



**THE EFFECT OF WHEAT STRAW TREATED WITH PLEUROTUS ERYNGII
MUSHROOM ON BLOOD PERFORMANCE AND PARAMETERS OF FATTENING
LAMBS OF AFSHARI BREED**

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ABSTRACT

The current study aims to review the effects of different levels of replacing wheat straw with *Pleurotus eryngii* mushroom instead of common wheat straw in basal diet on the ability of fattening performance, blood parameters of Afshari male lambs and chemical composition of wheat straw. To achieve the desired result, *pleurotus eryngii* mushroom was processed and prepared for cultivation in sterile conditions in the laboratory. Wheat straw was changed to medium according to international standards and was the context specific for mushroom cultivation. *eryngii* mushroom span with the ratio of 30-50 g per 1 kg medium wheat straw is inseminated and transferred to mushroom saloon and was tested after incubation period of 24 days and completing the processing cycle and product harvesting. This experiment was done with 24 fattened male lambs of Afshari breed with the mean weight of 30.21 kg in the framework of repetition observation design at time with 4 treatments. The experimental diets of treated straw was replaced by wheat straw in the basal diet to zero (diet 1), 50% (diet 2), 75% (diet 3)

and 100% (diet 4). The time of experiment period was considered 90 days (7 days for compatibility and 84 days for experiment). During the fattening, the lambs, the lambs were weighed every 15 days and the average daily gain, average daily feed intake and feed conversion in them were determined. Blood samples were taken from the lambs in 0, 4, 8 and 12 weeks. The results showed that the percentage of crude protein, crude ash, calcium and phosphorus in treated wheat straw than normal wheat straw (control) had a significant increase and the proportion of processed crude fiber was significantly reduced compared to control one. Replacing 75 percent and 100 percent of processed straw instead of the usual straw increase daily dry matter intake and average daily gain in treatments 3 and 4 were to the control ones. Conversion factor of treatment 3 compared to the control group was lower. Replacing various levels of wheat straw treated with fungus had no effect on glucose concentration and blood nitrogen urea. Replacing 75% and 100% levels of processed straw causes a significant increase of total blood protein in treatments 3 and 4 than the control treatment. Generally, it can be concluded that processed wheat straw can increase feed intake, weight gain and improved feed conversion in Afshari male lambs.

Keywords: Wheat straw, processing, Wheat straw, processing, mushrooms mushrooms, fattened lambs

INTRODUCTION

Today, due to population growth and increasing daily nutritional needs, the amount of food and its variety is increased. Although various approaches have been made to increase the yield of crops and livestock; however, because of limited natural resources, agriculture and animal husbandry certainly will not meet for human needs. Animal products play an important role in food production cycle and protein needed by humans. Because of their complex digestive system, ruminants can use various agro products and byproducts and human

consumption wastes and turn them into valuable animal products (Torbatinejad et al., 2007). Food of plant origin, which often come at the expense of animal feed, including crop and forage production and ancillary products such as straw, bagasse and other agricultural branches, they usually have a low digestibility and its most parts are formed of cell wall. Cell walls are made of cellulose, hemicellulose, lignin and minerals in that not only lignin is not digestible, but also prevents the digestion of other components. Therefore, their quality needs to

be added by providing various products. One way biological process to increase nutritional value of roughage is to use lignin parser microorganisms (Rodriguez et al., 2008). Some of the species of *Pleurotus* such as *P. eryngii* have particular importance due to high growth rate on straw, good saprotrophic nutrition, high decomposition of straw and lignin, high production of high production of fruiting body and increased digestibility of straw (Valizadeh et.al, 2008).

Types of meat as a nutritious ingredient are divided into several categories. The largest category in terms of volume of consumption is meat that include beef and lamb meats are the most common types of consumed meats. According to the Institute of Nutrition, the contribution of meat in a balanced diet pattern for each population has been suggested 30 g daily and 11 kg annually. In addition to the nutritional value of red meat in the world, industries related to the manufacture, storage, packaging, processing and distribution of red meat plays an important role in the creation of added value, employment, and trade with the countries involved with and in the whole world. (Cheraghi and Qolipur, 2010).

Over the past 25 years, various processing methods have been done to improve the nutritional value of food, however, these methods are often applied as chemical,

physical and biological methods (Fazaeli, 2008). Yet there are not enough data on the effects of *pleurotus eryngii* mushroom on the amounts of feed intake and performance and blood parameters of male lamb of Afshari breed. Therefore, this study aimed to determine the effect of biologically treated wheat straw and replace it with a portion of the basal diet and to determine the appropriate level of treated straw with *P. Eryngii* mushroom on the performance and blood parameters of fattened lambs of Afshari breed.

MATERIALS AND METHODS

Place and time of testing

Experiments related to fattening in this study was conducted in 90 days (7 days for compatibility and 84 days of original tests) in in the summer of 2013 in the field of agriculture and animal husbandry of white diamonds, located in the city of Kelidar village at Nishapur. Purification process *P.eryngii* mushroom and the formation of mycelium ready for inoculation of wheat in the Laboratory of Plant of Gorgan University of Agricultural Sciences and Natural Resources. The experiments related to blood metabolites was conducted in Veterinary Laboratory of Mashhad and the experiments related to food analysis was done in animal feed industry (granule) at Nishapur.

Livestock and diet

24 Afshari breed lambs with an average age of 4 months and average initial body weight of 30 kg were kept in solitary position. Dietary requirements based on the needs of male lambs (NRC, 2007) was set. All treatments were fed with mixed diets containing barley, wheat bran, wheat straw, hay, mineral and vitamin supplements. Wheat straw constituted 20% of basal diet. The feed was weighed daily and were given to feed the lambs twice daily morning and evening and the remaining food was weighed and recorded before giving daily feed. Straw processed at each meal was provided to the lambs totally mixed with main feed.

Experimental Treatments

Experimental treatments in this study include:

Treatment 1: basal diet (without straw processed) 2) Treatment 2: basal diet containing 50% wheat straw treated with fungus *P. eryngii* mushroom replacing the wheat straw in basal diets, 3) Treatment 3: basal diet containing 75% wheat straw treated with alternative fungus *P. eryngii* mushroom in diets, 4) Treatment 4: basal diet containing 100% of the processed wheat straw mushroom *P. eryngii* mushroom of alternative straw in the basal diet.

Measuring the chemical composition of common wheat straw and wheat straw treated with mushroom

Measuring the dry matter

Until the weight stability is established, the crucible aspect is exited out of the oven and put it in the desiccator for half an hour to be cooled. After cooling, its empty weight is determined. 5 g of wheat straw is taken by the spoon and poured into a cruise and the cruise will be re-weighed. To create weighting stability, the cruise-containing samples is put into the oven for 12 hours which its heat is 105 degrees Celsius. Then the samples are removed and then weighed after being cooled. The amount of dry matter is calculated using the collected data. To determine the dry matter processed with *P. eryngii* mushroom, 500 g of the processed sample were chosen. After determining the initial dry matter, the dried samples were grinded and then for 24 hours at a temperature of 105 ° C, dry milling of processed wheat straw was calculated.

By multiplying the total dry matter with the original dry matter, the samples of processed wheat straw with *P. eryngii* mushroom was achieved AOAC (2005).

Measuring raw ash

About 5 g of each sample was weighed into the Chinese plant and after burning on the

flame, it was transferred into the electric oven for 6-3 hours at 550 ° C. Then the samples was taken out and transferred into the desiccator and after being cooled in the desiccator, the samples were weighed and the percentage of raw ash was calculated AOAC (2005).

Measuring raw fibers

3. About 5.0 grams of dry sample was poured into a fiber measurement system (Erlen 500 ml or crucible of automatic device). 200 ml acid solution of 1.25% sulfuric is added to it. The sample was boiled for 30 min along with the above solution. Then the sample becomes flat with filter paper and Buchner funnel and the sample was distilled for 2-3 times which the impact of acid is washed away completely.

2. The filtered samples are transferred back to the flask and 200 ml of cold solution of 1.25% and 2 drops of ethanol is added to it and will be boiled with 30 minutes.

3. In parallel with the above operation, A Chinese plant with filter paper without Whatman No 41 ash in the oven at 110-100 ° C is arrived to constant weight (41) and write its weight down.

4. The above solution will pass through a filter weighed paper and round the Erlen Mayer will be distilled with hot water and is

rinsed with good stirring and was transferred to filter paper.

5. Fiber filter paper containing fiber is completely isolated from the water and then put into Chinese plant and is desiccated into the oven to 105 ° C for 2 hours and then were cooled in the desiccator and weighed. Then the Chinese plant along with filter plant is transferred into the electric oven at 600 ° C for 30 minutes. After this period, the samples were cooled in a desiccator and the weight difference before and after the furnace shows the raw fiber of the sample AOAC (2005).

Measuring Crude protein

Using the processes of digestion, distillation and titration stage and phase factor protein, crude protein was measured by AOAC (2005).

Measuring crude fat

1. Soxhlet round-bottom flask is first placed in an oven to 110-100 ° C to be completely dried and reached to a constant weight (about 4 hours is required).
2. The amount of 5.3 grams of milled feed samples were poured into cartouche and close its door with some fat-free cotton that prevents from exiting the sample and then put the cartouche into the oven at 90 ° C. Drying up the cartouche includes

food at 90 °, because the extraction process is not done well with Ether.

3. Soxhlet flask were removed from the oven and its weight was recorded with a precision scale after being cooled in the desiccator.
4. Cartouche containing the sample is inserted into the Soxhlet separator pipe and one end of the separator tube is put into the balloon and then slowly throw ether into the separator tube so that Ether is entered the balloon and fill 2.1-2.3 parts of balloon and then the other end of the connector pipe (separator) is connected to the condenser or refrigerant and the balloon is heated from below.
5. Soxhlet device is separated from each other and the ether in the connector tube is evacuated into the glass and cartouche is brought out from the connector tube and the remaining ether is evaporated on the water bath (under the hood) and then put it into the oven at 90 ° C for 2 hours after cleaning the balloon and cool it in the desiccator and the balloon containing fat is weighed with the same balloon that the empty balloon is weighed and the percentage of crude fat is calculated AOAC (2005).

Increasing daily weight

For this reason, the lambs were weighed individually at the start of the experiment and then every two weeks after 16-14 hours deprived of water and food. Weighing was done on days 1, 15, 29, 43, 57, 71, 85 and 92 at 7 am before giving feed and recorded and given the amount of weight gained, daily weight gain was determined.

Feed consumption

Daily feed consumption was weighed and was given for feeding to the lambs in the morning and afternoon and the remaining food was collected every day before morning food and was daily weighed and recorded.

FCR

FCR relates to each treatment depending on the level of feed intake and average daily gain and by dividing the amount of feed intake to the weight gained. \

Blood Samples

Of lambs tested, four times (day 1, 24, 56 and 84) of cervical venous blood samples were taken and 3 lambs were chosen for each treatment. Bloodletting of lambs four hours after the morning feed and vials without anticoagulant factors to determine serum glucose, blood urea nitrogen and total protein was performed. The samples taken blood were transferred immediately to the laboratory. Glucose, blood urea nitrogen and

serum total protein samples using commercial kits Pars central laboratory testing in Sahand veterinary microbiology in Mashhad was determined.

Statistical Design

For data on feed intake, weight gain, feed conversion ratio and blood parameters, the repeated observation design per time using Mixed process of SAS software was used. For data analysis, the chemical composition of wheat straw treated with and without T-test was used.

$$Y_{ijk} = \mu + T_i + \sigma_{ij} + P_k (TP)_{ik} + e_{ijk}$$

To view repetition design per time, the following statistical model was used.

For mean comparison of treatments, Tukey test at 5% was used.

Research findings

The results of the chemical composition of wheat straw before (control) and then treated with the fungus with *P. eryngii* mushroom based on dry matter shows that the amount of dry wheat straw wheat straw treated showed a significant decrease than the control group wheat straw ($P < 0.05$). To maximize their growth, mushroom growing body uses micronutrient status substrate such as starch, glucose, fructose, maltose, mannose, sucrose, pectin, cellulose, lignin and hemicellulose. This action of mushroom reduces dry material of bed and increasing mushroom

mycelium growth. Since 80% of mushroom body is formed by moisture, it reduces the dry bed matter. These findings were consistent with the findings of Nasehi et al. (2012), but not with the findings of (Mehrabi, 2012). Also, the results of the crude protein in treated wheat straw with mushroom showed a significant increase compared to the control ($P < 0.05$). The results obtained were consistent with the results of researches conducted (Hadi Tasbiti et al., 1987); (Fazaeli, 2008); (Nasehi et al., 2012) and (Sgiva Stawa et al., 2011).

According to information obtained, the amount of crude oil processed straw with *P. eryngii* mushroom is though numerically higher than normal wheat straw (control), but is not statistically significant. The amount of fat in dry weight of *P. eryngii* species is in the range of 1 to 8.3 percent and an average of 4 percent. Generally, the crude oil of *P. eryngii* mushrooms represents all components of lipids such as free fatty acids, mono-glyceride, di-glycerides, triglycerides, sterols, sterol esters and phosphoinositide lipids; that almost 72% of the total fatty acids are unsaturated fatty acids in each of the fungi family of *P. eryngii* mushrooms that are varied given the mushroom bed micronutrients (Foroughi, 2009). Since the crude oil of wheat straw is 1.6 average, the

results achieved were not unexpected. The amount of crude fiber in wheat straw processed was reduced than the control wheat straw and was statistically significant ($P < 0.05$). Most fungi are capable of decompose cellulose, hemicellulose and lignin. *P. eryngii* mushrooms grows in dead plants roots of Apiaceae family plants and is able to decompose cellulose and lignin materials and consume them. Lignin content after processing is reduced by mushrooms due to the enzymes secreted by the fungus decomposing by reduced lignin (Mehrabi, 2012). The results obtained in relation to the reduction of crude fiber in processed straw than the control straw with are consistent with the observations (Foroughi et al., 2006). In the wheat straw processed with *P. eryngii* mushrooms, the amount of crude fiber was significantly increased ($P < 0.05$). The results obtained are consistent with the findings of previous research (Nasehi et al., 2012) and (Sharma and Aurora, 2010), but not with the findings of (Mousavi et.al, 2005), which may be due to differences in the type of substrate used and fungi. Mushroom mycelium uses organic materials for growth and reduces the organic matter of the bed and increases crude ash. As the fungus contains large amounts of phosphorus, sodium, potassium and less calcium, mycelial growth on medium wheat

straw, it natural that the minerals are increased in processed wheat straw. Results achieved are consistent with the observations done by Shivastava et.al (2011).

The amount of consumed food

As can be observed from the results, the amount of food consumption in the lambs feed in treatment 4 with control treatment is statistically significant ($P < 0.05$). These findings are compatible with the ones obtained by Mousavi et al. (2005) on the use of processed rice straw with Florida *P. eryngii* mushroom in the diet of Afshari fattened lambs than the ordinary rice straw. Comparing the weighting times show that right up to the last week, the average daily consumption is significantly increased ($P < 0.05$). One of the reasons for the increase in food intake from the beginning to the end of the fattening period, in addition to food palatability by the fungus, it is due to the decrease in temperature and reducing environmental stress and enhancing the welfare of animals. The findings of this study in relation to an increase in dry matter intake from the beginning to the end of fattening is consistent with the Bazyar et.al's findings (2012), but not with the ones obtained by Kakar et.al (2008).

Increasing daily weight

Increasing the daily weight at different times of weighing also showed a significant difference and showed an incremental process from the beginning of the period to the end. The results obtained are not consistent with the findings of Mousavi et al., 2012m, but it is consistent with the findings of Biochman et.al (2003).

FCR

The results showed that the conversion ratio in treatment 3 compared to the control group was significant ($P < 0.05$). Although the processed straw increased feed intake, but the resulting weight gain during the fattening numerically reduce the conversion ratio in treatment 3. The results of the present research are not consistent with the findings obtained by Mousavi et.al (2005) in using processed rice straw with Florida P. eryngii mushroom. In none of the weighing times, the mutual impacts of conversion ratio and the time between different treatments did not differ significantly ($P > 0.05$). The results of the study findings is not consistent with the findings of (Bazyar, 2012).

Blood parameters

Blood glucose

The results indicate average blood glucose levels of lambs in different treatments. Statistical analysis shows no significant differences between the different treatments

in terms of blood glucose levels ($P < 0.05$). The results of the study is the same with the findings (Sharma and Aurora, 2010).

Blood urea nitrogen

The results show the average amount of blood urea nitrogen of lambs in different treatments. Statistical analysis shows no significant differences between the different treatments in terms of the amount of blood urea nitrogen ($P > 0.05$).

The effect of the fungus *Saccharomyces cerevisiae* on blood parameters of Baloochi lambs were studied. The researchers concluded that consumption of these mushrooms can reduce blood urea nitrogen concentration lower than normal level and has a significant difference in terms of statistical control. The results of the study are not consistent with the findings of (Total protein in blood Bazyar, 2012), but consistent with the results of (Fazaeli et al., 2005). The results indicate the average of total protein of the lambs in different treatments. Statistical analysis of data show a significant difference between different treatments in terms of total protein content of blood.

The results of the study show that the concentration of total protein in treatments 3 and 4 is higher than the control treatment. The nitrogen wheat straw treated with P.

eryngii mushroom has been reported more in conducted research (Kim et al., 2011). In addition, entering these materials to rumen and using microorganisms of the rumen, more microbial protein is produced. The results of the study are consistent with findings (Pan et al., 2011), but not with the results achieved by other researchers. The effects of the biological treatment of agricultural products on their nutritional value are widely done. However, the results of these biological treatments with mushroom and other microorganisms on performance and blood parameters of ruminants has been limited (Fazaeli & Masoudi, 2006).

DISCUSSION AND CONCLUSION

Some chemical compounds of wheat straw such as crude protein, crude ash, calcium and phosphorus in treated wheat straw showed a significant increase compared to the conventional straw. Crude fiber of processed straw was significantly decreased, but crude fat was not different from the control straw. Adding the treated straw in the ration of fattening lambs significantly increased daily feed intake and daily weight gain. Straw processed did not affect the parameters of glucose and blood urea nitrogen of fattened lambs. The total protein was significantly increased in consumer treatments compared

to control. In total, consumption of processed wheat straw with *P. eryngii* mushroom improve the performance of male lambs of Afshari breed.

REFERENCES

1. Bazayar, A, 2012, the effect of garlic powder on performance and blood parameters of fattening lambs of Dalaq breed. Master's thesis, Department of Animal Nutrition, College of Animal Sciences, Gorgan University. p 70.
2. Torbatinejad, N, Galeshi, S, Ghourchi, T and Safari, F (2007), Effect of planting and plant density on the nutritional value of foxtail millet. Research Design Reporting, Gorgan University of Agricultural Sciences and Natural Resources, P. 83.
3. Cheraghi, D & Gholipour, D, 2010, an overview of the main challenges in the meat in Iran. Commercial considerations. No. 14: June - July. Pp. 89-110.
4. Fazaeli, H, 2008, Digestibility and voluntary intake of wheat straw treated with oyster mushrooms in sheep and cattle. Journal of Science and Technology of Agriculture and

- Natural Resources. Year 7 (2): 141-149.
5. Foroughi, J. 2009. Principles and methods of oyster mushroom cultivation and other edible mushrooms. Jihad University of Mashhad Publications. PP. 396
 6. Mehrabi, A, 2012, Comparison of chemical composition and degradability of straw types processed by white rot fungi. Master's thesis, Department of Animal Nutrition, College of Animal Sciences, Gorgan University. p 88.
 7. Mousavi, S, S, Fazaeli, H, Amanlou, H and Ghazanfari, R (2005), Treated rice straw mushroom used in Afshari fattening lambs, The second research seminar of sheep and goats, Tehran, Research Institute of Animal Science.
 8. Nasehi, M, Torbatinejad, N, M, Zarehdaran, S, Safaiem A. R (2012), reviewing degradability of straw, soybean and canola treated with fungus *Florida P. eryngii* mushroom in nylon bag method in sheep. Congress of Animal Sciences, University of Technology. Pp. 1317-1321.
 9. Hadizadeh, Tasbiti, A, Mirhadi, Gh (1987): removing biological lignin of wheat straw using Basidiomycetes Fanor 8 *Kriseporium*, research and construction Journal. 37: 267-259.
 10. Beauchemin, K. A., Colombatto, D., Morgavi, D. P., and Wang, Y. 2003. Use of exogenous fibrolytic enzymes to improve feed utilization by ruminants. Journal of Animal Science. 81: 37- 47.
 11. Kakkar, V. K., and Dhanda, S. 1998. Comparative evaluation of wheat and paddy straws for mushroom production and feeding residual straws to ruminants. Bioresource Technology, 66(2): 175-177.
 12. Kim, M. K., Lee, H. G., Park, J. A., Kang, S. K., and Choi, Y. J. 2011. Recycling of fermented sawdust-based oyster mushroom spent substrate as a feed supplement for postweaning calves. Journal of Microbiological Methods, 24: 493-499.
 13. Pan, J., Cao, Y. F., Chao, L., Gao, T. Y., Fu, T., Li, G. Y., and Lian, H. X. 2011. Influence of spent mushroom substrate on fattening performance and blood physiological and biochemical indexes of beef cattle. Journal of Applied Microbiology, 43: 28-37.

14. Sharma, R. K., and Arora, D. S. 2010. Changes in biochemical constituents of paddy straw during degradation by white-rot fungi and its impact on in vitro digestibility. *Journal of Applied Microbiology*, 109(2): 679-686.

15. Shrivastava, B., Thakur, S., Khasa, Y. P., Gupte, A., Puniya, A. K., and Kuhad, R. C. 2011. white-rot fungal conversion of wheat straw to energy rich cattle feed. *Biodegradation*, 22(4): 823-831.