric formation and modulation of N- nitrosodimethlamine in a dynamic in vitro gastrointestinal model under human physiological conditions. Food and Chem. Toxicol., 42: 51.

Leigh-Broadhurst, C. (1999): Bee Products: Medicine from the hive. Nutr. Sci. News, 4(8): 366 – 368.

Lyama, T.; Takasuga, A.; and Azuma, M. (1996): Beta-carotene accumulation in mouse tissues and a protective role against lipid peroxidation. Int. J. Vitam. Nutri. Res., 66(4): 301 - 305.

May, J. M., Qu, Z. C., Xia, L. and Cobb, C.C. (2000): Nitrite uptake and metabolism and oxidant stress in human erythrocytes. Am. J. physiol. Cell Physiol., 279: 1946 –1954.

Meral, I.; Donmez, N.; Baydas, B.; Belge, F. and Kanter M. (2004): Effect of *Nigella sativa L.* on heart rate and some hematological values of alloxan – induced diabetic rabbits. Scand. J. Lab. Anim. Sci., 31(1): 49 – 53.

Miasoedova, E.E. and Nazarov, S.B. (2004): The response of erythrocytic system of mature rats to acute nitrite intoxication. Patol Fiziol EKsp Ter., 2: 16 – 18.

Michael, C.; Kohn-Ronald, L.; Frank, Y.E. and Christopher, J. P. (2002): Pharmacokinetics of sodium nitrite - induced methemoglobinemia in the rat. Drug Metabol. Dispos., 30(6): 676 - 683.

Mirvish, S.S.; Wallcave, L.; Eagen, M. and Shubik, P. (1972): Ascorbate- nitrite reaction: possible means of blocking the formation of carcinogenic N-nitroso compounds. Sci. 177: 65 – 68.

Nadkarni, K.M. (1976): Indian Material Medica. Bombay popular prakashan. Vol. I: 85.

Nair, S.C.; Salomi, M.J. and Panikkar, K.R. (1996): Modulatory effects of *Crorcus sativus* and *Nigella sativa* extracts on cisplatin–induced toxicity in mice. J. Ethnopharm., 31(1): 75 – 83.

Nasuti, C.; Gabbianelli, R.; Falcioni, G. and Cantalamessa, F. (2006): Antioxidative and gastroprotective activities of anti-inflammatory formulations derived from chestnut honey in rats. Nutr. Res., 26: 130 - 137.

Ogur, R.; Korkmaz, A. and Hasde, M. (2000): Effects of high nitrate intake in rats. J. Basic Clin. Physiol. pharm., 11(1): 47 – 56.

Park, C.S.; Baek, H.M. and Chung, W.G. (1999): Suppression of flavin containing monooxygenase by over produced nitric oxide in rat's liver. Mol. Pharm., 56(3): 504 - 507.

Park, D.V. and Lewis, D.F. (1992): Safety aspects of food perservatives. Food Addit. Contam., 5: 561-577.

Pollock, I. and Warner, J.O. (1990): Effect of artificial food colors on childhood behavior. Arc. Dis. Child. 65: 74–77.

Prasad, J. (1983): Effect of high nitrate diet on thyroid glands in goats. Ind. J. Animal Sci., 53(7): 791 – 794.

Prince, H.P. and Ramsden, D.B. (1977): A new theoretical description of the binding of thyroid hormones by serum proteins. Clin. Endocrinol., 7: 307 – 324.

Schrauzer, G.N. and Sacher, J. (1994): Selenium in the maintenance and therapy of HIV-infected patients. Chemico – Biol. Interact., 91: 199 - 205.

Sidney, S.M. (1986): Effects of vitamins C and E on N-nitroso compounds formation. carcinogenesis and cancer. Can., 58: 1842 - 1850.

Snedecor, G.W. and Cochran, W.G. (1989): Statistical Methods 7th ed. The State University Press Ametican, Iowa. P. 593.

Takruri, H.M.H and Dameh, M.A.F. (1998): Study of the nutritional value of black cumin seeds (*Nigella sativa L.*). J. Sci. Food Agric., 76: 404 – 410.

Tanaka, T. (1996): Reproductive and neurobehavioral effects of sunset yellow FCF administered to mice in the diet. Toxicol. Ind. Health, 12 (1): 69 –79.

Timofeeva, N.M.; Iezuitova, N.N.; Egorova, V.V.; Nikitina, A.A. and Starchenkov, S.V. (1995): The effect of sodium nitrate on the digestive enzyme activity of the small intestine. liver and kidneys of rats. Fiziol. Zh. Im. I. M. Sechenova. 81(1): 72 - 80.

Tsuchihashi, H.; Kigoshi, M.; Iwatsuki, M.; and Niki, E. (1995): Action of beta-carotene as an antioxidant against lipid peroxidation. Arch. Biophys., 323(1): 137.

Wender, E. H. (1980): New evidence on food additives and hyperkinesis. Am. J. Dis. Child, 134: 1122 - 1124.

Wiliams, M.N.D. (2004): Honey reduces heart disease risk. J. Med. Food, 1: 100 – 107.

Yamada, S.; Itoh, E.; Murakami, Y. and Asano, M. (1999): Prevention of ethanol – induced erythrocyte transformations by fructose and natural honey in low alcohol tolerance mice. Pathophysiol., 6: 163 – 170.

Yamagishi, K. Y.; Okazaki, M. K.; Furukawa, F. ; Imazawa, T. ; Nishikawa, A. and Hirose, M. (2006): Lack of enhancing effects of sodium nitrite on 2-amino-1-methyl-6-phenylimidazo[4,5-b]pyridine (PhIP)-induced mammary carcinogenesis in female Sprague-Dawley rats. Cancer Lett., 235(1): 69 -74

Yan, X.; Murphy, B.T.; Hammond, G.B.; Vinson, J.A. and Neto, C.C. (2002): Antioxidant activities and antitumor screening of extracts from cranberry fruit (*Vaccinium macrocarpon*). J. Agric. Food Chem., 50: 5844 – 5849.

Yanni, M.; Abdel–Dayem, S.M.; and Abdel–Azim, B.H. (1991): Biochemical and histological changes due to preservatives in rats. Egypt. J. Histol., 14(2): 431- 440.

Zumla, A. and Lulat, A. (1989): Honey a remedy rediscovered. J. Roral Soc. Med., 82: 384 – 385.

التأثيرات الضارة لبعض الإضافات الغذائية على معدل النمو وبعض المعايير الكيموحيوية والدموية في ذكور الجرذان البيضاء: دور الحبة السوداء و عسل النحل كعوامل وقائية

هناء على حسن - وفاء محمد الخولى - سمر السيد نور
قسم علم الحيوان - كلية العلوم - جامعة المنصورة

لاشك أن الاستخدام الواسع للنيتريت (nitrite) والصن ست الاصفر (sunset yellow) كإضافات غذائية يؤدى الى تكوين مواد سامة أو مسرطنة لها العديد من الاضرار. ومن ناحية أخرى فأن استخدام مواد طبيعية مثل حبة البركة وعسل النحل كعوامل مضادة للاكسدة قد يقلل هذه الاضرار. ولذلك يهدف هذا البحث الى توضيح التأثيرات السيئة لهذه الإضافات الغذائية وخاصة على النمو وبعض الدلائل الدموية والكيموحيوية بالإضافة الى توضيح ما قد يكون لحبة البركة و عسل النحل من دور فى الوقاية أو الحد من هذه التأثيرات. ولذا فقد تم اعطاء ذكور جرذان بالغة نيتريت الصوديم (١٠مجم لكل كجم من وزن الجسم) وصن ست الاصفر (٠,٠٦%) يوميا لمدة ٣٠ يوم:

و قد أسفرت النتائج عن مايلى:

- نقص فى وزن الجسم للجرذان.
- انخفاض مستوى البروتين الكلى فى المصل و الكبد.
- ارتفاع هرومانات الغدة الدرقية فى الدم.
- نقص فى عدد كرات الدم الحمراء والصفائح الدموية.
- نقص مستوى الهيموجلبين ونسبة Hct% و كذلك مستوى MCV ، MCH.
- ارتفاع عدد كرات الدم البيضاء.

وباستخدام الحبة السوداء (٤% فى الوجبة الغذائية) وعسل النحل (٢,٥ جم لكل كجم من وزن الجسم) مع نيتريت الصوديم وصن ست الاصفر يوميا لمدة ٣٠ يوم لوحظ تحسن كبير فى كل هذه القياسات و التى قد تصل الى المعدلات الطبيعية. و لذلك توصى هذه الدراسة باستخدام حبة البركة و/ أو عسل النحل كاضافات غذائية مفيدة للمنع او الحد من الاختلالات الناجمة عن استخدام بعض الاضافات الغذائية مثل النيتريت وصن ست الاصفر ذات التأثيرات الضارة على أعضاء الجسم الحيوية و توضح ايضا ان عسل النحل أظهر فعالية أكبر من حبة البركة و أن استخدام حبة البركة مع عسل النحل كان لها التأثير الأمثل.