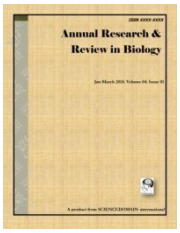

*Annual Research & Review in Biology*
*4(21): 3227-3237, 2014*

**SCIENCEDOMAIN** *international*
www.sciencedomain.org

# Effect of Feeding Chemically and Biologically Treated Barley Straw on Some Hematological and Serum Biochemical Parameters of Karadi Lambs

**Shaker Abdulameer Hassan[1], Khasraw Muheddin Hassan[2] and Sarwar Mohammed Sadq[2*]**

*[1]Department of Animal Resources, College of Agriculture, University of Baghdad, Iraq.*
*[2]Department of Animal Production, Faculty of Agricultural Sciences, University of Sulaimani, Iraq.*

***Authors' contributions***

*This work was carried out in collaboration between all authors. Authors SAH and KMH designed the study, wrote the protocol. Author SMS performed the samplings and the statistical analysis of the study, wrote the first draft of the manuscript and made the final manuscript. Author SMS managed the literature searches of the manuscript. All authors read and approved the final manuscript.*

***Original Research Article***

***Received 22nd February 2014***
***Accepted 21st May 2014***
***Published 7th June 2014***

## ABSTRACT

**Aims:** This study was conducted to evaluate the effect of feeding untreated, urea and fungal (*Pleurotus ostreatus*, *Po*) treated barley straw on some blood profiles of Karadi lambs.
**Place and Duration of Study:** Department of Animal Production, over the periods 1-2-2010 to 1-4-2010.
**Methodology:** The measured hematological parameters were; mean corpuscular hemoglobin concentration (MCHC), Mean corpuscular hemoglobin (MCH) and mean corpuscular volume (MCV) were calculated from red blood cell (RBC), white blood cell (WBC), hemoglobin (Hb), packed cell volume (PCV) and measured serum biochemical parameters were albumin, globulin, creatinine, high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglycerides and uric acid and alkaline phosphatase (ALP).
**Results:** The results revealed that red and white cells , packed cell volume, hemoglobin

**Corresponding author: Email: sarwarsadq4@gmail.com;*

and mean corpuscular hemoglobin were significantly higher in lambs fed fungal treated barley straw (FTS) than those fed urea treated barely straw (UTS) or untrated barley straw (US). Mean corpuscular hemoglobin concentration was (32.61g/dl) higher in lambs fed FTS and UTS (32.40g/dl) than those lambs fed US (32.09 g/dl). Lambs fed UTS and FTS had significantly increased serum albumin as compared with those lambs fed US; whereas, globulin concentration was significantly higher in lambs fed FTS than those lambs fed UTS and US. While, lambs fed FTS and UTS showed significant reduction in the uric acid and low-density lipoprotein as compared with those fed US. Lambs fed FTS had significantly reduced alkaline phosphatase as compared with those fed UTS and US.
**Conclusion:** It can be concluded that lambs fed FTS showed a good health as compared with those fed US or UTS.

*Keywords: Straw; urea; fungal; serum biochemical parameters; karadi lambs.*

## 1. INTRODUCTION

Straw breakdown is achieved by the influence of *Pleurotus ostreatus* digestive enzymes, particularly on cell wall components, cellulose and lignin, and these straws can be more easily digested by ruminants [1]. Previous studies have suggested the possibility of using biological or urea treated for agriculture by-products as an animal fed and its effect on some blood parameters were showen by many investigators [2,3]. Blood plays an important role in carrying end products of metabolic processes out of body tissues and supplying these tissues with different nutrients that they may need. These nutrients differ in concentrations according to differences in diets and ingredients or diet components or treatments that may be applied on diets via their interaction in metabolic pathways naturally occurring in different body tissues [4]. Fayed [5] found that biological treatment by white fungi significantly reduced blood cholesterol of lambs fed with white fungi treated diet as compared with those fed with control diet. Biochemical analyses of blood serum are very useful to get insight into the metabolic and health status of animals. During diagnostic procedure, it is very useful to compare the values obtained from ill animals with normal values in healthy animal [6].

Biological treated barley straw reduced rumen phenolic compounds but increased rumen anaerobic bacteria [7]. In contrast, blood parameters such as serum urea nitrogen, serum glucose, total protein, cholesterol, Aspartate Aminotransferase (AST) and Alanine transaminase (ALT) are the most parameters shown to vary with different basal diets and chemical and microbial treatments [8-10]. Therefore the objective of this experiment was to evaluate the effect of chemical and biological treatments of barley straw treated with urea or *Pleurotus ostreatus* fungi on some hematological and serum biochemical parameters of Karadi male lambs.

## 2. MATERIALS AND METHODS

### 2.1 Barley Straw Preparation

Barley straw was chopped (approximate 1.5-2cm) and divided into three treatments, untreated straw (US, control), straw treated with 70g urea/kg DM (UTS) and fungal treated straw (FTS) with *Pleurotus ostreatus* as described by Hassan et al. [3,7].

## 2.2 Lambs and Feeding

Twelve Karadi male lambs aged 5 months with an average initial body weight of 25±0.377 kg were randomly allocated to three treatments to receive either US, UTS or FTS . They all received an equal daily allowance of concentrate diet (2% of the body weight) which consisted of 49% barley, 39% yellow corn, 10% soybean meal and 1% of salt and 1% mineral and vitamin mixture. The chemical composition of concentrate diet, US, UTS and FTS are presented in Table (1).

**Table 1. Chemical composition of untreated, urea and *Po* treated barley straw and concentrate diet (% of DM basis)**

| Items % | US* | UTS* | FTS*** | Concentrate |
|---|---|---|---|---|
| DM | 96.2 | 94.5 | 95.1 | 94.6 |
| OM | 87.8 | 84.7 | 82.7 | 91.8 |
| CP | 4.1 | 19.9 | 12.4 | 13.25 |
| CF | - | - | - | 5.0 |
| NFE | 8.4 | 9.8 | 11.9 | 70 |
| EE | - | - | - | 3.4 |
| NDF | 81.3 | 75.8 | 74.16 | - |
| ADF | 54.3 | 50.1 | 50.2 | - |
| Lignin | 11.1 | 9.2 | 9.13 | - |
| Hemicellulose | 27.0 | 25.7 | 23.96 | - |
| Cellulose | 43.2 | 40.9 | 41.07 | - |

*Hassan et al. [10]; US*: Untreated straw, UTS**: Urea treated straw, FTS***: Fungi treated straw in this table and following tables. DM=Dry matter; OM =Organic matter; CP=Crude Protein; CF=Crude Fiber; NFE=Nitrogen-Free Extract; EE=Ether Extract; NDF= Neutral Detergent Fiber; ADF= Acid Detergent Fiber*

## 2.3 Chemical Analysis

Chemical analysis of raw and treated barley straw and concentrate samples in triplicate per each determination was carried out according to the AOAC [11]. Neutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (ADL) were analyzed according to Goering and Van Soest [12].

## 2.4 Blood Samples

Ten ml of blood samples were collected from three lambs for each treatment by jugular vein puncture on day-zero before initiation of the experiment, at the middle of the experiment (30 days) and at the end of the experimental period (60 days). Approximately 3ml of blood in tubes containing $K_2$EDTA (BD Vacutainer®, Plymouth, PL6 7BP, UK) was collected and analyzed immediately for hematology. Blood samples for biochemical assessments were placed into vacuum tubes approximately 7 ml (BD Vacutainer®) and centrifuged at 3,000 rpm for 15 min. The separated sera were then stored at-20ºC until the required assay was performed. At each period blood samples were taken at zero time (before morning feeding), 3and 6h post feeding according to Alkhazraji et al. [13]. For hematology assessments, blood samples placed on the roller mixer for 30 min and then analyzed using an automated hematology analyzer (XE-5000, made in Korea). The measured hematological parameters were; mean corpuscular hemoglobin concentration (MCHC), Mean corpuscular

hemoglobin (MCH) and mean corpuscular volume (MCV) were calculated from red blood cell (RBC), white blood cell (WBC), hemoglobin (Hb) and packed cell volume (PCV) as described by Park et al. [14]. The blood was retained in plain vacationer tubes for serum separation and it was analyzed by spectrophotometer (Hitachi U2900/2910, Hitachi Co., Japan), for albumin, globulin, creatinine, high-density lipoprotein (HDL), low-density lipoprotein (LDL), triglycerides according to Park et al. [14] and uric acid and alkaline phosphatase (ALP), according to Hassan and Hassan [10].

## 2.5 Statistical Analysis

The obtained data were analyzed according to XLSTAT [15] for one way analysis of variance. Differences among means were carried out by using Duncan [16] multiple range tests.

# 3. RESULTS

## 3.1 Hematological Studies

The effect of urea and fungus treatments on mean values of RBC, WBC, Hb, PCV, MCV, MCH and MCHC are presented in Table 2. The mean values of hematological parameters before starting of the experiment, at the 30 and 60 days post experimental period are presented in Table 3. Results revealed that the mean value of RBC ($10.2\times10^{6}$ $mm^{3}$) for all periods at zero, 30 and 60 days post experiment period was significantly ($P<0.05$) higher for lambs fed FTS than those fed UTS and US, while differences in RBC between UTS and US were not significant. The highest mean value of WBC ($11.05\times10^{3}$$mm^{3}$) was found in lambs fed FTS at zero day, 30 and 60 days post experimental period as compared with UTS and US; But the differences was significant ($P<0.05$) between UTS and US. The differences in WBC between UTS and US were significant ($P<0.05$). On the other hands, differences in the mean value of Hb, PCV and MCH were significant among treatments in favor of fungi treatment which was the highest ($P<0.05$) when compared with UTS and US at zero day, 30 and 60 days post experimental periods. Mean value of MCH at 60 days post feeding was significantly different across treatments, but lambs fed UTS and FTS at zero and 30 days were significantly higher ($P<0.05$) than control group (US), with no significant differences between FTS and UTS. The Mean values of MCHC were significantly higher in FTS and UTS as compared with untreated straw (US), while the differences in MCHC between UTS and FTS were not significant. But at zero day of sampling MCHC were not significant among treatments. In contrast at 30 and 60 days for sampling the mean corpuscular hemoglobin concentration were significant ($P<0.05$) for both FTS and US compared with UTS, but FTS and US were not significant ($P>0.05$). Mean value of hemoglobin and PCV at zero, 30 and 60 days period in male lambs fed diets with FTS were significantly ($P<0.05$) increased compared with UTS and US, but at 30 day of sampling Hb concentrations were not significant ($P>0.05$) among treatments. While the mean value of MCV was not significant among treatments.

## 3.2 Serum Biochemical Parameters

Mean values of some serum biochemical parameters, such as serum uric acid (SUN), albumin, globulin, alkaline phosphatase, low-density lipoprotein (LDL), high density lipoprotein (HDL), triglycerides and creatinine, of Karadi male lambs are showed in Table 4.

While the mean values of serum biochemical parameters, on zero, 30 and 60 days are presented in Table 5.

**Table 2. Overall means of hematological blood parameters**

| Parameters | US | UTS | FTS |
|---|---|---|---|
| RBC ($\times 10^6$ $mm^3$) | 8.84b | 8.94b | 10.2a |
| WBC ($\times 10^3$ $mm^3$) | 8.22c | 9.25b | 11.05a |
| Hb (g/dl) | 9.15c | 9.75b | 10.45a |
| PCV % | 27.11c | 28.83b | 33.07a |
| MCV (fL) | 38.47a | 38.58a | 38.63a |
| MCH (pg) | 9.46c | 10.05b | 10.3a |
| MCHC (g/dl) | 32.09b | 32.40a | 32.61a |

*Means followed by the same letter within a row are not significant (P<0.05)*

**Table 3. Effect of treatments and days of sampling on hematological parameters**

| Parameters | Days of sampling | US | UTS | FTS |
|---|---|---|---|---|
| RBC ($\times 10^6$ $mm^3$) | Zero day | 8.634b | 8.695b | 10.045a |
| | 30 | 8.96 b | 8.98b | 10.23a |
| | 60 | 8.926b | 9.139b | 10.32a |
| WBC ($\times 10^3$ $mm^3$) | Zero day | 8.329c | 9.156b | 10.659a |
| | 30 | 8.14c | 9.29b | 11.18a |
| | 60 | 8.199c | 9.31b | 11.31a |
| Hb (g/dl) | Zero day | 8.42c | 9.61b | 10.29a |
| | 30 | 9.63 | 9.64 | 10.36 |
| | 60 | 9.41c | 9.99b | 10.7a |
| PCV % | Zero day | 26.95c | 28.66b | 32.36a |
| | 30 | 27.01c | 28.80b | 32.67a |
| | 60 | 27.38c | 29.01b | 34.19a |
| MCV (fL) | Zero day | 38.43a | 38.70a | 38.46a |
| | 30 | 38.86a | 38.64a | 38.48a |
| | 60 | 38.61a | 38.40a | 38.48a |
| MCH (pg) | Zero day | 9.50b | 9.895a | 10.11a |
| | 30 | 9.28b | 10.01a | 10.33a |
| | 60 | 9.61c | 10.24b | 10.46a |
| MCHC (g/dl) | Zero day | 31.73a | 31.71a | 31.81a |
| | 30 | 32.45a | 31.83b | 32.76a |
| | 60 | 33.03a | 32.75b | 33.26a |

*Means followed by the same letter within a row are not significant (P<0.05)*

Data in Tables (4 and 5), showed that the mean value and post 30 days of sampling of serum uric acid were significantly lower (P<0.05) in lambs fed FTS and UTS compared with control group (US). While, mean value of uric acid was not significant between FTS and UTS.

From the results obtained it can be pointed out that the mean value of serum albumin at zero and 60 days periods in lambs fed with FTS and UTS was increased significantly (P<0.05) as compared with US. However, FTS showed significantly (P<0.05) higher value of albumin which was (3.02g/dl) as compared with other treatments.

**Table 4. Effect of treatments on overall mean of serum biochemical parameters**

| Parameters | US | UTS | FTS |
|---|---|---|---|
| Uric acid (mg/dl) | 0.97a | 0.83b | 0.79b |
| Albumin (g/dl) | 2.51b | 2.93a | 3.02a |
| Globulin (g/dl) | 1.95b | 2.14b | 2.47a |
| ALP (U/L) | 150.0a | 150.96a | 139.75b |
| LDL (mg/dl) | 35.83a | 27.63b | 24.88b |
| HDL(mg/dl) | 17.08a | 15.68a | 18.54a |
| Triglycerides (mg/dl) | 22.71a | 22.54a | 21.46a |
| Creatinine (mg/dl) | 1. 02a | 1.04a | 1.05a |

*Means followed by the same letter within a row are not significant (P<0.05)*

**Table 5. Effect of treatments and days of sampling on biochemical parameters**

| Parameters | Days of sampling | US | UTS | FTS |
|---|---|---|---|---|
| Uric acid (mg/dl) | Zero day | 1.25a | 1.24a | 1.20a |
| | 30 | 1.23a | 0.76b | 0.725b |
| | 60 | 0.438a | 0.513a | 0.45a |
| Albumin (g/dl) | Zero day | 1.56b | 2.24a | 2.49a |
| | 30 | 3.200a | 3.33a | 3.225a |
| | 60 | 2.775b | 3.21a | 3.34a |
| Globulin (g/dl) | Zero day | 1.213b | 1.68ab | 1.96a |
| | 30 | 2.06b | 2.63ab | 2.84a |
| | 60 | 2.59a | 2.11b | 2.61a |
| ALP (U/L) | Zero day | 150.0a | 148.1a | 139.8b |
| | 30 | 149.8b | 153.0a | 139.5c |
| | 60 | 150.3a | 151.8a | 140.0b |
| LDL (mg/dl) | Zero day | 38.0a | 27.5b | 24.5b |
| | 30 | 32.13a | 28.5a | 21.5b |
| | 60 | 37.38a | 26.88b | 28.63b |
| HDL(mg/dl) | Zero day | 8.75a | 10.25a | 9.2a |
| | 30 | 17.65a | 15.35a | 18.35a |
| | 60 | 24.84a | 21.45a | 27.58a |
| Triglycerides (mg/dl) | Zero day | 25.63a | 24.0a | 25.38a |
| | 30 | 25.13a | 25.38a | 23.25a |
| | 60 | 17.38a | 18.25a | 15.75a |
| Creatinine (mg/dl) | Zero day | 0.87a | 0.89a | 0.90a |
| | 30 | 0.86a | 0.86a | 0.89a |
| | 60 | 1.34a | 1.36a | 1.37a |

*Means followed by the same letter within a row are not significant (P<0.05)*

Mean value of serum globulin concentrations at zero and 30 days was increased significantly (P<0.05) in lambs fed FTS as compared with other treatments. The serum globulin concentration did not statistically differ across treatments; While the concentration of globulin at 60 days periods was significantly lower (P<0.05) in lambs fed UTS as compared with FTS and US treatments. Differences between FTS and US were not significant. The mean value of alkaline phosphatase in FTS had lower significantly (P<0.05) value as compared with UTS and US (control) at zero, 30 and 60 post days period. But the urea treated straw and untreated straw (control) had not shown significant differences between them except at 30 days (P<0.05).

Mean value of LDL at zero and 60 days periods were significantly (P<0.05) lower at lambs fed FTS and UTS as compared with the lambs fed untreated straw (US), with no significant differences between FTS and UTS treatments. The value of LDL in lambs fed FTS had lower significantly (P<0.05) values compared with other treatments at post 30 days; but no differences were shown between UTS and US treatments.

Mean value of serum HDL-cholesterol concentration in US, UTS and FTS were not significantly different among treatments at the same times of sampling. No statistically significant differences were observed in the mean value of HDL, triglycerides and creatinine and at all times of sampling at zero, 30 and 60 days of experimental periods (Table 4 and 5). On the other hand, creatinine had not shown significant differences (P>0.05) among all treatments.

## 4. DISCUSSION

### 4.1 Hematological Studies

In the present investigation, the significant increase in Hb concentration and RBCs of treated rations due to the *Po* have been recognized as a source of iron, which is essential for the synthesis of Hb and oxygenation of RBCs. This result was in agreement with those reported by Park et al. [17] when they fed ruminants with hay or biologically treated straw. These results appear to be consistent with another recent study [18], and it had been found that feeding products with 10% and 20% dried shiitake mushroom to rats with iron deficiency resulted in an increase in blood Hb concentration and serum and liver iron levels. It was also found that the iron in dried shiitake or *Po* had equivalent bioavailability as the iron form ferrous gluconate (iron supplement). Increased Hb and PCV levels in this study may be due to the inclusion of dietary fungi treated straw and related to the high iron bioavailability of spent Po substrate. Nevertheless, the detailed modes of action of this iron have not been determined. Thus, spent *Po* substrate inclusion in lambs diet may result in elevated Hb and RBCs levels. The hypothesis of this study was that the treated barley straw with *Po* to the lamb's diet might have positive effects on hematological and serum biochemical parameters. In this study, lambs fed a diet containing FTS showed higher WBC counts than lambs fed a control diet. WBC is a major part of the body's immune system and lymphocytes are small white blood cells that play a major role in defending the body against infectious diseases. This result was in agreement with that reported by Fayed [5]. Research has shown that β-glucan effectively enhances the immune system by activating WBC [19]. Nevertheless, the detailed modes of action of these polysaccharides have not been determined, although they may regulate some aspects of the humoral or cellular components of the immune system. Present findings imply that the treated straw with *Po* to diet has a modulating effect on the immune system associated with the activation of WBC, although significant differences were found among the FTS, UTS and the control group. In general, the values recorded for hematological blood parameters are within the normal physiological range of ($9.0\text{-}15.0\times10^6$ $mm^3$) for healthy sheep [20]. Mean PCV values obtained in this study were within the physiological range of 27.0–45.0% given by [20].

### 4.2 Effect of Treatments on Serum Biochemical Parameters

In our study, the significant increase in serum albumin of treated straw may be due to the higher digestibility of crude protein (CP) for fungal treated straw and urea treated materials than the control groups. Serum total protein reflects the nutritional status of the animal and it

has a positive correlation with dietary protein. These results were parallel with values of CP content in the experimental rations and of organic matter. This result is similar with the results reported by Fouda and Omer et al. [8,21]. The results of total protein and albumin are in accordance with finding of Kholif et al. [22]. They reported that biological treatments increased serum total protein. Zewil [23] reported that the serum albumin values were increased significantly with biological treated straws containing rations compared with other treatments. On the other hand, contrary results were reported by El-Marakby [24], who found that there was no significant effect of feeding lambs with *Agaricus bisporus* spawning wheat straw on plasma albumin.

The results in Table (4 and 5) indicate the healthy status of experimental animals, since the liver is the main organ of albumin synthesis. Also, El-Marakby [24] reported that mean values of plasma globulins tend to be insignificantly higher for lambs fed rations containing spawning wheat straw than those fed the control ration. The present values of serum globulin concentration were within the normal ranges reported by investigator Kholif et al. [22], who reported that a significant increase in serum globulin concentration with fungal treatments. Serum albumin and globulin in this study ranged from 3.05-3.75 and 1.65-3.3 g/dl respectively.

In this study, the significant decrease in serum uric acid of treated straw may favour better kidney function in FTS than the control groups (US). This result was in the normal range as reported by Hassan and Hassan [10].

In the present study, a significant lower serum LDL-cholesterol levels but not significant changes in triglyceride and HDL- cholesterol concentrations wae observed in the FTS and UTS. This result was in agreement with the results of Park et al. [14] when they found that goats fed on spent mushroom substrate (SMS) was significantly decreased of LDL-cholesterol concentration in SMS-fed groups, but did not affect serum triglyceride, or HDL -cholesterol concentrations. This result was in agreement with our study. Mushrooms have been extensively studied in the context of lipid metabolism and it has been reported that the β-glucans found in grains, such as, oats and barley, are effective at lowering elevated LDL-cholesterol levels [14]. Furthermore, the addition of mushroom to diet has been reported to affect serum triglyceride and cholesterol levels and to prevent the progress of hypercholesterolemia and cholesterol accumulation in liver in rats and hamsters feed induced by a high cholesterol diets [25]. When used for treating high cholesterol levels, it is believed that β-glucans decreases the gastrointestinal absorption of cholesterol and lipids from food. The results obtained from lambs in the present study showed that the spent mushroom substrate (SMS) reduced serum LDL-cholesterol levels, but did not change that of the total cholesterol, HDL-cholesterol, or triglyceride levels. The level of LDL in lambs fed FTS was lower may be due to the oyster mushroom that contains β-glucans from *P. ostreatus* lowered the serum cholesterol concentration [26].

Generally, serum creatinine level is a useful indicator of glomerular filtration in the kidney. From the previous data, it was found that the levels of serum creatinine for lambs were within the normal levels. This means that treated barley straw did not affect kidney function. This results is similar with the results reported by Zewil [23], but is in disagreement with El-Marakby [24], who found that, lambs fed biological treated straw was higher significantly than those fed the control ration in plasma creatinine. The significant variations in hematological and biochemical parameters that were observed between FTS and UTS of experimental diets are in agreement with the previous reports on other species [27]. The

values of blood parameters in our study remained within the normal physiological range of Karadi lambs.

## 5. CONCLUSION

This study showed that lambs fed fungal treated barley straw(FTS) for 60 days had significantly higher blood parameters such as Red Blood Cell (RBC), White Blood Cell (WBC)counts, Hemoglobin (Hb), Mean corpuscular hemoglobin (MCH), albumin and globulin than lambs fed Urea treated barley straw(UTS) or Untreated barley straw(US). In addition, FTS decreased serum Uric acid, Alkaline Phosphatase (ALP) and low-density lipoprotein (LDL) concentrations. The results of the present study indicate that FTS is a suitable feed ingredient for Karadi Lambs. Therefore it could be concluded that lambs fed FTS showed positive effects on hematological and serum biochemical parameters as compared with those fed US or UTS.

## ACKNOWLEDGEMENTS

The authors wish to thank Dr. Jabbar Kassim and Dr. Nawroz Abdulrazzaq (University of sulaimani, faculty of agricultural sciences) for providing cheaking grammatical and data analysis to complete this research.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Kim MK, Lee HG, Park JA, Kang SK, Choi YJ. Recycling of fermented sawdust-based oyster mushroom spent substrate as a feed supplement for post weaning calves. Asian-Aust J Anim Sci. 2011;24:493-499.
2. Sadq SM. Effect of fungi or urea treatment for straw on lambs performance. Msc Thesis, Lap Lambert Academic Publishing, Germany. 2013;13:978-3-659-46936-7.
3. Hassan SA, Sadiq SM, Hassan KM. Effect of feeding chemical and microbial treated barley straw on performance and some serum biochemical attributes of karadi lambs. Ksu J Nat Sci. 2011;14:29-38.
4. Hassan SA, Saeed AA. Effect of feeding different levels of dietary protein with high or low rumen degradable: Undegradable dietary nitrogen on awassi lambs performance.3- selected biochemical parameters. Ksu J Nat Sci. 2012;15:36-45.
5. Fayed AM. *In vitro* and *In vivo* evaluation of biological treated salt plants. American-Eurasian J Agric Environ Sci. 2009;6:108-118.
6. Jezek J, Klopcic M, Klinkon M. Influence of age on biochemical parameters in calves. Bull Vet Inst Palawy. 2006;50:211-214.
7. Hassan SA, AL-Samarae WF, Hashim AJ. Using of microbial treatment to improve nutritive value of ground and chopped barley straw. Iraqi J of Agric Sci. 2008b;38:43-58.
8. Fouda SMI. Studies of nutrition on sugar cane bagasse previous treated of some chemical and biological treatment. phd. Thesis, facult agric, AL-Azhar Univ Egypt; 2008.

9. Hassan SA, EL-Saady Yma, Tawffek JA. Effect substitution gradually percentages of reed silage with alfalfa hay fed with probiotic to awassi lamb. 3-some blood parameters. Iraqi J Agric Sci. 2009b;40:158-173.
10. Hassan SA, Hassan KM. Factors effecting medicinals plants supplementation on some blood parameters of karadi lambs.1-effect of alkali-treated or untreated barley straw. Diyala Agric Sci J. 2010;2:1-15.
11. AOAC. Association of official analytical chemists, official methods of analysis, 14th ed. Washington, dc. 1995;1018.
12. Goering HK, Vansoest PJ. Forage analysis. Agriculture handbook, U. S. Depart Agric. 1970;98:387-598.
13. Alkhazraji A, AL-Maadhidi JF, Abutabigh S. Effect of biological treated corn-cobs in growth, some hematological and biochemical aspects in awassi male lambs. International proceedings of chemical, biological and environ. 2012;48:33-36. Available: Http://connection.ebscohost.com/c/articles/87744977.
14. Park JH, Yoon SH, Kim SW, Shin D, Jin Sk, Yang BS, Cho YM. Hematological and serum biochemical parameters of korean native goats fed with spent mushroom substrate. Asian J Anim Vet Adv. 2012;7:1139-1147.
15. Addinsoft. Xlstat, analyse de données et statistique avec ms excel. Addinsoft; 2007. Ny, usa. Url Available: http://www.xlstat.com/.
16. Duncan DB. Multiple ranges and multiple "f" test. Biometrics. 1955;11:1-12.
17. Park JH, KIM SW, DO YJ, Kim H, Ko YG. Spent mushroom substrate influences elk cervus elaphus canadensis hematological and serum biochemical parameters. Asian-Aust J Anim Sci. 2012;25:320-324.
18. Regula J, Krejpcio Z, Staniek H. Bioavailability of iron from cereal products enriched with dried shittake mushrooms lentinula edodes as determined by iron regeneration efficacy method in female rats. J Med Food. 2010;13:1189-1194.
19. Lindequist U, Niedermeyer Thj, Jülich WD. The pharmacological potential of mushroom. Evidence-based complement. Evidence-based complement aletern med. 2005;2:285-299. Available: Http://www.hindawi.com/journals/ecam/2005/906016/abs/.
20. Jain NC. Essentials of veterinary haematology. Lea and ferbeiger, pennsylvania, USA. 1993;7.
21. Omer HAA, Ali Faf, Gad SM. Replacement of clover hay by biologically treated corn stalk in growing sheep rations. J Agri Sci. 2012;4:257-268.
22. Kholif AM, El-Ashry MA, EL-Alamy HA, EL-Sayed HM, Fadel M, Kholif S. Biological treatments banana wastes for feeding lactating goats. Egypt J Nutr and Feeds. 2005;8:149-162.
23. Zewil MGM. Upgrading of nutritive value for some agricultural residues through the biological treatments for animal feeding. Phd thesis, facult agric, cairo. Al-azhar Univ; 2010.
24. El-marakby KMA. Biological treatments of poor quality roughage and its effect on productive performance of ruminants. Msc thesis, anim prod depart. Facult. Agric. Zagazig Univ; 2003.
25. Xu C, Yan ZH, Hong ZJ, Jing G. The pharmacological effect of polysaccharides from lentinus edodes on the oxidative status and expression of vcam-1mrna of thoracic aorta endothelial cell in high-fat-diet rats. Carbohydr Polym. 2008;74:445-450.
26. Hossain S, Hashimoto M, Choudhury EK, Alam N, Hussain S, Hasan M, Choudhuri SK, mahmud I. Dietary mushroom pleurotus ostreatus ameliorates atherogenic lipid in hypercholesterolaemic rats. Clin Exptl Pharmacol Physiol. 2003;30:470–475.

27. Mohamed MI, Abou-Zeina HAA. Effect of dietary supplementation with biologically treated sugar beet pulp on performance and organs function in goat kids. American-Eurasian J Agric Environ Sci. 2008;4:410-416.



*Peer-review history:*
*The peer review history for this paper can be accessed here:*
*http://www.sciencedomain.org/review-history.php?iid=552&id=32&aid=4842*