Crude fibre digestibility in scavenger ducks

Rohfaserverdaulichkeit bei Enten im unbegrenzten Auslauf

M. Y. El Beeli¹, N. A. Musharaf¹, H. O. Abdalla¹ and W. Bessei²


Introduction

Crude fibre digestion is of great value for poultry under extensive production systems. Disruption of plant cell walls by digestive processes provides birds with the potential digestible nutrients. However, information on fibre digestibility in poultry is limited, and knowledge on fibre digestibility in scavenger ducks is completely lacking. Scavenger ducks can find a good portion of their own feed from weed plants, seeds, snails, slugs and insects and they are well resistant to diseases and poor conditions. In most countries small size local breeds are being used in scavenger production systems which have lower feed intake and growth rate compared to pekin or muscovy ducks.

Informations on crude fibre digestibility in different poultry species show considerable variations. Digestibility coefficient of 21.1 and 22.1% were reported for rye-grass feeding for different countries small size local breeds are being used in scavenger growth rate compared to pekin or muscovy ducks.

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Materials and Methods

Nine scavenger ducks (irrespective of sex) of local strain of different ages were purchased from different households. In Wad Medani City, Sudan. Ducks were divided into three groups designated as A, B and C. Each group consisted of three ducks of almost the same weight and age. The ages and average live weights of the three groups were 4–5, 15–18, and 36–40 months, and 1,750, 2,800 and 3,850 g, respectively. The birds were housed in triple deck cages. Each bird was kept in a separate cage of 60 × 50 × 40 cm. The experimental diets included four crude fibre levels, 10.3, 16.8, 21.5 and 26.8% (Table 1). High crude fiber levels were used to determine the maximum inclusion level of fiber and to evaluate to what extent scavenger birds can manage to satisfy their own requirements. Water was available ad libitum, 150 g/bird of each experimental diet was offered once a day. Natural day-light of 12 hour was allowed. Each age group was offered the experimental diets, successively. Each experimental diet was offered for 5 days as a preliminary period, followed by 4 days of collection period. All birds received a basal diet (150 g/bird/day) for 4 days before it was shifted to the next experimental diet. Fe₂O₃ at 0.5% was used as a dye to colour the faeces so as to differentiate between the experimental and basal diets. Feed intake was recorded daily. Faeces were collected once a day. The total faeces collected were oven dried at 55–60 °C overnight, followed to air drying at room temperature for 7 days, weighed, grounded, and samples were taken for chemical analysis. Fibre proximate analysis was carried out following the procedure outlined by A.O.A.C. (1980). The digestibility percentage for each duck was calculated as a mean of four readings. Digestibility of fibre was determined by measuring of feed intake, faecal output, and faecal fibre contents using the equation of Scott et al. (1982).

Data followed a completely randomised design (CRD) and were analysed by oneway analysis of variance (ANOVA). Treatments means were compared for statistical difference using Duncan's Multiple Range Test (DMRT; Duncan, 1955).

Results and Discussion

Due to the insufficient number of available scavenger ducks of the same strain, live weight, age and sex, the experimental ducks were selected irrespective of their sex. It was assumed that sex has no significant effect on digestibility (Musharaf, pers.com.). The digestibility coefficients were significantly affected by age of the duck, fibre levels in the diets (p < 0.01), and age × fibre level interaction (p < 0.05) (Table 3). Digestibility coefficients of 40.8, 48.1, and 52.8% were attained by 4–5, 15–18, and 36–40 months old ducks, respectively. The increase of digestibility coefficients with age of the birds may be attributed to the increase in caecum

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dimensions, thus giving more room and time for caecal micro-organisms to digest fibrous diets. Fibre levels of 10.3, 16.8, 21.5, and 26.8% displayed digestibility coefficients of 56.8, 52.7, 40.2, and 39.2%, respectively. These findings are consistent with those reported by Tyler (1964), Thornburn and Willcox (1965), Totsuka et al. (1997), and Vetesi et al. (2000).

Digestibility of low crude fibre levels (10.3 and 16.8%) in diets was significantly (p < 0.01) higher than digestibility of high fibre levels (21.5 and 28.8%) (Table 3). This finding suggests that under the present experimental conditions crude fibre in duck rations can be raised up to 16.8% without reduction in digestibility of fiber components. The highest crude fibre digestibility coefficient (59%) was attained when the lowest fibre level (10.3%) was fed to the oldest ducks (group 3) (Table 3).

Table 2. Composition, calculated and analysed nutrients of experimental diets [%]

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorghum</td>
<td>64.20</td>
<td>54.20</td>
<td>34.70</td>
<td>15.70</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>3</td>
<td>5</td>
<td>9.20</td>
<td>14.0</td>
</tr>
<tr>
<td>Groundnut cakes</td>
<td>18</td>
<td>20</td>
<td>24</td>
<td>27</td>
</tr>
<tr>
<td>Groundnut hulls</td>
<td>18</td>
<td>18</td>
<td>29</td>
<td>40</td>
</tr>
<tr>
<td>Sand</td>
<td>3</td>
<td></td>
<td>0.3</td>
<td>0.5</td>
</tr>
<tr>
<td>Oyster shell</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Common salt</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Fe₂O₃</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Proximate Analysis:

| Crude protein %              | 15.74    | 15.73    | 15.82    | 15.53    |
| Metabolisable energy* k cal/kg feed | 2919    | 2897    | 2895    | 2930    |
| Fibre %                      | 10.34    | 16.84    | 21.50    | 26.84    |
| Dry matter %                 | 91.42    | 90.97    | 91.30    | 91.25    |

* Calculated by the equation:

\[ ME = 1.369 + 0.0102 \times CP + 0.0275 \times EE + 0.0148 \times NFE - 0.0034 \times CF \]

Where: CP: Crude Protein; EE: Ether Extract; NFE: Nitrogen Free Extract,
CF: Crude Fiber

With increasing fibre levels in diets feed intake decreased and faeces dry matter (DM) mass and fibre contents increased (Tables 4–6). Probably, fibrous diets are bulky, requiring a bigger volume in the digestive tract, more time, and more micro-organisms in order to be digested.

Individual ducks consuming the same diets showed variation in faeces dry matter mass. This observation is consistent with previous reports, and confirms the conclusion that faeces DM mass is characteristic for individual birds but does not depend on type of food (Thornburn and Willcox, 1965; King et al., 1997).

The results indicate that the digestibility of dry matter in the diets is related to the crude fibre contents (Fig. 1). This confirms the findings of Hallsworth (1949), Thornburn and Willcox (1965), who described a negative linear relationship between crude fibre contents and digestibility coefficients.

The high digestibility coefficient reported in this study may be due to several reasons, including, low feed intake relative to maintenance needs, and thus small amounts of faeces DM mass, presence of sand grits in the diets, fine grinding of groundnut hulls, lower density of the feed.

Table 3. Digestibility coefficients of four fibre levels determined by ducks in three age periods

<table>
<thead>
<tr>
<th>fibre levels</th>
<th>Age in months</th>
<th>Mean of fibre effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.34%</td>
<td>53.3±b</td>
<td>57.9a</td>
</tr>
<tr>
<td>16.84%</td>
<td>45.9bc</td>
<td>53.8ab</td>
</tr>
<tr>
<td>21.5%</td>
<td>32.7de</td>
<td>40.2cde</td>
</tr>
<tr>
<td>26.84%</td>
<td>30.9e</td>
<td>40.2bc</td>
</tr>
</tbody>
</table>

Mean of age effect

|ibre effect | 48.1b         | 52.8a               |


Means of interaction effect with different letters are significantly different (P < 0.05). Means of fibre or age effect, followed by different letters are significantly different (P < 0.01) Duncan’s (1955).

Table 4. Feed intake, faeces mass, and faecal crude fibre content (mean ± sd) in ducks aged 4–5 months

<table>
<thead>
<tr>
<th>Fibre levels</th>
<th>10.34%</th>
<th>16.84%</th>
<th>21.50%</th>
<th>26.84%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed intake g DM/bird/day</td>
<td>92.00 ± 16.4</td>
<td>97.00 ± 13.7</td>
<td>73.00 ± 4.2</td>
<td>64.00 ± 6.1</td>
</tr>
<tr>
<td>Faeces g DM/bird/day</td>
<td>20.20 ± 3.2</td>
<td>23.64 ± 2.0</td>
<td>28.13 ± 3.4</td>
<td>28.73 ± 4.5</td>
</tr>
<tr>
<td>Faecal crude fibre %</td>
<td>22.00 ± 1.7</td>
<td>37.35 ± 1.2</td>
<td>37.46 ± 1.1</td>
<td>41.88 ± 0.39</td>
</tr>
</tbody>
</table>

Values are means of 12 readings/treatment ± S.D.
and the high fibre levels fed to the birds causing a reduction in transit time of the food in the gut allowing a better fibre digestion. Age of the ducks and their previous grazing habit makes them more adapted to non-starch polysaccharide rich diets, leading to an increase in the amount of gut microflora resulting in a higher fermentation activity. These suggestions are generally endorsed with several reports (ENSMINGER et al., 1990; CHOCHT et al., 1996; LANGHOUT, 1999; VETESI, 2000).

It can be concluded that the crude fibre digestibility coefficient increased with age of the ducks and decreased with increasing fibre level in the diet. The crude fibre contents in the diets of scavenger duck can be raised up to 16.8% without adverse effect on digestibility of fiber components.

**Summary**

Digestibility of crude fibre in nine scavenger ducks, aged 4 to 5, 15 to 18, and 36 to 40 months, and fed diets containing 10.3, 16.8, 21.5, and 26.8% fibre was determined. Each duck was housed individually in a cage. Respective experimental diets (150 g/bird/day) were offered for nine days (5 days as a preliminary period, plus 4 days as a collection period). Collected faeces were oven dried at 55–60 °C overnight followed by air drying at room temperature for 7 days, weighed, ground, and samples were taken for chemical analysis. The digestibility coefficients were determined by measuring feed intake, faecal mass, and faecal fibre contents.

The results showed that digestibility coefficients were significantly affected by age of bird, fibre levels in diets (p < 0.01), and age x fibre level interaction (p < 0.05). Ducks of 4-5, 15-18, and 36-40 months of age displayed digestibility coefficients of 40.8, 48.1, and 52.8%, respectively. Whereas, fibre contents of 10.3, 16.8, 21.5, and 26.8% in the diets showed digestibility coefficients of 56.8, 52.7, 40.2, and 39.2%, respectively. The results indicate a linear relationship between the digestibility of dry matter in the diets and the crude fibre contents. Fibre level in scavenger duck’s ration can be raised up to 16.8% without adverse effect on digestibility. The high digestibility coefficients reported herein may be due to low feed intake, presence of sand grits in diets, grinding of the groundnut hulls, reductions in the transit time of the food in the gut, age, and scavenger habits of the ducks.

Table 5. Feed intake, faeces mass, and faecal crude fibre content in (means ± sd) ducks aged 15–18 months

<table>
<thead>
<tr>
<th>Fibre levels</th>
<th>10.34%</th>
<th>16.84%</th>
<th>21.5%</th>
<th>26.84%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed intake g DM/bird/day</td>
<td>115.00 ± 13.2</td>
<td>97.00 ± 11.5</td>
<td>110.00 ± 2.0</td>
<td>80.00 ± 4.0</td>
</tr>
<tr>
<td>Faeces g DM/bird/day</td>
<td>25.33 ± 8.5</td>
<td>24.00 ± 3.7</td>
<td>40.10 ± 10.1</td>
<td>35.70 ± 1.1</td>
</tr>
<tr>
<td>Faecal Crude fibre %</td>
<td>19.76 ± 0.59</td>
<td>31.42 ± 0.68</td>
<td>35.00 ± 2.2</td>
<td>36.00 ± 0.33</td>
</tr>
</tbody>
</table>

Table 6. Feed intake, faeces mass, and faecal crude fibre content (means ± sd) in ducks aged 36–40 months

<table>
<thead>
<tr>
<th>Fibre Levels</th>
<th>10.34</th>
<th>16.84</th>
<th>21.50</th>
<th>26.84</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed intake g DM/bird/day</td>
<td>117.00 ± 8.9</td>
<td>90.00 ± 7.0</td>
<td>110.00 ± 10.1</td>
<td>85.00 ± 14.5</td>
</tr>
<tr>
<td>Faeces g DM/bird/day</td>
<td>25.50 ± 5.9</td>
<td>20.60 ± 4.2</td>
<td>37.62 ± 6.4</td>
<td>35.00 ± 4.8</td>
</tr>
<tr>
<td>Faecal crude fibre %</td>
<td>19.40 ± 1.1</td>
<td>30.60 ± 2.2</td>
<td>33.30 ± 3.0</td>
<td>34.80 ± 0.28</td>
</tr>
</tbody>
</table>

Figure 1. Digestibility of dry matter of diets

![Figure 1. Digestibility of dry matter of diets](image-url)
Die Rohfaserverdaulichkeit wurde bei neun Enten einer lokalen Rasse im Alter von 4 bis 5, 15 bis 18 und 36 bis 40 Monaten bestimmt. Die Enten wurden vor dem Versuch in einem unbegrenzten Auslauf gehalten und während der Versuchsphase mit Rationen gefüttert, die einen Rohfasergehalt von 10,3%, 16,8%, 21,5% und 26,8% enthielten. Für die Bestimmung der Verdaulichkeit wurden die Enten in Einzelkäfigen gehalten. Die Versuchsrationen (150 g/Tier/d) wurden jeweils für neun Tage angeboten (5 Tage Vorperiode, 4 Tage Sammelperiode). Die gesammelten Exkremente wurden im Ofen bei 55–60°C getrocknet, bei Raumtemperatur über 7 Tage nachgetrocknet, gewogen, vermahlen und danach für die chemischen Analysen verwendet. Die Verdaulichkeitskoeffizienten wurden bestimmt über die Messung der Futteraufnahme, der Masse der Exkremente und der Rohfaser-Verdaulichkeit.

Die Ergebnisse zeigen, dass die Verdaulichkeitskoeffizienten signifikant durch das Alter der Tiere, den Rohfasergehalt in der Ration (p < 0,01) und die Wechselwirkung zwischen Alter und Fasergehalt (p < 0,05) beeinflusst werden. Die Enten im Alter von 4–5, 15–18 und 36–40 Monaten wiesen Verdauungskoeffizienten von 10,3; 16,8; 21,5; 26,8% auf. Für die Rohfasergehalte von 4–5, 15–18 und 36–40 Monaten wiesen Verdauungskoeffizienten von 52,7; 40,2 und 39,2% ermittelt. Die Ergebnisse zeigen eine lineare Beziehung zwischen der Verdaulichkeit der Trockensubstanz und den Rohfasergehalten in den Rationen. Basierend auf den vorliegenden Erkenntnissen kann davon ausgegangen werden, dass der Rohfasergehalt in Futterrationen für Enten im unbegrenzten Auslauf bis zu 16,8% betragen kann, ohne negative Auswirkungen auf die Verdaulichkeit. Die in der vorliegenden Untersuchung ermittelten hohen Verdaulichkeitskoeffizienten können über die geringe Futteraufnahme, das Vorhandensein von Sand in den Rationen, die Mahlen der Erdnüsse, die Reduzierung der Passagezeit der Nahrung im Kropf sowie auf das Alter und die Außengewohnheiten der Enten zurückgeführt werden.

**Stichworte**
Enten, Auslauf, Fütterung, Rohfaser, Verdaulichkeit

**References**


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