



EFFECT OF EGYPTIAN CORN SILK POWDER SUPPLEMENTATION TO DIET ON SOME BLOOD PARAMETERS, LIVE BODY WEIGHT AND LIVER HISTOLOGY OF BROILER CHICKENS FED SLAUGHTER-HOUSES BY-PRODUCT

[17]

Fanoush¹, A.A.A.; S. El-Hady²; I. El-Wardany² and N.E. Ali²

1- Ministry of Agric. Giza, Egypt.

2- Agric. Biochemistry Dept., Fac. of Agric., Ain Shams Univ., Cairo, Egypt.

Keywords: Blood parameters, Corn silk and Growth Broiler chicks

ABSTRACT

The present study was conducted to evaluate the beneficial effects of corn silk powder addition to chicks diets containing poultry slaughter houses by- products (SH). A total number of 120 chicks were divided into five experimental groups of 24 chicks each in three replicates of 8 chicks. The first group was fed the basal control diet, the second and third groups were fed the basal diet supplemented with 3 and 6% of SH, while the fourth group was fed the basal diet supplied with 6% SH plus 1.5% corn silk powder (CSP) and the fifth group was fed the basal diet with 1.5% corn silk powder.

Live body weight and some blood parameters were recorded. Liver sections were examined to detect any histopathological signs of hepatic damage.

Results showed that malondialdehyde (MDA) levels were significantly decreased in CSP treatment groups compared with the control unsupplemented group. The level of alanine aminotransferase (ALT) and aspartate aminotransferase (AST) were significantly increased in the SH-fed chicken especially for those fed the 6% SH-supplemented diet, but the SP addition improved these parameters. Blood urea and creatinine were not significantly affected by different treatments. Live body weight and body weight gain were significantly increased as a result of CSP addition to diets.

Dietary inclusion of 6% SH by-products caused deleterious effects on liver histology including dis-

ruption in the arrangement of hepatocytes, dilation of the portal vein accompanied by the presence of many necrotic and cirrhotic areas, but CSP addition to chicken diet enhances liver histological structure. It is concluded that CSP addition to broiler chicks diet could improve the productive performance of chicks and protect their organs from the deleterious effect of by-products SH contamination.

INTRODUCTION

The maize has been cultivated in Egypt since a lot of centuries. This belonging to the Gramineae family. The production of maize in Egypt was estimated at 5.78 million tons in 2004/2005 (Anonymous, 2005). Corn silk (Maydis Stigma "Zea mays hairs") refers to the stigmas of maize female flowers (Rosli et al 2008). Corn silk has been used in traditional Chinese medicine for the treatment of hypertension, hepatitis, tumor, hyperglycemia, edema as well as for cystitis, gout, kidney stones, nephritis, diabetes mellitus, prostatitis, diuretic, cholagogic, demulcent functions, urethritis and possesses immune enhancing effects (Liu, 1995; Ma & Gao, 1998; Tang et al 1995; Namba et al 1993; Grase et al 1993; Velazquez et al 2005; Ebrahimzadeh et al 2008 and Li & Yu, 2009).

Corn Silk (CS) gives relief and treat human ailments (Ramesh and Okigbo, 2008). Corn Silk (CS) contains a lot of bioactive compounds such as proteins, vitamins, carbohydrates, salts, volatile oils, steroids (sitosterol and stigma sterol), alkaloids, Saponins, tannins, flavonoids, and mineral elements such as (Ca²⁺, K⁺, Mg²⁺ and Na⁺) (Ebrahimzadeh et al 2008 and Buttery et al 1980). CS is an excellent source of many bioactive

(Received 16 May, 2017)

(Revised 23 May, 2017)

(Accepted 25 May, 2017)

constituents for example flavonoids, saponin, alkaloids, tannins, Chlorogenic acid, phytosterol, allantoin, Vitamin E and K (Ebrahimzadeh et al 2008). *Zea mays* several flavonoids, for example maysin, apigmaysin, 3'-methoxymaysin, ax- 4'- OH- maysin, etc, have been isolated and identified (Waiss et al 1979; Elliger et al 1980a and Snook et al 1995). *Zea mays* L. (Gramineae) contain bioactive compound flavone (6,4'- dihydroxy -3'- methoxyflavone -7-O-glucoside) is a yellowish green crystal, soluble in methanol (Angela et al 1997) reported that.

Corn silk (CS) rich with antioxidants activity and polyphenol contents, for tannins and proanthocyanidins which determined Spectrophotometrically (Maksimović & Kovačević, 2003 and Maksimović et al 2005).

Phenolic compounds present in CS are anthocyanins, P-coumaric acid, vanillic acid, protocatechuic acid, derivatives of hesperidin and quercetin, and bound hydroxycinnamic acid forms composed of P- coumaric and ferulic acid (Kaur et al 2006) mentioned that.

These bioactive constituents in corn silk powder is a source of antioxidants activity, polyphenols contents, mineral elements, protein, ash and dietary fibers, therefore encourage could use of corn silk powder be very fruitful in fortifying foods (Arafa et al 2012).

MATERIALS AND METHODS

The present experiment was conducted at the poultry physiology experimental laboratory, Faculty of Agriculture, Ain Shams University. The main objective was to elucidate the impact of corn silk powder (CSP), as a feed additive to broiler chicks diet, in alleviating the deleterious effect (s) of slaughter houses by-product on chicks performance, biochemical constituents of blood and bird's immunity.

A total of 120 day old broiler chicks were obtained from a local hatchery. They were divided into five groups (24 chicks every group) in three replicates, 8 chicks each. The first group was fed on the basal corn-Soy bean diet as a control group, the second and third groups were fed the basal diet with 3% and 6% of slaughter houses (SH) by-product while the fourth group was fed on the basal diet supplemented with 6% SH by-product and 1.5% corn silk powder and the last group was fed the basal diet with 1.5% CSP only. The SH by-product was added to the experimental diet as a partial replacement from corn gluten

and soybean meal. Water and feed were provided ad libitum during the whole experimental period which was lasted for five weeks. Chicks of all treatment groups were kept under similar hygienic and environmental condition.

The composition and calculated analysis of the basal diets are shown in Table 1.

Table 1. Composition and calculated analysis of the basal diets

Ingredients	Starter %	Grower (%)
Yellow corn	53.0	56
Soybean meal (44%)	32	31
Corn gluten (60%)	9	6
Vegetable oil	2	3
Di calcium phosphate	2	2
Limestone	1.20	1.20
Lysine	0.5	0.25
Methionine	0.25	0.25
Salt (NaCl)	0.30	0.30
Total	100	100
Calculated analysis* (NRC, 1994)		
Crude protein (%)	23	21
MEC (Kcal/kg)	3000	3150
Calcium %	0.90	0.92
Av. Phosphorus	0.48	0.44

Live body weight (LBW) of chicks, feed intake and feed conversion ratio (FCR) were recorded at weekly intervals. Blood samples were collected at 3 and 5 weeks of age from three chicks/ treatment group. Plasma total protein, albumin, cholesterol, urea, creatinine and malondialdehyde (MDA) concentrations were determined. Transaminases activity (ALT and AST); alkaline phosphatase and acid phosphatase activities were also measured. All determinations were done by using available commercial kits (Spectrum comp. for Diagnostic kits, Cairo, Egypt).

Data were subjected to one way analysis of variance by using General Linear model procedure (GLM) of the statistical analysis system (SAS, 1994).

RESULTS AND DISCUSSION

Effect Of CSP On Malondialdehyde

The corn silk powder (C.S.P.) as an agricultural waste, is an excellent source of bioactive compounds such as flavonoids, phytosterols, vitamins, minerals and is rich in proteins. Corn silk (C.S.)

Effect of Egyptian corn silk powder supplementation to diet on some blood parameters, live body weight and liver histology of broiler chickens fed Slaughter-houses by-product 235

contains also proteins, carbohydrates, Fixed and volatile oils, tannins, saponins and alkaloids.

Effects of corn silk powder on M.D.A. (Malondialdehyde) levels

Oxidative stress induced by feeds containing slaughter-houses can significantly elevate markers of tissue per oxidative damage because the slaughter house additives promote the production of ROS (Reactive oxygen Species) due to substantial increase in oxygen consumption. MDA, a metabolite of phospholipid peroxidation, is a popular index of living body oxidative damage (Leeuwenburgh & Jeinecke, 2001, Lawler et al 1994; O' Neill et al 1996, Vesovic et al 2002, Powers et al 2004 and Lekhi et al 2007).

As shown in Table (2), MDA levels in different treatments of groups (T2, T3, T4 and T5) were significantly decreased compared to the control groups T1 ($P < 0.05$). The decrement were $\frac{0.47}{0.98} \%$, $\frac{0.62}{0.98} \%$, $\frac{0.83}{0.98} \%$ and $\frac{0.55}{0.98} \%$, respectively.

The results showed that CSP protected muscles of chickens from ROS mediated oxidative stress during feeding with slaughter houses. These results are in agreement with results mentioned by Hu et al (2010) who aimed to examine the effect of flavonoids from corn silk on oxidative stress induced by exhaustive exercise in mice.

Effect of CSP on ALT, AST, ALP and ACP levels

Feeds of chickens on additive slaughter house as additive promotes the formation of ROS which caused oxidative damage. Data presented in Ta-

ble (2) reveal that the levels of mentioned enzymes different in T4 treatment compared with control. CSP plays an essential role for the defense of body from ROS which improves the liver function due to high content of antioxidants such as flavonoids.

Many studies showed feed containing CSP have antioxidant properties in vitro, which can be used potentially as a ready accessible and valuable bioactive source of natural antioxidant (Hu et al 2010; Arafa et al 2012 and Adom & Liu, 2002).

The levels of ALT were 23.13, 26.33, 30.25, 26.80 and 23.40 for chickens feed on T1, T2, T3, T4, and T5 respectively. It is clear that a significant increase was noticed in T5 compared to control ($P < 0.05$). These results were in similar with those reported by Hu and Deng (2011) who examined that inhibiting lipid per-oxidation and increasing antioxidant enzymes levels.

Blood urea and creatinine parameters

The Blood urea and creatinine parameters for parameters for chickens feed on slaughter house as additive with or without adding CSP are shown in Table (2). It was found that the blood urea nitrogen (BUN) concentration of treatment groups were considerably higher than those of control group (T1). Urea concentration were not significant ($P < 0.05$). The concentration of urea were 19, 21.75, 22.26, 22.05 and 22.87 for different groups T1, T2, T3 T4 and T5 respectively. Such results were in agreement with those reported by Hu et al (2010) who found that retarding the formation of blood urea nitrogen.

Table 2. Effect of treatments on blood constituents of broiler chicks at five weeks of age

Treatment Blood parameters	Control	T1	T2	T3	T4	Sign
Total protein (g/dl)	4.21±0.12ab	4.04±0.14b	3.44±0.09c	4.18±0.16ab	4.53±0.05a	*
Albumin (g/dl)	2.50±0.13ab	2.31±0.05bc	2.13±0.07c	2.40±0.13abc	2.66±0.06a	*
Globulin	1.71±0.09a	1.74±0.09a	1.31±0.09a	1.78±0.05a	1.88±0.04a	NS
Urea (mg/dl)	19.00±1.09a	21.75±2.93a	22.26±0.98a	22.05±0.69a	22.87±1.28a	NS
Creatinine (mg/dl)	2.01±1.28b	26.33±0.90ab	30.25±2.48a	26.80±1.35ab	23.40±1.85b	*
ALT (U/L)	23.13±128b	26.33±0.90ab	30.25±2.48a	26.80±1.35ab	23.40±1.85b	*
AST (U/L)	79.43±3.52c	100.20±4.37b	115.18±3.80a	99.25±1.25b	85.48±4.06c	*
ALKP (U/L)	56.70±1.60bc	62.30±2.83b	71.20±2.31a	61.35±1.59b	53.60±1.26c	*
ACP (U/L)	15.20±1.25b	19.43±1.30a	23.35±1.18a	20.63±1.41a	14.25±1.74b	*
MDA (mg/dl)	0.98±0.12a	0.47±0.14c	0.62±0.12bc	0.83±0.07ab	0.55±0.08bc	*
Cholesterol (mg/dl)	183.63±3.06ab	211.88±5.75ab	223.25±5.03a	224.20±24.75a	177.15±3.75b	*

a,b Means within the same rows with different superscripts are significant different ($P \leq 0.05$) *

T1, control; T2: control + 3% slaughter-houses, T3: control+ 6% slaughter-houses, T4: control + 6% slaughter-houses+ 1.5 corn silk powder, T5: control + 1.5% corn silk powder

Blood creatinine levels in different treatments were 2.01, 1.10, 1.82, 1.86 and 1.74 (mg/dl) for different groups T1, T2, T3, T4 and T5 respectively. It is clear that not significant decrease in these levels and the results were non-significant.

Live body weight (LBW)

Live body weight of broiler chicks are presented in **Table (3)**. The initial LBW of chicks was nearly similar at the beginning of the experiment indicative of the randomly distribution of treatment groups.

On the other hand, there were significant differences between groups in LBW at 4 and 5 weeks of age. The best values at 4wk were obtained for chicks (T4) that fed diet (6% SH plus 1.5% CSP) followed by those fed T2 and T5 diets. The lowest value was recorded for the control chicks. Moreover, at 5 weeks of age, chicks that fed the basal diet (control) plus CSP only (T5) had the heaviest LBW compared with the other treatment groups. The same was observed for chicks in the T4 group which was significantly better than T3, T2 and control groups.

These results may reflect the beneficial effect of CSP as a dietary supplement either singly or in

combination with the slaughter houses- by product. It appears also that CSP acts as a growth promoter to broiler chicks beside its effect as antitoxic, antibacterial and antioxidant properties due to existence of flavoroids, tannins, and many bioactive compounds.

In this respect **Ebrahimzadeh et al (2008)** reported that CS contains many compounds such as proteins, carbohydrates, vitamins, steroids and many minerals (Ca, K, Mg and Na) which could explain the improvement in LBW of birds in our study. These results are in close agreement with many workers who showed and illustrated the benefits of CSP in alleviating many health disorders in different mammalian and avian species (**Buttery et al 1980; Bushman, 2002; Kaur et al 2006 and Arafa et al 2012**).

Results in **Table (4)** showed significant differences between groups at different periods of the experiment during the whole experiment period (0-5 weeks) chicks of the T5; T1 and T4. Treatments groups consumed significantly more feed than those of T2 and T4 groups, respectively. This trend was also observed during different periods but with more or less change between groups in feed consumption.

Table 3. Effect of different treatments on live body weight (Kg) of broiler chicks at different ages

Age \ Treatment	Control	T2	T3	T4	T5	Sign
Day 1	0.034±0.001	0.034±0.0003	0.034±0.001	0.034±0.001	0.035±0.0003	NS
2 wk	0.42±0.01	0.43±0.01	0.45±0.01	0.44±0.01	0.44±0.01	NS
4 wk	1.29±0.01	0.34±0.01ab	1.32±0.02bc	1.38±0.01a	1.33±0.02bc	*
5 wk	1.81±0.01c	1.82±0.01bc	1.84±0.01b	1.87±0.01a	1.88±0.01a	*

a,b Means within the same rows with different superscripts are significant different ($P \leq 0.05$) *

T1, control; T2: control + 3% slaughter-houses, T3: control+ 6% slaughter-houses, T4: control + 6% slaughter-houses+ 1.5 corn silk powder, T5: control + 1.5% corn silk powder

Table 4. Effect of different treatments on body weight gain of broiler chicks at different ages treatment

Age \ Treatment	Control	T2	T3	T4	T5	Sign
0-2 wk	386±10b	393±10a	416±10ab	409±010ab	403±010	*
2-4 wk	867±10b	913±10ab	873±20a	933±10a	888±10ab	*
4-5 wk	520±10ab	480±11b	517±20	493±10b	533±20	*
0-5 wk	1773±10c	1786±10BC	1806±10B	1836±10a	1845±20a	

a,b Means within the same rows with different superscripts are significant different ($P \leq 0.05$) *

T1, control; T2: control + 3% slaughter-houses, T3: control+ 6% slaughter-houses, T4: control + 6% slaughter-houses+ 1.5 corn silk powder, T5: control + 1.5% corn silk powder

Liver histology

Histological examination of liver sections from different treatment groups showed moderate to severe changes associated with the treatments, **Fig. (1)** shows the liver parenchyma of the control chicks with its normal size hepatocytes and central vein engorged with blood. There are some necrotic areas and infiltrated fluids near the central vein and blood sinusoids. There is moderate hypertrophy of liver cells indicative of hyperactivity as a consequence of higher metabolic activity of the meat-type chicken strains. It is clear from **Figs. (2 and 3)** that supplementation of the diet with either 6% or 3% slaughter house-by-products caused deleterious effects on liver histology structure. This includes marked disruption in the arrangement of the hepatocytes and dilation of the central vein accompanied with many fibrotic and necrotic areas and infiltrated fluids. These changes were severe in liver section from birds that fed 6% SH-byproducts (**Fig. 3**) than those fed 3% SH (**Fig. 4**).

Of interest is the improvement observed in the histological structure of liver after addition of corn silk powder (CSP) to the diet (**Fig. 5**). It appears that CSP with its biological contents can alleviate many negative effects of SH-byproducts on organs histology. There was an obvious hypertrophy and to lesser extent hyperplasia of liver cells accompanied by normal appearance of the central vein and few necrotic areas. A similar-but greater-improvement was also observed for liver tissue from chicks that fed 1.5% CSP without SH. There were marked increase in the hepatocytes with few infiltrated fluids and normal arrangement of the hepatic cords.

This indicate CSP could be used to protect liver tissues from damage that may be caused from the toxic substances in the SH-byproducts, via its antioxidant properties as reported by **Elliger et al. (1980a)** and **Snook et al. (1995)**. They reported that CS contains several flavonoids, which have antioxidant capacity which in turn scavenging liver tissues from damage.

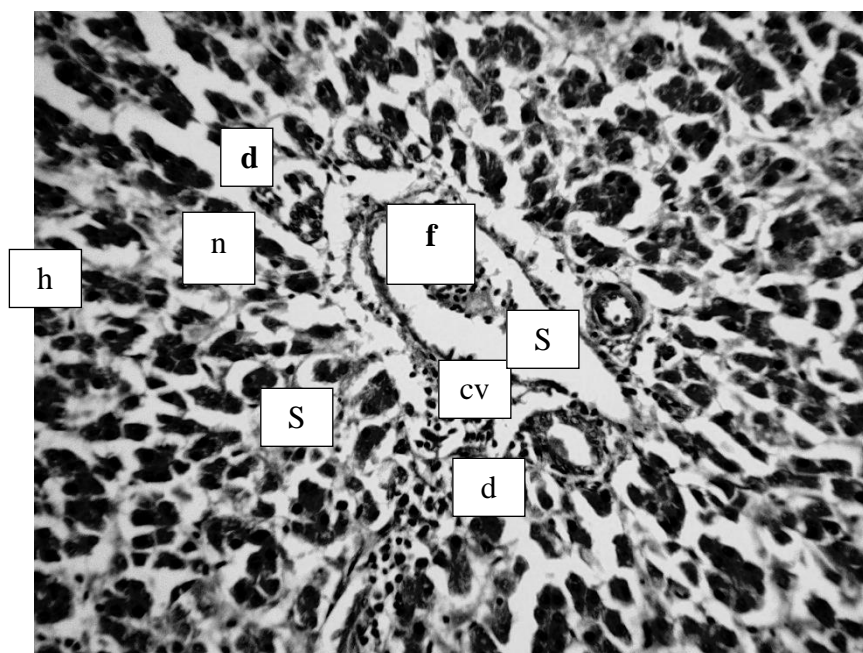


Fig. 1. TS. in Liver from the control (T1) group of broiler chicks at 35 days of age (H & E x 10) Abbreviation key:
 cv: Central vein d : Bile duct
 s : Blood sinusoids h : Hepato cytes
 n: Necrotic area f : Infiltrated fluids

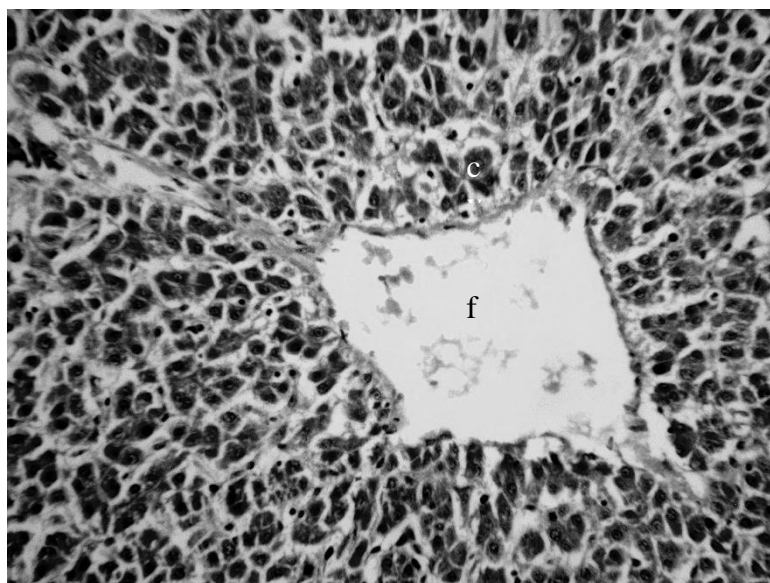


Fig. 2. TS. in Liver from the 3% slaughter houses (T2) group of broiler chicks at 35 days of age (H & E x 10)

Abbreviation key:

cv: Central vein	d : Bile duct
s : Blood sinusoids	h : Hepatocytes
n: Necrotic area	f : Infiltrated fluids

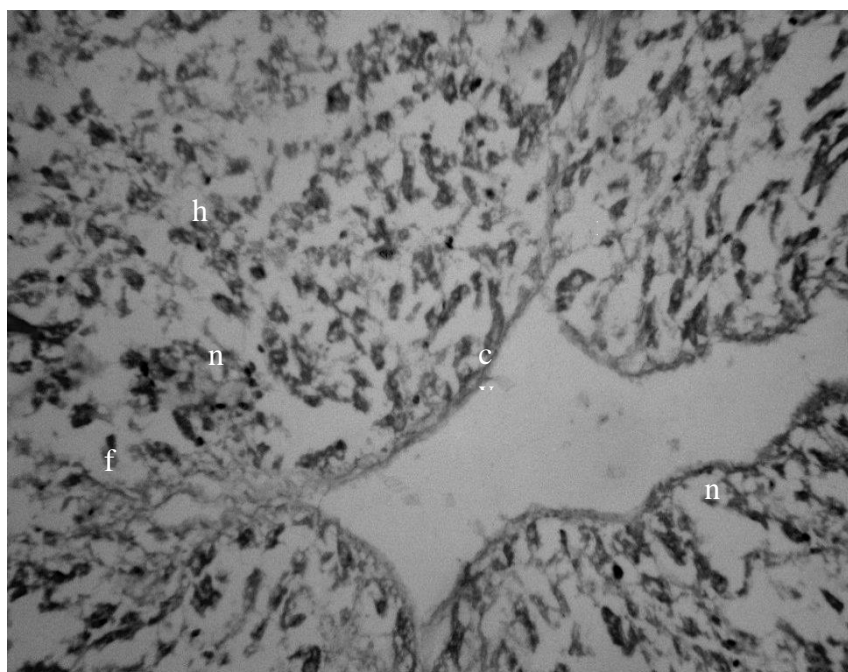


Fig. 3. TS. in Liver from the 6% slaughter-houses (T3) group of broiler chicks at 35 days of age (H & E x 10)

Abbreviation key:

cv: Central vein	d : Bile duct
s : Blood sinusoids	h : Hepatocytes
n: Necrotic area	f : Infiltrated fluids

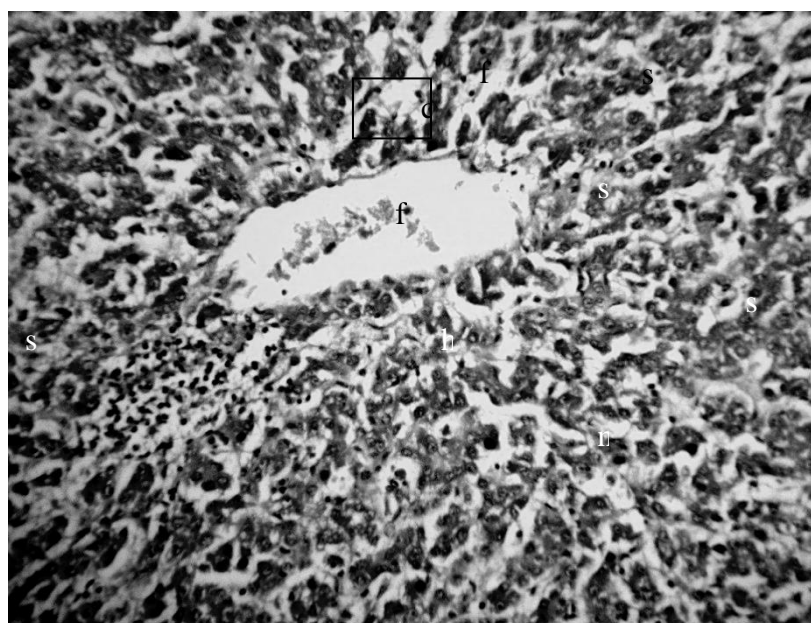


Fig. 4. TS. in Liver from the 6% slaughter-houses + 1.5% corn silk powder (T4) group of broiler chicks at 35 days of age (H & E x 10)

Abbreviation key:

cv: Central vein	d : Bile duct
s : Blood sinusoids	h : Hepatocytes
n: Necrotic area	f : Infiltrated fluids

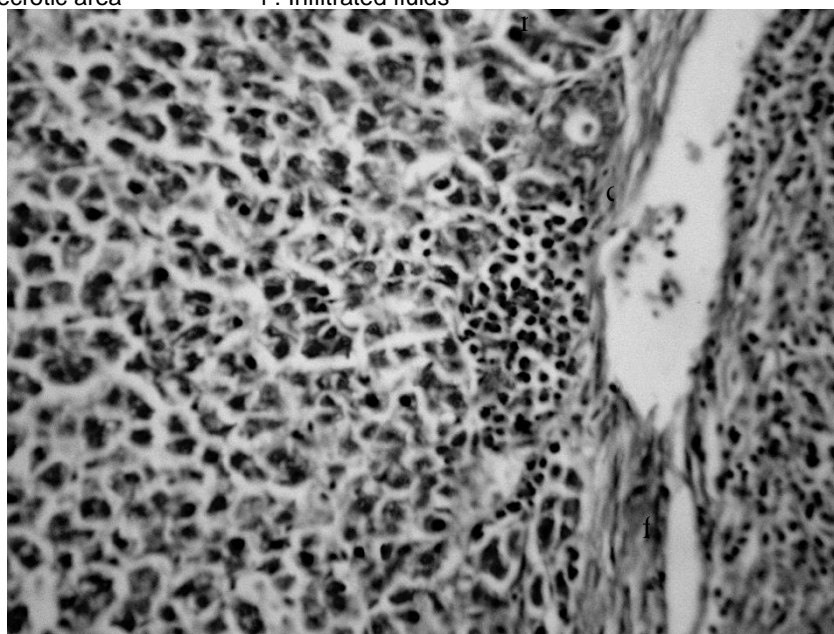


Fig. 5. TS. in Liver from the 1.5% corn silk powder (T5) group of broiler chicks at 35 days of age (H & E x 10)

Abbreviation key:

cv: Central vein	d : Bile duct
s : Blood sinusoids	h : Hepatocytes
n: Necrotic area	f : Infiltrated fluids

REFERENCES

- Adom, K.K. and Liu, R.H. 2002. Antioxidant activity of grains. *Journal of Agricultural and Food Chemistry*, **50**, 6182- 6187.
- Angela, S. and El-Rosa and Maria D.R. 1997. Flavonoids and saponins from styles and stigmas of *Zea mays* L. (Gramineae). *Lat. Am. J. Pharm. (Span)* **4**, 215-218.
- Anonymous (2005). World corn production, consumption and stocks. US Department of Agriculture, foreign Agricultural Service. Web site of corn refiners association: <http://www.corn.org/wcornprod.htm>.
- Arafa, S.A.; Neven M.M. and M. Kh. 2012. Effect of corn silk on characteristics and keeping quality of Cake. *J. Biol. Chem. Environ. Sci.*, **7**(4), 371-400.
- Buttery, R.G.; Ling I.C. and Teranishi R. 1980. Volatiles of corn tassels: possible corn ear worm attractants. *Journal of Agricultural and Food Chemistry*, **28**(4), 771-774.
- Ebrahimzadeh, M.S.; Pourmorad F. and Hafezi, S. 2008. Antioxidant Activities of Iranian Corn Silk. *Turkish J. Biol.* **32**, 43- 49.
- Elliger, C.A.; Chan B.G., Waiss A.C., Lundin R.E. and Haddon W.F. 1980a. C-Glycosylflavones from *Zea mays* that inhibit insect development. *Phytochemistry* **19**, 293-297.
- Grase, F., J.G. March, M. Ramis, A. Costa-Bauza' (1993). The influence of *Zea mays* on urinary risk factors for kidney stones in rats. *Phytother Res.*, **7**, 146-149.
- Hu, Q.L., L.J. Zhang, Ding, Y.J. and Li, F.L. 2010. Purification and anti-fatigue activity of flavonoids from corn silk. *Int. J. Physical. Sci.*, **5**(4), 321-326.
- Hu, Q.I. and Deng, Z.H. 2011. Protective effects of flavonoids from corn silk on oxidative stress induced by exhaustive exercise in mice. *Afr. J. Biotechnol.*, **10**(16), 3163-3167.
- Kaur, G., Alam M.S., Jabbar, Z., Javed K. and Athar, M. 2006. Evaluation of antioxidant activity of cassia Siamea flowers. *Journal of Ethanopharmacology*, **108**, 340-348.
- Lawler, J.M., Powers, S.K., Van Dijk H., Visser, T., Kordus, M.J. and Ji, L.L. 1994. Metabolic and antioxidant enzyme activities in the diaphragm: effects of acute exercise. *Respir. Physiol.* **96**(2-3), 139-149.
- Leeuwenburgh, C. and Jeinecke, J.W. 2001. Oxidative stress and antioxidants in exercise. *Curr. Med. Chem.* **8**(7), 829-838.
- Lekhi, C., Gupta, P.H. and Singh, B. 2007. Influence of exercise on oxidant stress products in elite Indian cyclists. *Br. J. Sports Med.* **41**, 61-693.
- Li, FL. and Yu, L. 2009. Flavonoids extraction from maize silk and its function on blood sugar control. *China Food Additives*. **94**, 121-124.
- Ma, H. and Gao, L. (1998). Study on effect of corn silk extract (ESM) on K562 and SGS cell. *J. Nanjing Univ. Traditional Chinese Med. (China)* **1**, 28-29.
- Maksimović, Z.A. and Kovačević, N. (2003). Preliminary assay on the antioxidative activity of Maydis stigma extracts. *Fitoterapia*; **74**, 144-147.
- Maksimović, Z.A., Kovačević, N. and Malencic, D. (2005). Polyphenol contents and antioxidant activity of Maydis stigma extracts. *Bioresource technology*, **96**, 873-877.
- Namba, T., Xu, H., Kadota, S., Hattori, M., Takahashi, T. and Kojima, Y. (1993). Inhibition of ige formation in mice by glycoproteins from corn silk. *Phytother, Res.* **3**, 227-230.
- NRC (1994). *Nutrient Requirements of Poultry*. 9th rev. National Research Council, National Academy Press, Washington, D.C. USA.
- O, Neill C.A.; CL.Stebbins, Bonigut S., Halliwell B. and Longhurst, J.C. (1996). Production of hydroxyl radicals in contracting skeletal muscle of cats. *J. Appl. Physiol.* **81**, 1197-1206.
- Powers, S.K., Deruisseau, K.C., Quindry J. and Hamilton K.L. (2004). Dietary antioxidants and exercise. *J. Sports Sci.* **22**(1), 81- 94.
- Ramesh, P. and Okigbo R.N. 2008. Effect of plants and medicinal plant combinations as anti-infectives. *Afr. J. Pharm. Pharmacol.* **2**, 130-135.
- Rosli, W., Nurhanan W.I., Mohsin, A.R., Farid S.S.J. and Ghazali C. 2008. Aqueous alcoholic treated and proximate analysis of Maydis Stigma (*Zea mays* hairs). *Annals of microscopy*, **8**, 66-72.
- SAS (1994). *SAS /STAT ® User's Guide: statistics ver. 6.04*, 4th ed. SAS Institute Inc. Cary, NC.
- Snook, ME., Widstrom N.W., Wiseman, B.R., Byrne P.F., Harwood J.S. and Castello C.E. 1995. New C-4'-hydroxy derivatives of maysin and 3'-methoxymaysin isolation from corn silks (*Zea mays*). *J. Agric. Food Chem.* **43**, 2740-2745.
- Tang, L. and Ding X. 1995. Bio-active substances from corn silk- corn silk polysaccharids (CSPS) and its immunological enhancing function. *J.*

- Wuxi University Light Indus. (China) 4, 319-324.
- Velazquez, D.V.O., Xavier H.S., Batista, J.E.M., and Casro-Chavas, C. 2005. *Zea mays* L. Extracts modify glomerular function and potassium urinary excretion in conscious rats. **Phyto-medicine. Hytomedicine. 12, 363-369.**
- Vesovic, D., Borjanovic S., Markovic S. and Vidakovic, A. (2002). Strenuous exercise and action of antioxidant enzymes Med. Lav. 93(6), 540-550.
- Waiss, A.C., Chan B., Elliger, C.A., Wiseman B.R., Mcmillian, W.W., Widstrom N.W., Zuber, M.S. and Keaster, A.J. 1979. A flavone glycoside from corn silks with antibiotic activity towards corn earworm, J. Econ. Entomol. 72, 256-258.