ABSTRACT:
The present work was conducted to study effect of different levels (5%, 10% and 15%) from onions and fenugreek on liver, kidney, function and blood lipid profile in rats feeding with diets containing high fat content for induction obesity. Fifty five female albino rats weighing of 250±10g were used and divided into eleven equal groups, one was kept as a control group, while the other groups were fed on high fat diet for induction obesity and treated with onions, fenugreek and mixture from (onions and fenugreek) for 8 weeks. Body weight and food intake were recorded weekly. At the end of the experimental, all rats were weighted for calculation of body weight lose%, feed efficiency ratio. Blood serum samples were used for estimation of the liver and heart functions. Serum analysis showed a significant decrease in cholesterol, triglyceride and LDL in rat groups consumed different concentrations from onions and fenugreek. While HDL was significantly increased in all rats groups comparing with control positive group, serum liver function was significantly decreased. The obtained results concluded that an improvement of all chemical analysis as compared to the positive control group.

It can be recommended that dietary intake from onions and fenugreek to decrease the side effects of obesity and to reach healthy conditions. Further study should be conducted to carry out the pathological and safety investigation in concern to consume onions and fenugreek for a long time.

Key words: Obese rats, fenugreek, onions, high fat, HDL, LDL, cholesterol.
المجلة العلمية لعلوم التربية النوعية
(العدد الثاني)

دراسات بيولوجية وتشريحية على البصل والحلبة في الفئران المصابة بالسمنة

الملخص:

استهدف هذا البحث تقييم استخدام نسب مختلفة للبصل والحلبة (5%, 10%, 20%) على وظائف الكبد والكلي وصور دهون الدم في الفئران التي تغذي علي وجبات عالية الدهن تم استخدام 55 فأر من اناث الألبانو يترجح وزن كل منهم 10±0.5 جرام وتم تقسيمهم الى 11 مجموعة احدهم المجموعة الضابطة السالبة أما المجموعات الأخرى تم تغذيتهم علي وجبات تحتوي علي وجبات تجريبيه تحتوي علي وجبات عالية الدهن للتحريض علي السمنة وتم معالجتها بالبصل والحليا وخلط من البصل والحلية.

وسجل وزن الجسم والمتناول أسبوعيا وفي نهاية التجربة تم حساب معدل التغيير في وزن الجسم ومعدل كفاءة الغذاء وبدأت وظائف الكبد والحليا عن طريق سيرم الدم وقد أوضح المستحيل المتاح عليها. نقص معنوي في كل من الكولسترول والجليسيريدات الثلاثية والليپوفرينات منخفضة الكثافة في كل المجموعات المعالجة بينما ظهر زيادة معنوية في الليپوفيرونيت عالية الكثافة في كل مجموعات الدراسة. وحذف تحسن معنوي في وظائف الكبد.

وتوصي الدراسة بضرورة تناول البصل والحليا حتى نتجنب الآثار الجانبية والمحافظة على كفاءة القلب والكبد مع اجراء ابحاث مستقبلية وفهوديولوجية لمعرفة سلامة الآثار الناتج لاستعمال البصل والحليا لفترات طويلة.

الكلمات الرئيسية: الفئران السمنة، الحلبة، البصل، وجبات عالية الدهن، بروتينات الدهون مرتفعة الكثافة، بروتينات الدهون منخفضة الكثافة، الكوليسترول.
INTRODUCTION

Raju et al. (2001) found that the altered enzyme activities were significantly restored to control values in both the liver and kidney after *Trigonella* seed powder treatment. The therapeutic role of *Trigonella* seed powder in type-1 diabetes as exemplified in this study can be attributed to the change of glucose and lipid metabolising enzyme activities to normal values, thus stabilizing glucose homeostasis in the liver and kidney. These biochemical effects exerted by *Trigonella* seeds make it a possible new therapeutic in type-1 diabetes.

Thakran et al. (2004) showed that liver degenerative and early nephropathic changes in diabetic rats. Ultrastructure of the diabetic liver revealed a reduction in the rough endoplasmic reticulum and swelling of mitochondria in the hepatocytes. TSP treatment to the diabetic rats effectively prevented the alteration in the activities of the two enzymes and partially prevented the structural abnormalities thus suggesting a protective effect of TSP on the liver and kidney of the diabetic rats. The role of TSP in reversing the diabetic state at the cellular level besides the metabolic normalization further proves its potential as an antidiabetic agent.

Arivalagan et al. (2013) found that *Trigonellafoenum-graecum*, commonly called fenugreek, is a leguminous plant native to many Asian, Middle Eastern and European countries. Fenugreek oil is very effective in digestion. Identification of fenugreek genotype rich in saponins and fixed oil will be useful for pharmaceutical industries. In the present study, steroidal saponin and fixed oil content was analysed in 46 diverse fenugreek genotypes on dry weight basis.

Kendler (1987) found that garlic and onion have been used for millenia in the traditional medical practice of many cultures to treat cardiovascular and other disorders. Both *Allium* species, their extracts, and the chemical constituents of these plants have been investigated for possible effects on cardiovascular disease risk factors—both definite (hyperlipidemia, hypertension and hyperglycemia) and suspected (platelet aggregation and blood fibrinolytic activity).

Lata et al. (1991) found that oral administration of petroleum ether extract of *Allium sativum*, *Allium cepa* and ethylacetate extract of Commiphoramukul in albino rats significantly prevented rise in serum cholesterol and serum triglyceride level, caused by atherogenic diet. All the three agents were also found to confer significant protection against atherogenic diet induced atherosclerosis.

Banq et al. (2009) indicated that onion decreased blood glucose, serum lipid levels and reduced renal oxidative stress in STZ-induced diabetic rats and this effect might exert the anti-diabetic effect of onion.

Orie et al. (2012) suggested that dietary onion extract is beneficial for improving diabetes by decreasing lipid levels. They also examined differentiation ability of rat white preadipocyte cells using the onion extract and its sulfur-containing components. Cycloalliin, S-methyl-L-cysteine, S-propyl-L- cysteine sulfoxide, dimethyl trisulfide, especially S-methyl-L- cysteine sulfoxide were reported to be
effective in inhibiting formation of oil drop in the cells, suggesting that these compounds may be involved in the anti-obesity effect of the onion extract. 

Kim et al. (2013) found that the total cholesterol level, low-density lipoprotein cholesterol level and atherogenic index significantly decreased (P ≤ 0.05). No changes were observed in activities of erythrocyte antioxidant enzymes or levels of lipid peroxidation markers following onion peel extract supplementation. Additionally, no significant difference was found in plasma antioxidant vitamin (retinol, tocopherols, carotenoids, and coenzyme Q10) levels or ex vivo H2O2-provoked oxidative DNA damage after onion peel extract supplementation. The present interventional study provides evidence of the health benefits of onion peel extract and demonstrates its effects in modulating lipid profiles in healthy young Korean women.

**MATERIALS AND METHODS**

**Materials:**

1. Casein, all vitamins, minerals, cellulose, L-Cystine and choline chloride were obtained from El-Gomhoriya Company, Cairo, Egypt.
2. Beef tallow, sucrose and corn oil were obtained from local market, Cairo, Egypt.
3. Strach was obtained from local market, Cairo, Egypt.
4. *(Allium cepa)* for slimming was obtained from the spices shop and *Trigonella foenum* gained it.

**Animals:**

Fifty five female albino rats were obtained from The Research Institute Ophthalmology Medical Analysis Department, Giza, Egypt and divided to eleven groups of five rats, each rat housed individually in cylindrical metabolic wire cages.

- Group 1 is a negative control group, 2 is a positive control and numbers from 3 to 5 were treated with *Trigonella foenum* (5% - 10% - 15%). Groups 6 to 8 were treated with *Allium cepa* (5% - 10% - 15%). Groups 9 to 11 were treated with a mixture of *Allium cepa* and *Trigonella foenum* (2.5 : 2.5 % - 5 : 5 % - 7.5 : 7.5%).

**Animals and Experimental Design:**

Rats housed individually in well aerated cages under hygienic laboratory conditions, in animals house of Medical Analysis Department, Giza, Egypt, and fed for 8 weeks on high diet (20% fat and 20% protein) for adaptation before the beginning of the experiment according to AIN (1993).

Rats were divided into 11 groups, every five rats in each group fed on certain diet for 58 days as following:

Group (1): Rats fed on normal diet as negative control.

Group (2): Rats fed on high fat diet (20% fat and 20% protein) as positive control.
Group (3) : Obeserats fed on high fat (20 % fat and 20% protein ) and treated with *Trigonella foenum* (for slimming ) 5 % decoction.

Group (4) : Obeserats fed on high fat (20 % fat and 20% protein ) and treated with *Trigonella foenum* (for slimming ) 10 % decoction.

Group (5) : Obeserats fed on high fat (20 % fat and 20% protein ) and treated with *Trigonella foenum* (for slimming ) 15 % decoction.

Group (6) : Obeserats fed on high fat (20 % fat and 20% protein ) and treated with *Allium cepa* (for slimming ) 5 % decoction.

Group (7) : Obese rats fed on high fat (20 % fat and 20% protein ) and treated with *Allium cepa* (for slimming ) 10 % decoction.

Group (8) : Obeserats fed on high fat (20 % fat and 20% protein ) and treated with *Allium cepa* (for slimming ) 15 % decoction.

Group (9) : Obeserats fed on high fat (20 % fat and 20% protein ) and treated with amixture of *Allium cepa* and *Trigonella foenum* (for slimming ) 2.5:2.5 % decoction.

Group (10): Obeserats fed on high fat (20 % fat and 20% protein ) and treated with amixture of *Allium cepa* and *Trigonella foenum* (for slimming ) 5 :5 % decoction.

Group (11): Obeserats fed on high fat (20 % fat and 20% protein ) and treated with amixture of *Allium cepa* and *Trigonella foenum* (for slimming ) 7.5 :7.5 % decoction.

**Methods:**

Food intake was calculated daily and rats were weighed weekly. Feeding and growth performance were carried out by determination of feed intake, body weight gain and feed efficiency ratio (FER) according to Chapman *et al.* (1959), using the following formulae:

\[
\text{FER} = \frac{\text{Body weight gain (g)}}{\text{Feed Intake (g)}}
\]

\[
(BWG\%) = \frac{\text{Final weight} - \text{Initial weight}}{\text{Initial weight}} \times 100
\]

At the end of the of the experiment period(8 weeks), rats were starved for 12 hr., then sacrificed under ether for anesthesia. Blood samples were collected into clean dry centrifuge tubes and stored at room temperature for 15 minutes, then put into a refrigerator for 2 hour; after that centrifuged for 10 minutes at 3000 rpm to separate transferred into dry clean Wasserman tubes using a Pasteur pipette and then kept frozen at (-20°C) till analysis.

**Biochemical Analysis:**

Serum total cholesterol was calorimetrically determined according to Allain *et al.* (1974) and triglyceride was determined calorimetrically according to Wahlefeld (1974). High Density Lipoprotein cholesterol (HDL-c) was determined calorimetrically according to Richmond (1973). Low Density Lipoprotein
cholesterol (LDL-c) and Very Low Density Lipoprotein cholesterol (VLDL-c) were calculated mathematically according to Friedewald et al. (1972): LDL-c = TC-[HDL-c + (TG/5)] VLDL-c = Triglycerides/5.

Serum glucose and serum insulin were estimated according to Trinder (1969). Serum Asparate and Alanine amino transferases (AST and ALT) were determined using enzymatic colorimetric methods Young (1990) and Tietz (1976).

Statistical Analysis:
Statistical analysis was performed using computer program, Statistical Package for Social science and compared with each other using the suitable tests SPSS (1998).

RESULTS AND DISCUSSION
Data present in Table (1) show effect of feeding with different concentrations (5%, 15% and 15%) for onions, fenugreek and their mixture of them on food intake, body weight gain% and feed efficiency ratio in obeserats. The mean value of feed intake of control positive group was 18.72g while the mean value of control negative group was 16.86g. The obtained results showed that there were non-significant differences except for 5%, 10% and 15% tested groups as compared to positive groups.

The same table showed the highest mean value of BWG% was 95.62 for rats fed on control positive group. While the lowest mean value was 15.45g and 25.72g of rats fed on diet containing for 15% mixture of onions and fenugreek and 15% for fenugreek. However, feeding rats on 5% onions and onions 10% gave the highest values as compared with the other treatments.

There were a significant decrease in BWG% among all tested groups as compared to positive group.

As for FER, the results show that mean value of all groups were a significantly differences among all tested groups as compared to positive groups expect for rats feeding 5% Which was significant (P≤0.05).

The mean values of feed intake were almost the same in most of cases, food efficiency ratio showed a pronounced decrease as compared to the negative control. This reduction may be due to the decrease of body weight during the experimental period.

The results agreed with Gisele et al. (2011) and Parveen and Uma (2013) reported that onions and fenugreek supplemented can decrease the body weight gain than that of control group but the difference was not significant.

Parveen et al. (2013) found that results were comparable with orlistat, a anti-obesity drug, and standard provide clear evidence that the AqE-TFG treatment offered significant protection against MSG-induced dyslipidemia and oxidative stress.

Vatset et al. (2004) found that administration of all the three plant extracts exerted a favorable effect on body weight and blood glucose.
Gisele et al. (2011) found that NAC improved high-sucrose diet-induced obesity and its effects on glucose tolerance, lipid profile, in vivo LDL-oxidant defences.

**Table (1):** Feed intake (F1) g, body weight gain (BWG%) and feed efficiency ratio (FER) of control and obese rats treated with onions, fenugreek and mixture from them.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Feed intake g/day</th>
<th>BWG %</th>
<th>FER</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative group</td>
<td>18.72 ±7.35</td>
<td>40.85±3.15</td>
<td>2.182±0.081</td>
</tr>
<tr>
<td>Positive group</td>
<td>16.86±2.38</td>
<td>95.62±1.38</td>
<td>5.671±0.39</td>
</tr>
<tr>
<td>Fenugreek 5%</td>
<td>16.08±1.75</td>
<td>53.83±1.13**</td>
<td>3.347±0.014</td>
</tr>
<tr>
<td>Fenugreek 10%</td>
<td>16.71±1.61</td>
<td>42.5±2.04**</td>
<td>2.543±0.026</td>
</tr>
<tr>
<td>Fenugreek 15%</td>
<td>15.65±1.54</td>
<td>25.72±1.62***</td>
<td>1.643±0.091</td>
</tr>
<tr>
<td>Onions 5%</td>
<td>16.91±3.23</td>
<td>68.81±3.28*</td>
<td>4.069±0.251</td>
</tr>
<tr>
<td>Onions 10%</td>
<td>16.42±3.19</td>
<td>58.59±2.16**</td>
<td>3.568±0.136</td>
</tr>
<tr>
<td>Onions 15%</td>
<td>15.82±3.52</td>
<td>35.76±1.54***</td>
<td>2.260±0.101</td>
</tr>
<tr>
<td>Mixture 2.5:2.5%</td>
<td>16.18±2.16</td>
<td>46.69±1.46**</td>
<td>2.885±0.026</td>
</tr>
<tr>
<td>Mixture 5:5%</td>
<td>16.32±1.81</td>
<td>40.95±1.16**</td>
<td>2.509±0.031</td>
</tr>
<tr>
<td>Mixture 7.5:7.5%</td>
<td>16.38±1.19</td>
<td>15.45±1.31***</td>
<td>0.0943±0.061</td>
</tr>
</tbody>
</table>

Mixture: (onions and fenugreek).

* Differences are significant at P≤0.05
** Differences are highly significant at P≤0.01
*** Differences are highly significant at P≤0.001.

1 Feed efficiency ratio

Table (2) illustrate the fasting serum lipids and the effect of feeding with different concentrations (5%, 10% and 15%) of onions, fenugreek and mixture from them on serum lipids of obese rats.

It could be observed that total cholesterol, TG and LDL decreased as a result of adding onions, fenugreek and mixture from them in the diet. There were very highly significant differences in TC and TG of mixture from onions and fenugreek 15% group as compared to positive group. As for HDL, the mean value of negative control was higher than that of positive control. While the mean values of groups fed on diets with 15% mixture from onions and fenugreek and 15% onions were more significantly higher than that of positive control.

Concerning LDL, the mean value of negative control was lower than that of positive control. The mean values of all the groups were significantly lower than that of positive control.
The results agreed with Kim et al. (2013) and Atta et al. (2012) they showed that, onions and fenugreek decreased total cholesterol, LDL cholesterol and triglycerides.

Parveen and Uma (2013) found that AqE-TFG (Aqueous extract of Trigoellafoenumgarecum) produced significant reduction in serum total cholesterol (TC), triglycerides (TGs), lactate dehydrogenase (LDH) and elevation in serum high density lipoprotein cholesterol (HDL-C), hepatic and cardiac antioxidant enzymes. Kim et al. (2013) found that the total cholesterol level, low-density lipoprotein cholesterol level and atherogenic index significantly decreased (P ≤0.05).

**Table (2):** Mean values of lipids parameters of control and obese rates treated fed on onions, fenugreek and mixture from them.

<table>
<thead>
<tr>
<th>Serum lipids</th>
<th>Total cholesterol</th>
<th>Triglycerides</th>
<th>HDL-cholesterol</th>
<th>LDL-cholesterol</th>
<th>VLDL-cholesterol</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative group</td>
<td>168.13±5.06</td>
<td>70.85±3.27</td>
<td>54.91±1.17</td>
<td>99.05±2.32</td>
<td>14.17±0.73</td>
</tr>
<tr>
<td>Positive group</td>
<td>196.87±2.31</td>
<td>93.73±2.15</td>
<td>43.48±0.92</td>
<td>134.65±4.15</td>
<td>18.74±0.56</td>
</tr>
<tr>
<td>Fenugreek 5%</td>
<td>188.33±3.19</td>
<td>86.61±1.37</td>
<td>47.16±0.76</td>
<td>123.45±4.50</td>
<td>17.72±0.89</td>
</tr>
<tr>
<td>Fenugreek 10%</td>
<td>180.02±2.57*</td>
<td>82.45±1.16*</td>
<td>50.53±2.31*</td>
<td>113.0±2.46*</td>
<td>16.49±0.92</td>
</tr>
<tr>
<td>Fenugreek 15%</td>
<td>178.15±1.88**</td>
<td>77.55±1.33**</td>
<td>51.07±1.19**</td>
<td>111.57±1.88**</td>
<td>15.51±0.64</td>
</tr>
<tr>
<td>Onions 5%</td>
<td>186.19±1.51</td>
<td>85.47±1.11</td>
<td>50.38±1.38</td>
<td>118.7±1.93</td>
<td>17.09±0.79</td>
</tr>
<tr>
<td>Onions 10%</td>
<td>178.46±1.67***</td>
<td>79.75±2.47***</td>
<td>51.01±2.15***</td>
<td>111.5±0.65***</td>
<td>15.95±0.25***</td>
</tr>
<tr>
<td>Onions 15%</td>
<td>175.77±6.13***</td>
<td>76.81±3.81***</td>
<td>53.46±3.08***</td>
<td>106.95±2.29***</td>
<td>15.36±0.67***</td>
</tr>
<tr>
<td>Mixture 2.5:2.5%</td>
<td>180.48±2.31</td>
<td>80.17±2.97</td>
<td>50.78±1.27</td>
<td>113.67±2.28</td>
<td>16.03±0.44</td>
</tr>
<tr>
<td>Mixture 5.5%</td>
<td>177.67±5.43</td>
<td>75.31±1.81</td>
<td>50.29±3.11</td>
<td>111.69±4.67</td>
<td>15.06±0.27</td>
</tr>
<tr>
<td>Mixture 7.5:7.5%</td>
<td>173.23±3.11***</td>
<td>73.28±1.05***</td>
<td>53.87±1.32***</td>
<td>104.71±1.63***</td>
<td>14.65±0.66***</td>
</tr>
</tbody>
</table>

Mixture : (onions and fenugreek).

* Differences are significant at P≤0.05  ** Differences are highly significant at P≤0.01  *** Differences are highly significant at P≤0.001.

**Table (3):** shows serum ALT, AST and serum glucose of control positive and different groups of obese rats fed on different concentration (5%, 10% and 15%) from onions, fenugreek and mixture from them. It’s clear that ALT and AST for control positive was higher than control negative.

It could be observed the improvement of ALT and AST was highest for mixture

Fenugreek 5% from onions and fenugreek 15% diet (6.20 and 16.11) while was lowest for diet (7.11 and 19.76) difference were high significant (P ≤0.001) when compared with control positive group.
This result in table (3) agreed with those reported by Parveen and Uma (2013) aspartate amino transferase (AST), alanine amino transferase (ALT), hepatic and cardiac lipid peroxides (MDA) levels. Mete et al. (2013) indicated that pretreatment with ACE (Allium cepa) protects against DOX- (Doxorubicin) induced hepatotoxicity due to the antioxidant properties of ACE. Further studies on efficacy of antioxidant treatment by ACE in DOX-mediated toxicity and underlying mechanisms would provide a better explanation.

**Table (3):** Mean values of liver function parameters of control and obese rates treated fed on onions, fenugreek and mixture from them.

<table>
<thead>
<tr>
<th>Groups</th>
<th>AST u/l</th>
<th>ALT u/l</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative group</td>
<td>16.25±0.091</td>
<td>6.17±0.13</td>
</tr>
<tr>
<td>Positive group</td>
<td>20.67±0.53</td>
<td>7.71±0.36</td>
</tr>
<tr>
<td>Fenugreek 5%</td>
<td>19.76±0.75</td>
<td>6.53±0.049*</td>
</tr>
<tr>
<td>Fenugreek 10%</td>
<td>17.63±0.73</td>
<td>6.37±0.021**</td>
</tr>
<tr>
<td>Fenugreek 15%</td>
<td>18.46±0.90</td>
<td>6.65±0.033</td>
</tr>
<tr>
<td>Onions 5%</td>
<td>17.15±0.18</td>
<td>6.53±0.049*</td>
</tr>
<tr>
<td>Onions 10%</td>
<td>16.32±0.26</td>
<td>6.53±0.049*</td>
</tr>
<tr>
<td>Onions 15%</td>
<td>17.17±0.26</td>
<td>6.65±0.033</td>
</tr>
<tr>
<td>Mixture 2.5:2.5%</td>
<td>16.56±0.37</td>
<td>6.53±0.049*</td>
</tr>
<tr>
<td>Mixture 5:5%</td>
<td>16.56±0.88</td>
<td>6.65±0.033</td>
</tr>
<tr>
<td>Mixture 7.5:7.5%</td>
<td>16.11±0.37</td>
<td>6.20±0.015***</td>
</tr>
</tbody>
</table>

Differences are significant at P≤0.05
**Differences are highly significant at P≤0.01
***Differences are highly significant at P≤0.001.

**Table (4):** Shows serum glucose of control positive and different groups of obese rats fed on different concentration (5%, 10% and 15%) of onions, fenugreek and mixture from them. It’s clear that serum glucose of control positive was higher than control negative.

It could be observed the improvement of serum glucose was highest for 15% diet mixture of onions and fenugreek (79.63mg/dl) while it was lowest for fenugreek 5% diet (81.75mg/dl), the difference was high significant (P ≤ 0.01) when compared with control positive group.
This result agreed with those reported by Tripathi and Chandra (2009). That extractin diabetic rats has remarkably improved the elevated levels of lipid fasting blood glucose. A significant decrease in peroxidation (p ≤ 0.001) significant.

Imad et al. (2010) found that in assessment of hypoglycaemic activity of Allium cepa in type 1 and type 2 diabetic patients, ingestion of crude Allium cepa (100 g) caused a considerable reduction in fasting blood glucose levels by about 89 mg/dl in relation to insulin (145 mg/dl) in type 1 diabetic patients and it reduced fasting blood glucose levels by 40 mg/dl.

**Table (4):** Mean values of serum glucose parameters of control and obese rats treated fed on onions, fenugreek and mixture from them.

<table>
<thead>
<tr>
<th>Grops</th>
<th>Serum Glucose mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative group</td>
<td>75.17±3.38</td>
</tr>
<tr>
<td>Positive group</td>
<td>94.22±6.18</td>
</tr>
<tr>
<td>Fenugreek 5%</td>
<td>89.93±1.19</td>
</tr>
<tr>
<td>Fenugreek 10%</td>
<td>86.32±2.65</td>
</tr>
<tr>
<td>Fenugreek 15%</td>
<td>84.97±1.11</td>
</tr>
<tr>
<td>Onions 5%</td>
<td>85.36±2.06</td>
</tr>
<tr>
<td>Onions 10%</td>
<td>84.22±1.87</td>
</tr>
<tr>
<td>Onions 15%</td>
<td>81.75±2.34</td>
</tr>
<tr>
<td>Mixture 2.5:2.5%</td>
<td>83.27±3.63</td>
</tr>
<tr>
<td>Mixture 5:5%</td>
<td>82.81±5.16</td>
</tr>
<tr>
<td>Mixture 7.5:7.5%</td>
<td>79.63±4.82</td>
</tr>
</tbody>
</table>

Mixture: (onions and fenugreek).

*Differences are significant at P≤0.05*  
**Differences are highly significant at P≤0.01**  
***Differences are highly significant at P≤0.001. 1 Feed efficiency ratio.
REFERENCES


