# THE EFFECT OF SHORTENING THE COLLECTION PERIOD IN DIGESTIBILITY TRIALS WITH SHEEP WITH REFERENCE TO SHORT-CUTS IN CALCULATIONS

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## SUMMARY

Investigations were carried out in digestibility trial technique in order to study the effect of shortening the collection period and to make short-cuts in calculating digestibility coefficients and digestible nutrients with feeds. Two digestion trials were performed with sheep, using clover hay alone and along with wheat straw. The collection period was devided into 3 sub -periods, of 4 days each, then digestibilities were calculated for each sup-period and during the whole period. It was found that, there was a similarity in the daily dry matter balance, digestion coefficients, digestible nutrients as well as the feeding value at the three sub-periods and the whole period in both trials. With clover hay, the total digestible nutrients were found to be 47.41,48.73 and 48.24 in the 3 sub-periods and 48.13 in the whole period. The respective feeding value was 32 04,33.30 and 32.77 as starch value. With wheat straw, the T.D.N. values were 42.29, 42.07, 41.87 and 42.47 in the 3 sub-periods and the whole period respectively against a starch value of 23.93,23.77, 23.47 and 24.11. It appears permissible in practice to shorten the collection period with similar feeds down to 4 days. The study included also some deduced equations to facilitate calculation of digestion coefficients and digestible nutrients for feeds fed along with a basal ration.

## INTRODUCTION

Investigations about facilitating digestibility trial technique was presented. It was thought that shortening the length of the collection period down to four days might be allowable without obtaining different results in digestibility trial. This would save time and labour for producing the feeding value of feeds and roughages such as those used with experiments including the alkali treatment. This was tested at first with hay, the commonest basal ration used in Egypt in digestibility trials with sheep. It was also intented to test this in a trial in which the digestibility coefficients were obtained indirectly (by the difference method) using hay as a basal ration and wheat straw as tested one. In the indirect method more experimental errors were to be expected and it was decided to find out how far such shortening of the collection period would be applicable.

Short cuts in calculating digestible nutrients and digestibility coefficients in the indirect method was also presented.

## EXPERIMENTAL AND METHODS

The digestibility trials were performed with duplicate sheep in each experiment using the ordinary convential methods using metabolism trials and the official methods for analysis (2). The whole collection period of 12-days was divided into 3-periods (or sub-periods) of 4 days each. In each 4-days period the faecal material was collected as in an independant trial. Analysis of the faeces was made for each sheep seperately in a representative composite faecal sample of each 4-days collection. The digestion coefficinets of nutrients were obtained per sheep for each sub period. The average from the two sheep was taken for comparison between the digestibility coefficients obtained during other sub-periods and the whole period of 12 days. The coefficients during the 12 days period were obtained by summation of individual nutrients eaten and excreted during the 3 sub-periods. Two experiments were conducted :

Experiment 1, using hay, as basal ration, the digestibility obtained directly.

Experiment 2, using wheat straw along with hay as a basal ration, the digestibility obtained indirectly.

The digestible nutrients and feeding value as starch value or T.D.N., were also compared.

Examples for applying the short-cuts in caluclating were taken from results with Experiment 2. It is also to be noted that the preliminary period was extended to 10 days.

## RESULTS AND DISCUSSION

### Expt. 1.—Study of the effect of reducing the collection period in digestion trial with clover hay.

*Daily dry matter balance*

The average daily consumption per sheep during each period of 4 days and the whole period of 12 days as well as the average daily dry matter excretion were practically the same (Table 1). For sheep 1 the range was 838-863 g. for food and 358-362 g. for faeces, the corresponding ranges for Sheep 2 were 812-857 and 335-342 gm. There was a similarity between the daily dry matter balance among the three sub-periods (Periods 1, 2, 3) and the whole period for each sheep.

*Analysis of food and faecal material during the sub-periods of collection with hay*

The food analysis was obvoiusly the same. Results in Table 2 showed that the analysis of dry faeces was practically the same for each sheep during the three periods. The units of differences in percentage was not exceeding about (2 except), in some cases with the N-free extractives where the difference was reaching 2.4.

*Comparison of digestibility coefficients with hay during the sub-periods and the whole period*

There was satisfactory agreement between each duplicate sheep during each period, (Table 3) in the majority of cases, the difference was not exceeding 1-2 percentage units and in rare cases the difference reached about 11.

Comparison of the average coefficients of digestion during each sub-period and the whole period indicated that they were even closer than with the case of duplicate sheep at a certain period. The following table makes this clear :

**Average digestion coefficients of nutrients.**

| | Crude protein | Ether extract | Crude fibre | N. F. E. |
|---|---|---|---|---|
| | % | % | % | % |
| Period 1. . . . . | 58.18 | 59.14 | 58.20 | 61.44 |
| Period 2. . . . . | 56.22 | 64.23 | 59.62 | 63.28 |
| Period 3. . . . . | 55.51 | 56.78 | 58.68 | 64.64 |
| All periods. . . . . | 55.43 | 58.50 | 59.05 | 63.39 |

TABLE 1.—**Average daily dry matter intake and dry matter excretion during the periods of digestibility trial with each sheep**

| Sheep No. | Period No. | Expt. 1 | | Expt 2. | | |
|---|---|---|---|---|---|---|
| | | Dry matter consumed | Dry matter excreted | Dry matter consumed | | Dry matter excreted |
| | | Hay (gm.) | Faeces (gm.) | Hay (gm.) | Straw (gm.) | Faeces (gm.) |
| 1 | 1 | 838.0 | 361.3 | 461.0 | 453.4 | 420.0 |
| | 2 | 863.5 | 358 3 | 461.0 | 453.4 | 428.8 |
| | 3 | 858.5 | 365.8 | 461.0 | 453.4 | 426.3 |
| | All periods . . . . . | 853.4 | 361.8 | 461.0 | 453.4 | 425.0 |
| 2 | 1 | 811.8 | 335.0 | 461.0 | 453.4 | 395.5 |
| | 2 | 842.0 | 342.0 | 461.0 | 453.4 | 404.4 |
| | 3 | 857.0 | 341.3 | 461.0 | 453.4 | 399.4 |
| | All periods . . . . . | 837.0 | 338.1 | 461.0 | 453.4 | 399.4 |

TABLE 2.—**Chemical analysis of feed and dry faeces during the periods of each trial with each sheep**

| Item | Dry matter | Crude protein | Ether extract | Crude fibre | N.F.E. | Ash |
|---|---|---|---|---|---|---|
| | % | % | % | % | % | % |
| Hay, air dried . . . | 88.20 | 14.53 | 3.07 | 24.60 | 33.92 | 12.08 |
| Hay, dry metter . . | 100.00 | 16.47 | 3.48 | 27.89 | 38.46 | 13.70 |
| Wheat straw, air dried | 90.67 | 2.97 | 1.87 | 31.14 | 38.53 | 16.20 |
| Wheat straw,dry matter | 100.00 | 3.28 | 2.02 | 34.34 | 42.49 | 17.87 |
| *Faeces, Expt.* 1 *Sheep 1* | | | | | | |
| period 1 . . . . | 100.00 | 17.37 | 3.66 | 27.11 | 34.60 | 17.06 |
| period 2 . . . . | 100.00 | 17.97 | 2.99 | 28.37 | 33.86 | 16.81 |
| period 3 . . . . | 100.00 | 19.23 | 3.78 | 28.36 | 32.17 | 16.46 |
| *Faeces, Expt.* 1 *Sheep 2* | | | | | | |
| period 1 . . . . | 100.00 | 16.62 | 3.07 | 28.19 | 35.74 | 16.38 |
| period 2 . . . . | 100.00 | 17.31 | 3.07 | 26.75 | 34.95 | 17.92 |
| period 3 . . . . | 100.00 | 16.73 | 3.39 | 28.38 | 34.91 | 16.59 |
| *Faeces, Expt.* 2 *Sheep 1* | | | | | | |
| period 1 . . . . | 100.00 | 10.79 | 2.73 | 30.45 | 35.70 | 20.33 |
| period 2 . . . . | 100.00 | 10.82 | 3.03 | 28.72 | 36.05 | 21.38 |
| period 3 . . . . | 100.00 | 10.97 | 2.32 | 28.72 | 37.92 | 20.07 |
| *Faeces, Expt.* 2 *Sheep 2* | | | | | | |
| period 1 . . . . | 100.00 | 11.84 | 3.12 | 29.22 | 34.62 | 21.20 |
| period 2 . . . . | 100.00 | 10.93 | 3.15 | 27.46 | 35.23 | 23.23 |
| period 3 . . . . | 100.00 | 11.23 | 3.17 | 29.16 | 34.71 | 21.73 |

The difference was not exceeding 1-2 percentage units in the majority of cases. The maximum difference reached 6.73 percentage units in one case with ether extractives (between period 2 and all periods). This means that with hay digestion trial, a 4-days collection period produced practically the same digestion coefficients as the usual 12-days collection period so long a suitable preliminary period was used.

*Comparison of the feeding value with hay during the sub periods of* 4 *days and the whole period of* 12 *days*

As was expected, the results with digestible nutrients and starch value or T.D.N. were parallel to those of the digestion coefficients (Table 5). The deviation of results with sub-periods from that with the whole period was not exceeding 1.3 unit percentage. The range of starch value with the three sub-periods was 32.04–33.30 while it was 32.77 with the whole periods of 12 days. The corresponding figures for T.D.N. were 47.41 48.73 and 48.13 and for digestible protein were 8.07-8.16 and 8.05.

TABLE 3.—**Digestibility coefficients of hay nutrients during the periods of each trial with each sheep, Experiment 1.**

| Item | Dry matter | Org. matter | Crude protein | Ether extract | Crude fibre | N.F.E. |
|---|---|---|---|---|---|---|
| | % | % | % | % | % | % |
| *Period 1* (4days).. | | | | | | |
| Sheep 1 . . . . | 56.89 | 58.57 | 54.00 | 54.66 | 58.09 | 61.22 |
| Sheep 2 . . . . | 58.73 | 60.02 | 58.35 | 63.61 | 58.30 | 61.66 |
| Average . . . . | 57.81 | 59.30 | 56.18 | 59.14 | 58.20 | 61.44 |
| *Period 2* (4 days). | | | | | | |
| Sheep 1 . . . . | 58.51 | 60.00 | 54.73 | 64.30 | 57.79 | 63.47 |
| Sheep 2 . . . . | 59.38 | 61.64 | 57.70 | 64.16 | 61.45 | 63.09 |
| Average . . . . | 58.95 | 60.82 | 56.22 | 64.23 | 59.62 | 63.28 |
| *Period 3* (4 days). | | | | | | |
| Sheep 1 . . . . | 57.41 | 58.67 | 50.27 | 51.22 | 56.69 | 64.37 |
| Sheep 2 . . . . | 60.18 | 62.67 | 60.74 | 62.34 | 60.66 | 64.91 |
| Average . . . . | 58.80 | 60.67 | 55.51 | 56.78 | 58.68 | 64.64 |
| *All periods* (12 days). | | | | | | |
| Sheep 1 . . . . | 57.60 | 58.95 | 52.05 | 53.37 | 57.52 | 63.14 |
| Sheep 2 . . . . | 59.04 | 61.73 | 58.81 | 63.63 | 60.58 | 63.63 |
| Average . . . . | 58.32 | 60.34 | 55.43 | 58.50 | 59.05 | 63.39 |

Therefore, with a basal ration as hay, in a digestion trial it appears safe to reduce the collection time to 4 days instead of 12 days. This would not affect the digestibility coefficients or the feeding value of the feed, mainly its starch value and digestible protein, the main necessary figures for calculating rations for live-stock. In such simple digestion trial with a single feed of which coefficients are obtained directly, and of which composition from day to day is constant, shortening the collection period appears to be a recommendable in practice. This would save the time for obtaining the digestion coefficients for the basal ration, as clover hay used repeatedly in digestion trials.

**Expt. 2.—Study of the effect of reducing the collection period in digestion trial with wheat straw using clover hay as a basal ration.**

*Daily dry matter balance*

With sheep 1 and 2, the average daily feed consumption was 461.0 g. dry matter from hay and 453.4 g. dry matter from the straw, being constant through the sub-periods and whole period (Table 1). The average daily dry matter excreted with sheep 1 was between 420-428.8 gm. during the three sub-periods, being nearly of the same order as 425 gm. of the whole period. With sheep 2, although the average daily dry matter excreted was slightly less than with sheep 1, but it was approaching one another in the sub-periods and the whole period; the range was between 395.5-404.4 in sub-periods and 399.4 g. in the whole period. Therefore, so long the dry matter intake was not variable the dry matter excretion would remain fairly constant.

*Analysis of food and faecal material during the sub-periods of collection*

The analysis of hay and wheat straw were obviously the same during the whole period (Table2). The composition of faecal material with each sheep during the subperiods (periods 1,2 and 3) was practically the same; the differences were minute not exceeding 2 units of percentage, except with N. free extractives where the difference reached 2.22 for sheepl, period 1 & 3.

*Comparison of digestibility coefficients of wheat straw during the sub-periods and the whole period*

Results in Table 4 indicated that the agreement of digestibility coefficients for duplicate sheep during the sub-periods or the whole period was satisfactory particularly with major nutrients, *i.e.*, dry matter, organic matter, crude fibre and nitrogen free extractives. There was some divergence with minor nutrients, *i.e.*, the crude protein and ether extractives. This feature appeared to be allowable with minor nutrients of which digestibilities were obtained by difference. For comparison of the average digestion coefficients obtained at each sub-period and that obtained for the whole period, the following table could be extracted from Table4.

**Average digestion coefficients of nutrients**

| | Crude protein | Crude fat | Crude fibre | N. free extractives |
|---|---|---|---|---|
| | % | % | % | % |
| Period 1. . . . . | 17.72 | 42.74 | 55.14 | 59.24 |
| Period 2. . . . . | 22.93 | 32.26 | 58.61 | 56.60 |
| Period 3. . . . . | 19.51 | 49.08 | 57.10 | 55.76 |
| All periods . . . . . | 20.08 | 41.54 | 58.18 | 57.20 |

TABLE 4.—**Digestibility coefficients of wheat straw during the periods of each trial with each sheep, Experiment 2.**

| Item | Dry matter | Org. matter | Crude protein | Ether extract | Crude fibre | N.F.E. |
|---|---|---|---|---|---|---|
| | % | % | % | % | % | % |
| *Period* 1,4 days : | | | | | | |
| Sheep 1 . . . . . | 49.74 | 52.59 | 22.80 | 47.49 | 51.68 | 55.86 |
| Sheep 2 . . . . . | 55.14 | 58.75 | 12.64 | 37.99 | 59.59 | 62.62 |
| Average . . . . . | 52.44 | 55.67 | 17.72 | 42.74 | 55.64 | 59.24 |
| *Period* 2,4 days : | | | | | | |
| Sheep 1 . . . . . | 47.79 | 51.91 | 15.53 | 30.90 | 54.72 | 53.45 |
| Sheep 2 . . . . . | 52.80 | 58.07 | 30.33 | 33.62 | 62.49 | 59.74 |
| Average. . . . . | 50.30 | 55.49 | 22.93 | 32.26 | 58.61 | 56.60 |
| *Period*, 3,4 days : | | | | | | |
| Sheep 1 . . . . . | 48.35 | 50.94 | 13.05 | 63.25 | 55.18 | 49.78 |
| Sheep 2 . . . . . | 54.28 | 58.50 | 25.96 | 34.50 | 59.02 | 61.73 |
| Average . . . . . | 51.32 | 54.72 | 19.51 | 49.08 | 57.10 | 55.76 |
| *All periods*, 12 days : | | | | | | |
| Sheep 1 . . . . . | 48.63 | 51.82 | 17.15 | 47.71 | 53.86 | 53.03 |
| Sheep 2 . . . . . | 54.19 | 59.67 | 23.00 | 35.37 | 62.50 | 61.37 |
| Average . . . . . | 51.41 | 55.75 | 20.08 | 41.54 | 58.18 | 57.20 |

The differences between digestion coefficinets for the particular nutrient did not exceed 3 percentage units in case of crude protein, crude fibre and N-free extractives. With crude fat the differences were great in 3 cases reaching 7.54 between period 3 and all periods, 9.28 between

period 2 and all periods and 16.82 between period 2 and period 3. Such differences would be practically neglected with such a nutrient which was low in the straw. This would not affect materially the amount of digestible nutrient or the feeding value. Therefore, shortening the collection time to 4 days would produce practically the same results as with 12 days collection period.

*Comparison of the feeding value with wheat straw during the sub-periods of 4 days and the whole period of 12 days*

As there was no practical differences between digestion coefficients obtained during a 4-days collection period and a 12-days collection, the percentage of digestible nutrients as well as the feeding value (starch value or T.D.N.) were expected to be the same (Table 5). The difference with crude protein was not exceeding 0.08 unit percentage and with ether extract it was not exceeding 0.17. With major nutrients the difference was 1.23 at a maximum. The starch value during the 3 sub-periods was between 23.47 and 24.09 and the T.D.N. was between 41.87 and 42.45. The corresponding values obtained during the whole period of 12 days were 24.11 starch value and 42.47 T.D.N., being of the same order as obtained during the 3 sub-periods. The composition, digestion coefficients and the feeding value of wheat straw, with 3 sub-periods and the whole period were within the range of published data about the Egyptian wheat straw using hay as a basal ration (1, 3& 4). Therefore, reducing the time of collection period down to 4 days in a digestibility trial for obtaining indirectly the feeding value of a feeding-stuff such as wheat straw which is constant in composition, is permissible and is a recommendable practice. This would reduce labour and time for performing such digestion trials. Perhaps in digestibiity trials with feeding-stuffs variable in composition (such as clover obtained directly or green maize and wet alkali pulpe usually obtained indirectly), a long collection period of 10 to 12 days would be safer. Further studies on the effect of shortening the collection period in digestibility trials with such feeding-stuffs worth to be carried out.

## Short-cuts in calculating digestibilities obtained indirectly

*Calculation of digestion coefficients.*

Usually, to calculate the digestion coefficient of a certain nutrient in a tested ration, the necessary data would be the amount of dry matter in the food eaten from both the basal ration and the tested one and in the faeces voided as well as the percentage of the nutrient in the basal ration, tested ration and faeces. The digestion coefficient of the same nutrients in the basal ration should be also known in a previous digestion trial with

the basal ration alone. Taking an example, Sheep 1 in period 1 with wheat straw, Expt. 2 above, from Table 1, 2, the necessary data for crude fibre would be as follows :

| Dry matter balance | % crude fibre in dry matter |
|---|---|
| From hay (basal) 461.0 gm. . . . . | 27.89 |
| From straw (trsted) 453.4 gm. . . . . | 34.34 |
| Faeces voided 420.0 gm. . . . . | 30.45 |

The digestion coefficient of crude fibre in the basal ration was 59.05%.

TABLE 5.—**Digestible nutrients and feeding value of feeding stuffs during the different periods**

| Item | % Digestible nutrrients in material as offered | | | | Feeding value as offered | | Feeding value dry matter | |
|---|---|---|---|---|---|---|---|---|
| | Crude protein | Ether extract | Crude fibre | N.F.E. | (S. V.) kg. | T.D.N. kg. | (S. V.) kg. | T.D.N. kg. |
| **Expt. 1.** | | | | | | | | |
| *Hay* : | | | | | | | | |
| Period 1 . . . . . | 8.16 | 1.82 | 14.32 | 20.84 | 32.04 | 47.41 | 36.33 | 53.75 |
| Period 2 . . . . . | 8.17 | 1.97 | 14.07 | 21.46 | 33.30 | 48.73 | 37.76 | 55.25 |
| Period 3 . . . . . | 8.07 | 1.74 | 14.44 | 21.93 | 33.01 | 48.24 | 37.43 | 54.69 |
| All periods . . . . . | 8.05 | 1.80 | 14.53 | 21.50 | 32.77 | 48.13 | 37.15 | 54.57 |
| **Expt. 2.** | | | | | | | | |
| *Wheat straw* : | | | | | | | | |
| Period 1 . . . . . | 0.53 | 0.78 | 17.33 | 22.83 | 23.93 | 42.29 | 26.39 | 46.64 |
| Period 2 . . . . . | 0.68 | 0.59 | 18.25 | 21.81 | 23.77 | 42.07 | 26.22 | 46.40 |
| Period 3 . . . . . | 0.58 | 0.90 | 17.78 | 21.48 | 23.47 | 41.87 | 25.89 | 46.18 |
| All periods . . . . . | 0.60 | 0.76 | 18.12 | 22 04 | 24.11 | 42.47 | 26.59 | 46.84 |

The calculation goes ordinarily as follows :

Crude fibre eaten from hay = 461.0 × 27.89/100 = 128.57 gm.

Crude fibre eaten from straw = 453.4 × 34.34/100 = 155.70 gm.

Total crude fibre eaten = 128.57 + 155.70 = 284.27 gm.

Crude fibre voided in faces = 420.0 × 30.45/100 = 127.89 gm.

Total crude fibre digested = 284.27 — 127.89 = 156.38 gm.

Crude fibre digested from hay = 128.57 × 59.05/100 = 75.92 gm

Crude fibre digested from straw = 156.38 — 75.92 = 80.46 gm

Digestion coefficient of crude fibre in straw $= \frac{80.46}{155.70} \times 100 = 51.68$

Such operations would be gathered in one step, the digestibility percentage for the crude fibre "D" equals :

$$\frac{100 \times (453.4 \times 0.3434 + 461.0 \times 0.2789 - 461.0 \times 0.2789 \times 0.5905 - 420 \times 0.3045)}{453.4 \times 0.3434}$$

$$= \frac{100\ (\ 453.4 \times 0.3434 + 461.0 \times 0.2789 \times 0.4095 - 420 \times 0.3045\ )}{453.4 \times 0.3434}$$

Where 0.4095 equals the coefficient of indigestibility of crude fibre, *i.e*, (1—0.5905), then dividing by the denaminator,

$$\therefore D = 100\ (1 + \frac{461}{453.4} \times \frac{0.2789}{0.3434} \times \frac{0.4095}{1} - \frac{420}{453.4} \times \frac{0.3045}{0.3434})$$

$\because \frac{461}{453.4}$ is a constant for each sheep in a digestion trial (being the ratio between dry matter in basal food and tested one or being equal to the amount of dry matter in basal ration corresponding to each 1 unit eaten from the tested ration) and could be denoted by $w_b$ and designated "the basal dry matter ratio"

$\because \frac{420}{453.4}$ is also a constant per sheep in the same trial (being the ratio between dry matter in faeces voided and in tested food or being equal to the amount of dry matter voided in faeces per unit dry matter eaten in tested ration) and could be denoted by $w_f$ and designated the faecal dry matter ratio and,

$\because$ 0.4095 is also a constant for each nutrient, being the coefficient of indigestibility of the nutrient in the basal ration and could be denoted by I.

$$\therefore D = 100 \left( 1 + W_b \times I \times \frac{\% \text{ nutrient in basal ration}}{\% \text{ nutrient in tested ration}} - W_f \times \frac{\% \text{ nutrient in faeces}}{\% \text{ nutrient in tested ration}} \right) \quad \text{Equation 1}$$

$$\text{or } D = 100 + W_b \times I \times \frac{\% \text{ nutrient in basal ration}}{\% \text{ nutrient in tested ration}} \times 100 - W \times \frac{\% \text{ nutrient in faeces}}{\% \text{ nutrient in tested ration}} \times 100) \quad \text{Equation 2}$$

The fraction $\frac{\% \text{ nutrient in basal}}{\% \text{ nutrient in tested}} \times 100$ could be designated as the basal nutrient ratio or $N_b$

and the fraction $\frac{\% \text{ nutrient in faeces}}{\% \text{ nutrient in tested}} \times 100$ could be designated as the faecal nutrient ratio $N_f$

Then $D = 100 + W_b \times I \times N_b - W_f N_f$ . . . . . Equation 3

Where $N_b$ and $N_f$ are variable according to each nutrient.

In this cases :

$$D = 100 + 1.0168 \times 0.4095 \times \frac{27.89}{34.34} \times 100 - 0.9263 \times \frac{30.45}{34.34} \times 100 = 100 + 33.81 - 82.14 = 51.67.$$

Which is the same as obtained in the usual way(Table 4). It is to be noted that the fraction $W_b I N_b$ is the amount of the indigestible nutrient in the basal ration corresponding to each 100 units of the nutrient in the tested food eaten. The fraction $W_f N_f$ is the amount of nutrient in faeces (total indigestible) corresponding to each 100 units of the nutrient in the tested food eaten.

Therefore, such equation could be used to reduce the labour in calculating digestion coefficients obtained indirectly in digestibility trials. It could be used for checking the results of the usual ordinary way of calculation.

Moreover, such equation might be useful in investigations related to the marker- technique for producing digestibilities obtained in digestibility trials by difference (indirectly).

*Calculation of the digestible nutrients*

It would be calculated from digestion coefficients obtained by Equation 3 and the percentage analysis of the nutrient in the tested ration. But it could be also obtained directly without calculating the digestion coefficient as follows :

$$\% \text{ digestible crude fibre, L} = \frac{D \times \% \text{ crude fibre in tested ration}}{100}$$

Substituting for D using the right hand side of Equation 1.

$\therefore L = \%$ crude fibre in tested $+ W_b I \times \%$ crude fibre in basal $- W_f \times \%$ crude fibre in faeces

Therefore, if the percentage of the nutrient in tesed ration is denoted by $M_t$ and in the basal ration by $M_b$ and in the faeces by $M_f$ .

$\therefore L = M_t + W_b I M_b - W_f M_f$ . . . . . Equation 4)

In the case of crude fibre the result would be for Sheep 1 in Period 1 Expt. 2 above :

$$L_1 = 34.34 + 1.0168 \times 0.4095 \times 27.89 - 0.9\ 9263 \times 30.45$$
$$= 34.34 + 11.61 - 28.21 = 17.83$$

And For Sheep 2

$$L_2 = 34.34 + 1.0168 \times 0.4095 \times 27.89 - \frac{395.5}{461.0} \times 29.22$$
$$= 34.34 + 11.61 - 25.07 = 20.88.$$

$\therefore$ Average digestible crude fibre in dry matter $= 19.35$
and in air dried material (as fed) $= 17.54$,

$\therefore$ Average $= 17.54$ being the same as obtained in the ordinary method.

$\therefore$ This equation is applicable in practice.

Such equation above (No.4) could be used to obtains digestible nutrients directly without any need for calculating the digestion coefficient. This would avoid a long path way in calculation used in the ordinary met hods.

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*(Printed in 1966)*

# تاثير تقصير مدة الدور الرئيسى فى تجارب الهضم مع الغنم مع اشارة لتبسيط طرق الحساب

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## الملخص

لقد قورن تأثير تخفيض الدور الرئيسى فى تجارب الهضم على الغنم باستخدام طريقة الهضم المباشرة على الدريس وغير المباشرة على تبن القمح باستخدام الدريس كعليقة أساسية ، وقسم الدور الرئيسى الى ثلاث فترات قصيرة كل منها أربعة أيام وقورنت نتائج تجربة الهضم فى كل الفترات القصيرة ببعضها مع نتائج الدور الرئيسى كله وذلك من حيث ميزان المادة الجافة المأكولة يوميا والخارجة والتحليل الكيماوى للروث ومعاملات الهضم لكل مركب غذائى والمهضوم منه ، وأخيرا مجموع المركبات المهضومة الكلية لكل مادة علف فى كل فترة وقيمتها الغذائية المحسوبة على صورة معادل نشا مهضوم لكل ١٠٠ كجم ، ولقد وجد تقارب فى النتائج ولم تزد الفروق عن المسموح به بين التجارب العادية ، وفى حالة الدريس كانت المركبات المهضومة الكلية ٤١ر٤٧ ، ٧٢ر٤٨ ، ٢٤ر٤٨ فى الفترات القصيرة و ١٣ر٤٨ فى الدور الرئيسى كله ويقابل ذلك معادل نشا ٠٤ر٣٢ ، ٣٠ر٣٣ ، ٠١ر٣٢ فى الفترات القصيرة و ٧٧ر٣٢ فى الدور الرئيسى ، وفى حالة تبن القمح كانت المركبات المهضومة الكلية ٢٩ر٤٢ ، ٠٧ر٤٢ ، ٨٧ر٤١ ، ٤٧ر٤٢ يقابلها معادل نشا ٩٣ر٢٣ ، ٧٧ر٢٢ ، ٤٧ر٢٣ ، ١١ر٢٤ فى الثلاث فترات القصيرة وفى الدور الرئيسى على الترتيب ، وبذلك يمكن تقصير مدة الدور الرئيسى الى ٤ أيام مع مراعاة اطالة فترة الدور التمهيدى ، ولا ينصح بتقصير مدة الدور الرئيسى فى مواد العلف الخضراء التى قد يتغير تركيبها من يوم لآخر .

كما استنبطت معادلات بسيطة لتسهل حساب معاملات الهضم يمكن استخدامها لتوفير الوقت أو مراجعة معاملات الهضم المحسوبة بالطريقة العادية .