The effect of physiological status on metabolic profile in Egyptian Zarabi does

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Abstract

The aim of this paper is to determine the influence of physiological status on blood metabolic profile in the blood of Egyptian Zarabi does. The experiment was carried out on 35 Egyptian Zarabi does (10 non-pregnant Egyptian Zarabi does, 10 pregnant Egyptian Zarabi does, 10 lactating Egyptian and 5 non-pregnant non-lactating Egyptian Zarabi does and this group act as control group). The experiment occurs during winter-feeding season. The Egyptian Zarabi does were average 2.5±0.5 years old and they were healthy. These Zarabi does were fed on green barseem and 150 g of feed mixture. The hematological examination of all groups indicated the presence of great increase of RBCs, Hg and PCV in pregnant Egyptian Zarabi does when compared to others. On the other hand, there was a decrease in WBCs and PLT than other groups. The biochemical analysis of serum indicated the presence of lower concentrations of glucose and urea and higher concentration of a higher concentrations of total protein, albumin n in relation to non-pregnant Egyptian Zarabi does and lactating Egyptian does and nonpregnant and non-lactating group. In the doe’s blood in lactation were determined higher concentrations of triglycerides, K, Na+ and Cl- in relation to pregnant Zarabi does. Also there were higher concentrations of urea, total bilirubin, AST and GGT activities determined in the blood of Egyptian Zarabi does in lactation compared to high pregnant and non-pregnant Zarabi does. The results obtained from blood indicators point out justification of the blood metabolic profile in improve feeding, management, detect health problems and prevent production disorders in Egyptian Zarabi does and ensuring good health in very demanding physiological states like high pregnancy and lactation.

Key words: Egyptian-Zarabi-does- metabolic- profile

INTRODUCTION

The metabolic profile is based on the concept that the laboratory measurement of certain components of the blood will reflect the nutritional status of the animal, with or without the presence of clinical abnormalities. The metabolic profile test was first established as a tool for assessing metabolic status in dairy herd but recently many studies have applied metabolic profile on sheep to improve feeding, management, detect health problems and prevent production disorders. The results of the research indicate that the test may be useful only as an aid in the diagnosis of nutritional imbalance and production diseases. The metabolic profile testing has been used for prevention of production diseases by early
diagnosis following by feeding management changes, (Herdt et al., 2000). The most common indicators in the blood of animals used in the preparation of the BMP are biochemical and hematological parameters. BMP is used in assessing nutritional status and animal health (Herdt et al., 2000). Significant variations in the blood metabolic profile depend on many, genetic and non-genetic factors. One of the important factors is physiological status which effects on concentration of indicators in blood that are involved in the development of the blood metabolic profile (Antunović et al., 2002; Roubies et al., 2006). However, most research does not include all important biochemical and hematological parameters in blood of does. High pregnancy and lactation, especially in the early stages, are very demanding physiological state of the organism when nutritional requirements are increased (Goff and Horst, 1997). During lactation the mammary gland secretary cells utilize 80% of the circulating metabolites in the blood for milk synthesis (Karapehlivan et al., 2007). The term production disease includes those diseases previously known as metabolic diseases which are attributable to an imbalance between the rates of input of dietary nutrients and the output of production. So the high incidence of production diseases occurs in this period. (Radostits, et al., 2007).

2. MATERIAL AND METHODS

2.1. Animals
The present study was carried out in farm of faculty of veterinary medicine in sadat city, sadat city University. Thirty five apparently healthy, multiparous egyptian Zarabi does during winter feeding season. The Zarabi does were average 2.5±0.5 years old. The mean body weights and standard error of pregnant Zarabi does were 60.25 ± 0.41 kg, for lactating Zarabi does 49.02 ± 0.28 kg and for non pregnant Zarabi does 56.60 ± 10.11 kg. The Zarabi does were fed on green barseem and 150 g of feed mixture. Water and a vitamin-mineral mixture were provided ad libitum to all does for the entire trial. Pregnancy was detected by ultrasonographic examination as follow:

Group 1: includes ten non-pregnant Egyptian Zarabi does.
Group 2: includes ten pregnant Zarabi does.
Group 3: includes ten lactating Zarabi does.
Group 4: includes five does (non-pregnant non-lactating) which acts as a control group.

2.2. Samples
Blood was collected from the jugular vein into both serum vacutainer tubes and the EDTA tubes were inverted several times to ensure adequate mixing of the blood with anticoagulant for hematological analysis. After that, the serum was separated by centrifugation (10 min) at 3000 revolutions/ min. Within the blood serum we make biochemical analysis.

2.3. Haematological examination
Determination of haematological indicators (number of white blood cells-WBCs, red blood cells RBCs, number of platelet-PLT and content of haemoglobin Hg, mean erythrocyte volume-MCV, average content of haemoglobin in erythrocytes-MCH, and mean concentration of haemoglobin in erythrocytes -MCHC) in the whole blood of does was carried out according to (Coles, 1986)

2.4. Biochemical analysis
Spectrophotometric assays were conducted for colorimetric determination of:

2.4.1. Serum Calcium level
Calcium was determined by using of the special kits according to (Thomas, 1998).

2.4.2. Serum phosphorus level
Phosphorus was determined by using of the special kits according to (Young, 1990)

2.4.3. Serum chloride level
Chloride was determined by using of the special kits according to (Tietz, 1999).

2.4.4. Serum Potassium and sodium level
Potassium and sodium was determined by using of the special kits according to (Tietz, 1999).

2.4.5. Serum urea level
Urea was determined by using of special kits according to the method that described by (Patton and crouch, 1977)

2.4.6. Serum creatinine level
Creatinine was determined by using of special kits according to the method that described by (Young, 1990).

2.4.7. Serum glucose
Glucose was determined by using of special kits according to the method that described by (Caraway, 1987).

2.4.8. Serum total cholesterol
Total cholesterol was determined by using of special kits according to the method that described by (Elefson and Caraway, 1976)

2.4.9. Serum triglyceride:
Triglyceride was determined by using of special kits according to the method that described by (Tietz, 1999).

2.4.10. Serum total protein level
Total protein was determined by using of special kits according to the method that described by (Grant et al., 1988).

2.4.11. Serum albumin.
Albumin was determined by using of special kits according to the method that described by (Grant et al., 1988).

2.4.12. Serum globulin
Globulin was determined by the differences between total protein and albumin according to (Coles, 1974).

2.4.13. Bilirubin:
Bilirubin was measured in serum by colorimetric method by using bilirubin kit that was produced by BioMed company according to the method described by (Walters et al., 1970).

2.4.14. Serum GPT (ALT)
ALT was determined by using of the special kits according to the method that described by (Tietz, 1990).

2.4.15. Serum GPT (AST)
AST was determined by using of the special kits according to the method that described by (Reitman and Frankel, 1957)

2.4.16. Serum \( \gamma \)-glutamyl transferase (GGT)
GGT was determined by using of the special kits according to the method that described by (Tietz, 1999).

2.4.17. Alkaline phosphatase (AP)
AP was determined by using of the special kits according to the method that described by (Persijn and Van Der Silk, 1974).

2.4.18. Lactate dehydrogenase (LDH)
LDH was determined by using of the special kits according to the method that described by (Young, 1990).

2.5. Statistical analysis
Data obtained were statically analyzed by one way ANOVA to illustrate the results of this study using the methods of Norman and Baily (1997).

3. RESULTS
The present study is carried out to investigate the normal blood and serum constituents of the examined Egyptian Zarabi does during different physiological states. The results obtained from hematological and biochemical analysis of blood and serum are presented in tables (1-4).

In table no (1), there are great significant increases in RBCs, Hb and PCV of the blood of pregnant does than non-pregnant and lactating does, also there are no changes in these parameters in lactating and non-pregnant than control group while the number of WBCs in blood of lactating does is mild increase than other groups.

On the other hand there is a great significant decrease in PLT in pregnant does than non-pregnant, lactating and non-pregnant non lactating (control) group. The mean values of MCV, MCH and MCHC count of does did not significantly changed in different groups.

In additions, there are great variations in K, Na and Cl activities were determined in the blood of does in lactation compared to pregnancy, non-pregnancy and control does. The opposite trend was observed for Ca and P in pregnancy rather non pregnancy, lactation and control does (table 2).

Lower concentrations of glucose, total bilirubin and urea in the blood of pregnant does were observed in table (3) in relation to non-pregnancy, lactation and control does.
Also, total protein, albumin, creatinine and triglycerides showed highly significant increase in relation to does in relation to non-pregnancy, lactation and control groups.

Furthermore, there are higher concentrations of ALT activity, AST, LDH and GGT activities were determined in the blood of does in lactation compared to pregnancy, non-pregnancy and control does. (Table 4).

### Table (1): Blood hematological parameters in different physiological states of Egyptian Zarabi does.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Physiological status</th>
<th>Non pregnant Mean ± SE</th>
<th>Pregnant Mean ± SE</th>
<th>Lactating Mean ± SE</th>
<th>Control Mean ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBCs (x 10/L)</td>
<td></td>
<td>11.97 ± 0.01</td>
<td>11.55 ± 0.14</td>
<td>10.71 ± 0.02</td>
<td>10.89 ± 0.02</td>
</tr>
<tr>
<td>RBCs (x 1012/L)</td>
<td></td>
<td>11.02 ± 0.04</td>
<td>12.10 ± 0.11</td>
<td>10.11 ± 0.33</td>
<td>10.03 ± 0.02</td>
</tr>
<tr>
<td>Hemoglobin (g/L)</td>
<td></td>
<td>12.44 ± 0.02</td>
<td>13.00 ± 0.03</td>
<td>11.40 ± 0.07</td>
<td>11.20 ± 0.07</td>
</tr>
<tr>
<td>PCV</td>
<td></td>
<td>46 ± 0.04</td>
<td>51 ± 0.05</td>
<td>44 ± 0.05</td>
<td>43 ± 0.05</td>
</tr>
<tr>
<td>PLT (x 109/L)</td>
<td></td>
<td>428.75 ± 0.07</td>
<td>252.36 ± 0.7</td>
<td>411.10 ± 0.78</td>
<td>410.10 ± 0.78</td>
</tr>
<tr>
<td>MCV, fl</td>
<td></td>
<td>42.19 ± 2.11</td>
<td>42.05 ± 2.31</td>
<td>43.55 ± 2.01</td>
<td>43.55 ± 2.01</td>
</tr>
<tr>
<td>MCH, pg</td>
<td></td>
<td>10.97 ± 0.73</td>
<td>10.91 ± 0.63</td>
<td>11.04 ± 0.51</td>
<td>11.04 ± 0.51</td>
</tr>
<tr>
<td>MCHC, g/L</td>
<td></td>
<td>259.56 ± 8.02</td>
<td>259.45 ± 10.76</td>
<td>253.90 ± 9.68</td>
<td>253.90 ± 9.68</td>
</tr>
</tbody>
</table>

Means within the same row having the different letters are significantly different at (P<0.05)
*Non pregnant-non lactating act as control.

### Table (2): Blood electrolytes in different physiological status of Egyptian Zarabi does.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Physiological status</th>
<th>Non pregnant Mean ± SE</th>
<th>Pregnant Mean ± SE</th>
<th>Lactating Mean ± SE</th>
<th>Control Mean ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ca, mmol/L</td>
<td></td>
<td>2.95 ± 0.01</td>
<td>3.85 ± 0.06</td>
<td>2.59 ± 0.07</td>
<td>2.99 ± 0.07</td>
</tr>
<tr>
<td>P-inorganic, mmol/L</td>
<td></td>
<td>1.55 ± 0.10</td>
<td>1.63 ± 0.25</td>
<td>1.61 ± 0.52</td>
<td>1.61 ± 0.52</td>
</tr>
<tr>
<td>K, mmol/L</td>
<td></td>
<td>5.54 ± 0.33</td>
<td>5.39 ± 0.61</td>
<td>5.83 ± 0.40</td>
<td>5.83 ± 0.40</td>
</tr>
<tr>
<td>Na, mmol/L</td>
<td></td>
<td>156.00 ± 0.09</td>
<td>153.20 ± 0.04</td>
<td>166.30 ± 0.21</td>
<td>155.30 ± 0.21</td>
</tr>
<tr>
<td>Cl, mmol/L</td>
<td></td>
<td>102.40 ± 0.21</td>
<td>103.90 ± 0.20</td>
<td>115.80 ± 0.92</td>
<td>115.80 ± 0.92</td>
</tr>
</tbody>
</table>

Means within the same row having the different letters are significantly different at (P<0.05).
*Non pregnant-non lactating act as control.

### Table (3): Blood biochemical parameters in different physiological states of Egyptian Zarabi does.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Physiological status</th>
<th>Non pregnant Mean ± SE</th>
<th>Pregnant Mean ± SE</th>
<th>Lactating Mean ± SE</th>
<th>Control Mean ± SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creatinine, µmol/L</td>
<td></td>
<td>84.02 ± 6.28</td>
<td>85.19 ± 7.11</td>
<td>79.20 ± 11.71</td>
<td>85.19 ± 0.11</td>
</tr>
<tr>
<td>Urea, mmol/L</td>
<td></td>
<td>6.02 ± 0.02</td>
<td>5.610 ± 0.04</td>
<td>7.70 ± 0.06</td>
<td>5.910 ± 0.04</td>
</tr>
<tr>
<td>Cholesterol, mmol/L</td>
<td></td>
<td>1.59 ± 0.24</td>
<td>1.85 ± 0.53</td>
<td>1.57 ± 0.28</td>
<td>1.85 ± 0.53</td>
</tr>
<tr>
<td>Triglyceride, mmol/L</td>
<td></td>
<td>0.15 ± 0.05</td>
<td>0.25 ± 0.09</td>
<td>0.17 ± 0.06</td>
<td>0.17 ± 0.06</td>
</tr>
<tr>
<td>Glucose, mmol/L</td>
<td></td>
<td>3.86 ± 0.32</td>
<td>3.01 ± 0.30</td>
<td>3.26 ± 0.37</td>
<td>3.84 ± 0.02</td>
</tr>
<tr>
<td>Total bilirubin, µmol/L</td>
<td></td>
<td>2.40 ± 0.52</td>
<td>2.60 ± 0.52</td>
<td>3.10 ± 0.57</td>
<td>2.40 ± 0.52</td>
</tr>
<tr>
<td>Total proteins, g/L</td>
<td></td>
<td>74.97 ± 0.07</td>
<td>76.86 ± 0.08</td>
<td>72.50 ± 0.01</td>
<td>74.97 ± 0.03</td>
</tr>
<tr>
<td>Albumine, g/L</td>
<td></td>
<td>30.31 ± 0.31</td>
<td>30.93 ± 0.64</td>
<td>28.60 ± 3.80</td>
<td>30.31 ± 1.31</td>
</tr>
<tr>
<td>globulin, g/L</td>
<td></td>
<td>44.66 ± 0.31</td>
<td>45.93 ± 0.11</td>
<td>44.9 ± 0.61</td>
<td>44.66 ± 0.31</td>
</tr>
</tbody>
</table>

Means within the same row having the different letters are significantly different at (P<0.05)
*Non pregnant-non lactating act as control.
Table (4): Activities of blood enzymes in different physiological states of Egyptian Zarabi does.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Physiological status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non pregnant</td>
</tr>
<tr>
<td></td>
<td>Mean ± SE</td>
</tr>
<tr>
<td>AST</td>
<td>96.20 ± 0.48</td>
</tr>
<tr>
<td>ALT</td>
<td>19.80 ± 0.53</td>
</tr>
<tr>
<td>GGT</td>
<td>46.80 ± 9.40</td>
</tr>
<tr>
<td>CK</td>
<td>95.40 ± 36.92</td>
</tr>
<tr>
<td>LDH</td>
<td>440.10 ± 0.07</td>
</tr>
</tbody>
</table>

*Means within the same row having the different letters are significantly different at (P<0.05).

4. DISCUSSION

There are great significant increase in RBCs, Hb and PCV of the blood of pregnant does than non-pregnant and lactating does, also there is no changes in these parameters in lactating and non-pregnant than control group, these results are similar to data obtained from Azab and Abdel-Maksoud (1999), Iriadam (2007), Antunovic et al., (2011). A rise in RBC volume during later pregnancy causing increased volume of water during advanced pregnancy (Kataria et al., 2002). Increased hemoglobin content in later pregnancy does are probably due to higher demand for oxygen and the requirements of higher metabolic rate for pregnancy. Increase in hemoglobin content during pregnancy confirms the results by El-Sharif and Assad (2001).

The decreased number of WBC during pregnancy and the increase at parturition and early lactation is probably a response to uterine involution. The results agree with those in does (Mbassa and Poulsen, 1991). There is a great significant decrease in PLT in pregnant does than non-pregnant, lactating and non-pregnant non lactating (control) group. The mean values of MCV, MCH and MCHC count of does were not significantly changed in different groups.

The great changes in K, Na and Cl activities that were determined in the blood of does in lactation compared to pregnancy, non-pregnancy and control does are attributed to increase of synthesis of milk in lactation. (Kaneko et al., 2008). The opposite trend was observed for Ca and P in pregnancy rather non pregnancy, lactation and control does which attributed to an increase of requirements for intensive growth of fetus in high pregnancy Antunovic et al. (2004). Azab and Abdel-Maksoud (1999). (Pambu-Gollah et al., 2000). Current findings are consistent with earlier report in lactating does (Roubies et al., 2006) and in lactating mares (Heidler et al., 2002).

Low glucose levels in high pregnancy are associated with fetus development and mobilization of maternal glucose to fetal blood circulation (Jacob and Vadodaria, 2001). Greater urea concentration in lactating does can also be a result of catabolizing muscle protein when large amounts of body reserves are mobilized. This is accordance with BCS and body weights of does. (Pambu-Gollah et al., 2000) and (Caldeira et al. 2007) concluded that does with lower BCS can have greater urea concentration. Similar results have obtained Whitney et al. (2009). The pregnant does have had statistically higher concentrations of total proteins and albumin in blood comparing to the lactating does. Similar concentrations of total proteins in blood of the pregnant does and those in lactation have been found by Roubies et al., (2006) and Karapehliyan et al. (2007). Decrease of total protein and albumins over the lactation could be explained by a rapid extraction of immunoglobulin from the plasma during the last few months of pregnancy when colostrum is being formed in the mammary gland (Kaneko et al., 2008). The highest concentrations of triglycerides and LDL-cholesterol in the blood of the does during late pregnancy comparing to the non-pregnant does can be explain with a consequence of a heavier
transport of the lipoproteins or energy deficiency in a meal. Similar results have been detected by Nazifi et al. (2002). Decreased triglycerides and cholesterol concentrations in early lactation are consistent with an increased energy requirement and negative energy balance. These results are in agreement with those of Heidler et al., (2002). Karapehlivan et al. (2007). In this investigation we have detected the increase of the total bilirubin in the blood of the lactating does and those in pregnancy compared to the non-pregnant ones. This could be the reason of the increased liver metabolism in those stages (Kaneko et al., 2008).

The increase in ALT activity, AST, and GGT in the blood of does in lactation indicated an increased hepatic metabolism. Current findings in blood of lactating does are consistent with earlier reports (Antunović et al., 2004) and Antunovic et al., (2011). Significantly higher LDH activity was observed in the blood of does in lactation compared to pregnant does. Changes in activities of these enzymes may be related to reduced dry matter intake around parturition, may lead to hepatic lipidosis to alter the normal function of the liver (Greenfield et al., 2000).

5. CONCLUSION

- Effect of physiological status significantly manifested on the blood metabolic profile.
- Changes in biochemical indicate the energy deficit of does in early lactation and pregnancy.
- It is recommended development of the blood metabolic profile of does in assessing the nutritional status and ensuring good health states in very demanding physiological conditions like high pregnancy and lactation.

6. REFERENCES


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