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NEW APPROACH FOR USING HEART GIRTH FOR CALCULATING ENERGY REQUIREMENTS: 3- FOR FATTENING FRIESIAN CROSSBRED MALE CALVES.

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ABSTARCT

Twenty male Friesian crossbred calves of 180 kg average live body weight (LBW) were divided into four groups. Animals were fed according to NRC (1984) allowances (T_1), animal heart girth (HG)x0.028 (T_2), animal (HG)x0.032 (T_3)and animal (HG)x 0.034 (T_4). The average daily gain in T_4 was significantly higher than T_2 and non significantly higher than T_1 and T_3. The fourth treatment was economically more efficient as well as in feed conversion than the other treatments with no significant differences among them. Every cm of HG in T_4 (The best treatment in average daily gain, feed conversion and economic efficiency) required 0.055, 0.048, 0.006, 0.025 and 0.033 kg from DM, OM, CP, SE and TDN, respectively. Also, the results showed that every kg of DM, OM, CP, SE and TDN in T_4 was consumed by the following numbers of cm of animal HG: 18.0, 21.0, 162.9, 39.6 and 30.2, respectively. Therefore, the nutrient requirements of male Friesian crossbred calves can be predictied from the following equations:-

DM requirement (kg) = Animal HG x 0.055
OM requirement (kg) = Animal HG x 0.048
CP requirement (kg) = Animal HGx0.006
SE requirement (kg) = Animal HG x 0.025
TDN requirement (kg)= Animal HG x 0.033

Or:

DM requirement (kg) = Animal HG / 18.0
OM requirement (kg) = Animal HG / 21.0
CP requirement (kg) = Animal HG / 162.9
SE requirement (kg) = Animal HG / 39.6
TDN requirement (kg)= Animal HG / 30.2

The results of this study showed that the small holder can use the following equations to obtain the feed quantity for male Friesian crossbred calves which fed concentrate feed mixture (CFM), berseem hay and rice straw:-

The requirement of CFM (kg) = Animal HG x 0.042 or Animal HG/26.1,

The requirement of berseem hay (kg)=Animal HG x 0.0094 or Animal HG/106.7,

and The requirement of rice straw (kg) =Animal HG x 0.013 or Animal HG/76.6

Roughage:concentrate ratio will be 0.60:0.40 by using the previous equations.

Keywords*:* Friesian calves, heart girth, nutrition requirements.

INTRODUCTION

Many investigators studied the relationship between animal heart girth (HG) and its weight (Johnsson and Hildeman, 1954, Abdellah and Rashed, 1981 and Salama and Schaller, 1992). Kidewell (1955) found a high correlation between live weight and heart girth. Vas and Vas (1967) reported that heart girth can be considered as a suitable measurement to estimate the live weight more than the other body measurements. Salama (2002) found a new relationship between animal HG and its nutrient requirement. By this relationship, the energy requirement of an animal can be calculated without converting animal HG to weight and without using nutrition Tables.

MATERIALS AND METHODS

The animals in this study were fed according to Salama (2002) method. This method is based on multiplication the animal HG (cm) by a constant (Factor) to obtain the energy requirement of the animal. Salama et al. (2001) suggested the predicition following equations to calculat the energy requirement for fattening Friesian calves:-

TDN requirement (kg) = Animal HG x 0.028

TDN requirement (kg) = Animal HG x 0.032

TDN requirement (kg) = Animal HG x 0.034

In the present study, the previous equations were tested to calculate the energy requirement for Friesian crossbred calves.

Twenty male Friesian crossbred calves of 180.45 kg as an average live body weight (LBW) were divided according to LBW into four similar groups. Animals of group (1) were fed according to NRC (1984) allowances (control group), animals of group (2), (3) and (4) received their energy requirements (expressed as TDN) according to the previously mentioned equations. The animals in all groups were fed individually. Animals TDN requirements were adjusted monthly either according to the animal HG (for groups 2, 3 and 4) or its weight (for the control group). The animals initial weight and its HG are shown in Table (1). The proximate analysis of feedstuffs is shown in Table (2). Components of the rations are shown in Table(3). Animals were weighed every two weeks and HG was measured monthly. The experiment lasted eight months. Average daily gain (ADG), feed conversion and economic efficiency were calculated in the first and the second period for four months each.

Table (1): Initial live body weight and heart girth of male Friesian cross-bred calves.

T1				T2				T3				T4			
Anim No.	Anim. Wt. (kg)	Anim. HG (cm)	NRC (kg TDN)	Anim No.	Anim. Wt. (kg)	Anim. HG (cm)	HGx0.028 (kg TDN)	Anim No.	Anim. Wt. (kg)	Anim. HG (cm)	HGx0.032 (kg TDN)	Anim No.	Anim. Wt. (kg)	Anim. HG (cm)	HGx0.034 (kg TDN)
1	252	148	4.05	6	270	152	4.25	11	270	151	4.83	16	200	137	4.66
2	210	131	3.37	7	200	130	3.64	12	210	139	4.45	17	215	140	4.76
3	206	138	3.37	8	174	128	3.58	13	130	116	3.71	18	180	128	4.35
4	144	118	2.70	9	160	126	3.53	14	150	122	3.90	19	170	125	4.25
5	91	100	2.70	10	100	107	3.00	15	140	118	3.78	20	137	113	3.84
Mean	180.6	127			180.8	128.6			180.0	129.2			180.4	129.2	

Table (2): Proximate analysis (%) of the feedstuffs used and experimental rations (on dry matter basis).

Items	DM	OM	CP	EE	CF	NFE	Ash	TDN**	SE**
CFM*	91.00	86.60	14.30	3.10	12.36	56.84	13.40	65.00	55.00
Berseem hay	91.40	88.00	11.60	1.90	28.50	46.00	12.00	48.00	32.00
Rice straw	90.70	88.18	1.30	1.28	31.14	54.56	11.82	36.00	21.00
T_1	91.00	87.80	10.76	2.43	19.60	54.33	12.77	55.20	42.97
T_2	92.60	87.30	10.93	2.47	19.40	54.37	12.79	55.53	43.35
T_3	90.98	87.17	10.94	2.48	19.20	54.51	12.80	55.71	43.60
T_4	90.99	87.15	11.02	2.49	19.03	54.56	12.83	55.92	43.87

*CFM = concentrate feed mixture consisted of undecorticated cotton seed cake 35%, coarse wheat bran 20%, Yellow corn 17%, rice bran 25%, salt 1% and lime stone 2%.
** SE and TDN of feedstuffs cited from Salama et al. (2001).

Table (3): Composition of the rations (%).

Ingredients	T_1	T_2	T_3	T_4
CFM	58.9	60.0	61.2	62.1
Berseem hay	17.8	17.8	16.4	16.1
Rice straw	23.3	22.2	22.4	21.8

Feedstuffs were analyzed for moisture, ash, crude protein, crude fiber and ether extract according to A.O.A.C (1990). Nitrogen free extract was calculated by differences.

Statistical analysis was applied as repeated measure to the following model:

$Y_{ijk} = \mu + t_i + an_k(t)_i + p_j + (txp)_{ij} + e_{ijk}$
T_{ijk} = Observation of parameters.
μ = Overall mean.
t_i = Effect of treastments, i =1 to 4.
$an_k(t)_i$ = Animal effect with treatment.
P_j = Effect of period, j = 1 to 2.
$(txP)_{ij}$ = Effect of interaction between treatment and period.
e_{ijk} = The random error.
In applying to the previous model, SAS (1987) procedure was used.

RESULTS AND DISCUSSION

Data in Table (4) showed that ADG in P_1 in T_4 (Factor of 0.034) was significantly higher than T_1 and T_2 (Factor of 0.028) but non significantly higher than T_3 (Factor of 0.032) while in P_2, no significant differences were observed among tratments. Also, Table (4) showed no significant differences among treatments in DMI, OMI, CPI, SEI, TDNI/kg gain and economic efficiency in P_1 and P_2.

Table (5) showed that the average daily gain in T_4 was significantly higher than T_2 and non significantly higher than T_1 and T_3. Also, T_4 was not significantly by higher than the other treatments in average daily HG. With regard to DMI, OMI, CPI, SEI and TDNI/kg gain, data of Table (5) indicated that T_4 was more efficient than other treatments with no significant differences among them. It could be noticed that the highest economic efficiency was recorded for T_4. Values of economic efficiency calculated as a ratio between price of the weight gain and the cost of feed consumed. Salama (2002) fed male Baladi calves on four levels of SE: T_1 control (Shehata allowances,1976), T_2: Animal HGx0.032, T_3: Animal HGx0.034 and T_4: Animal HGx0.036. The results showed that T_2 was the best level in feed conversion and economic efficiency.

Salama *et al.* (2001) fed male Friesian calves on four levels of TDN: T_1: control (NRC allowances), T_2: Animal HGx0.028, T_3: Animal HGx0.032 and T_4: Animal HGx0.034. The results indicated that T_3 was the best level in feed conversion and economic efficiency. Results of Table (5) indicated that the average of HG gain in P_1 was not significantly higher than P_2. The economic efficiency and feed conversion (expressed as DMI, OMI, CPI, SEI and TDNI/kg gain) in P_1 were significantly better than in P_2. This may be due to the increase in animal requirements offered as a result of increasing both live body weight and animal HG.

Table (4): Average daily gain, feed conversion and economic efficiency of the experimental groups of animals through two periods (P).

Treatments	Periods	
	P_1	P_2
	Initial weight (kg)	
T_1	180.6 [a]	291.0 [b]
T_2	180.8 [a]	285.0 [c]
T_3	180.0 [a]	297.0 [b]
T_4	180.4 [a]	307.0 [a]
	Final weight (kg)	
T_1	291.0 [b]	410.0 [b]
T_2	285.5 [c]	388.4 [c]
T_3	297.8 [b]	408.4 [b]
T_4	307.0 [a]	445.0 [a]
	Average daily gain (kg)	
T_1	0.920 [bc]	0.991 [a]
T_2	0.868 [c]	0.861 [a]
T_3	0.981 [ab]	0.921 [a]
T_4	1.058 [a]	1.146 [a]
	DMI/kg gain	
T_1	7.809 [a]	10.297 [a]
T_2	8.067 [a]	9.360 [a]
T_3	8.163 [a]	10.018 [a]
T_4	7.944 [a]	8.987 [a]
	OMI/kg gain	
T_1	6.856 [a]	9.040 [a]
T_2	7.042 [a]	8.171 [a]
T_3	7.115 [a]	8.732 [a]
T_4	6.923 [a]	7.832 [a]
	CPI/kg gain	
T_1	0.866 [a]	1.145 [a]
T_2	0.898 [a]	1.054 [a]
T_3	0.913 [a]	1.118 [a]
T_4	0.891 [a]	1.000 [a]
	SE/kg gain	
T_1	3.548 [a]	4.68 [a]
T_2	3.689 [a]	4.313 [a]
T_3	3.750 [a]	4.573 [a]
T_4	3.649 [a]	4.092 [a]
	TDN/kg gain	
T_1	4.378 [a]	5.777 [a]
T_2	4.540 [a]	5.294 [a]
T_3	4.608 [a]	5.634 [a]
T_4	4.484 [a]	5.046 [a]
	Economic efficiency	
T_1	1.7 [a]	1.4 [a]
T_2	1.7 [a]	1.5 [a]
T_3	1.7 [a]	1.4 [a]
T_4	1.8 [a]	1.5 [a]

a, b and c mean of different letters in the same column are significantly different (P<0.05.

Table (5): Average daily gain, feed conversion and economic efficiency of animal groups.

	Treatment				Periods	
	T_1	T_2	T_3	T_4	P_1	P_2
ADG (kg)	0.955 ± 0.049^{ab}	0.865 ± 0.049^{b}	0.951 ± 0.049^{ab}	1.102 ± 0.049^{a}	0.957 ± 0.032^{a}	0.980 ± 0.032^{a}
Daily HG gain (cm)	0.219 ± 0.016^{a}	0.190 ± 0.016^{a}	0.201 ± 0.016^{a}	0.231 ± 0.016^{a}	0.220 ± 0.007^{a}	0.200 ± 0.007^{a}
DMI/kg gain (kg)	8.790 ± 1.205^{a}	8.783 ± 1.475^{a}	9.157 ± 1.205^{a}	8.524 ± 1.475^{a}	7.954 ± 0.396^{b}	9.673 ± 0.396^{a}
OMI/kg gain (kg)	7.717 ± 1.010^{a}	7.667 ± 1.237^{a}	7.982 ± 1.010^{a}	7.428 ± 1.237^{a}	6.943 ± 0.332^{b}	8.444 ± 0.332^{a}
CPI/kg gain (kg)	0.976 ± 0.132^{a}	0.985 ± 0.161^{a}	1.025 ± 0.132^{a}	0.953 ± 0.161^{a}	0.891 ± 0.043^{a}	1.079 ± 0.043^{a}
SEI/kg gain (kg)	3.994 ± 0.538^{a}	4.040 ± 0.658^{a}	4.196 ± 0.538^{a}	3.899 ± 0.658^{a}	3.648 ± 0.179^{b}	4.416 ± 0.179^{a}
TDNI/kg gain (kg)	4.939 ± 0.668^{a}	4.962 ± 0.819^{a}	5.162 ± 0.668^{a}	4.800 ± 0.819^{a}	4.486 ± 0.221^{b}	5.440 ± 0.221^{a}
Economic efficiency*	1.6 ± 1.321^{b}	1.6 ± 1.321^{b}	1.5 ± 1.190^{b}	1.7 ± 1.340^{a}	1.7 ± 0.134^{b}	1.5 ± 1.291^{a}

a and b mean of different letters in the same raw are significantly different ($P<0.05$)*. The assumption that the price of one ton of CFM, berseem hay and rice straw 540, 380 and 60 L.E. respectively, and the price of one kg body weight on selling was 7.5 L.E.

Table (6) showed how much of nutrients consumed for each cm of animal HG (kg/cm). It was calculated by dividing each of DMI, OMI, CPI, SEI and TDNI on animal HG. Also, Table (6) showed how many of cm of animal HG meet each kg of feed consumption (cm/kg) by dividing animal HG on DMI, OMI, CPI, SEI and TDNI. The values of T_4 (the most economic treatments as shown in Table 5) from these nutrients were: 0.055, 0.048, 0.006, 0.025 and 0.033 kg/cm respectivly and 18.0, 21.0, 162.9, 39.6 and 30.2 cm/kg respectively.

Therefore, the following equations was calculated to predict the nutrient requirements of male crossbred calves:-

DM requirement (kg) = Animal HG x 0.055
OM requirement (kg) = Animal HG x 0.048
CP requirement (kg) = Animal HGx0.006
SE requirement (kg) = Animal HG x 0.025
TDN requirement (kg)= Animal HG x 0.033

Or:

DM requirement (kg) = Animal HG / 18.0
OM requirement (kg) = Animal HG / 21.0
CP requirement (kg) = Animal HG / 162.9
SE requirement (kg) = Animal HG / 39.6
TDN requirement (kg)= Animal HG / 30.2

Table (6) showed that DMI, OMI, CPI, SEI and TDNI/cm HG in T_2 were significantly lower than the other treatments that may be due to the energy requirement of T_2 was calculated based on the lowest factor (0.028). Also, Table (6) showed that DMI, OMI, CPI, SEI and TDNI/cm HG in T_2 were significantly higher than P_1 that may be possibly related to the increase in animal requirements as a result of increasing animal HG.

Table (7) showed that DMI, OMI, CPI, SEI and TDNI/cm HG of T_3 and T_4 in P_1 were higher than the other treatments. This may by due to the quantities of ration of T_3 and T_4 which were higher than the other treatments.

The average daily intake from CFM, berseem hay and rice straw are shown in Table (8). If the daily intakes of CFM, berseem hay and rice straw were divided on animal HG, then the quantity of these rations which consumed by one cm of animal HG will be obtained, therefore, the following equation could be used to calculate the intake of ration:-

The intake of ration = Animal HG x quantity of this ration which is required for each cm of animal HG.

By using the opposite approach, i.e. if the animal HG was divided on the intake of CFM, hay and rice straw, the numbers of cm of animal HG/kg of ration will be obtained, therefore, the following equation could be used to caculate the intake of ration:-

The intake of ration = Animal HG/numbers of cm of HG per kg ration

All these calculations for dietary ingredients throught the while experimental periods are shown in Tables (9) and (10). Tables (9) and (10) showed that DMI, OMI, CPI, SEI and TDN/ cm HG in T_4 were higher than T_2 and T_3 that may be due to the energy requirement of T_4 was calculated based on the highest factor (0.034). Also, Tables (9) and (10) showed that DMI, OMI, CPI, SEI and TDN/cm HG in P_2 were higher than P_1 that because of the increasing in animal requirements as a result of increasing animal HG. The results of Table (5) showed that T_4 was the best treatment because it was the highest in ADG, the more efficient in feed conversion and the highest in economic efficiency, therefore, the values of T_4 in Table (9) could be used to make the following equations to be used for determining the requirements of crossbred Friesian calves in small farms which do not have a balance and their animals are fed the previous feed only:

The requirements of CFM (kg) = Animal HG x 0.042.
The requirements of berseem hay (kg) = Animal HG x 0.0094.
The requirements of rice straw (kg) = Animal HG x 0.013.

Or, the following equations:-

The requirements of CFM (kg) = Animal HG / 26.1.
The requirements of berseem hay (kg) = Animal HG / 106.7.
The requirements of rice straw (kg) = Animal HG / 76.6.

The roughage : concentrate ratio will be around 0.40:0:60, by using the previous equations.

Table (6): Effect of treatments and periods on feed consumption by cm of animal HG (kg/cm), and numbers of cm of HG per kg nutrients (cm/kg).

Item	Treatment				Periods	
	T_1	T_2	T_3	T_4	P_1	P_2
DMI/cm HG(kg/cm)	0.056±0.0005 ^{a}	0.050±0.0007 ^{b}	0.054±0.0005 ^{a}	0.055±0.0007 ^{a}	0.050±0.0001 ^{b}	0.058±0.0001 ^{a}
OMI/cm HG(kg/cm)	0.049±0.0004 ^{a}	0.044±0.0006 ^{b}	0.047±0.0004 ^{a}	0.048±0.0006 ^{a}	0.044±0.0001 ^{b}	0.050±0.0001 ^{a}
CPI/cm HG(kg/cm)	0.006±0.00007 ^{a}	0.005±0.00008 ^{b}	0.006±0.00007 ^{a}	0.006±.00008 ^{a}	0.005±0.00002 ^{b}	0.006±0.00002 ^{a}
SEI/cm HG(kg/cm)	0.025±0.0002 ^{a}	0.023±0.0003 ^{b}	0.025±0.0002 ^{a}	0.025±0.0003 ^{a}	0.022±0.0001 ^{b}	0.026±0.0001 ^{a}
TDNI/cm HG(kg/cm)	0.031±0.0003 ^{a}	0.028±0.0004 ^{b}	0.031±0.0003 ^{a}	0.033±0.0003 ^{a}	0.028±0.0001 ^{b}	0.034±0.0001 ^{a}
Anim.HG/DMI(cm/kg)	17.7±0.188 ^{b}	19.9±0.230 ^{a}	18.5±0.188 ^{b}	18.0±0.230 ^{b}	20.0±0.062 ^{a}	17.1±0.062 ^{b}
Anim.HG/OMI(cm/kg)	21.0±0.226 ^{b}	23.1±0.276 ^{a}	21.5±0.226 ^{b}	21.0±0.276 ^{b}	23.2±0.075 ^{a}	20.0±0.075 ^{b}
Anim.HG/CPI(cm/kg)	159.1±1.827 ^{b}	179.1±2.238 ^{a}	165.3±1.827 ^{b}	162.9±2.238 ^{b}	180.4±0.668 ^{a}	152.7±0.668 ^{b}
Anim.HG/SEI(cm/kg)	38.9±0.404 ^{b}	433.5±0.495 ^{a}	40.3±0.404 ^{b}	39.6±0.495 ^{b}	43.9±0.157 ^{a}	37.3±0.157 ^{b}
Anim.HG/TDNI(cm/kg)	31.5±0.3299 ^{b}	35.4±0.404 ^{a}	30.8±0.329 ^{b}	30.2±0.404 ^{b}	35.6±0.111 ^{a}	29.3±0.111 ^{b}

a and b mean of different letters in the same raw are significantly different (P<0.05).

Table (7): Relationships between animal HG and nutrients requirements as affected by dietary treatments and experimental periods.

Treatments	Periods		Periods	
	P_1	P_2	P_1	P_2
	DMI/cm HG(kg/cm)		Animal HG/DMI (cm/kg)	
T_1	0.051 ^{bc}	0.056 ^{b}	19.6 ^{ab}	18.8 ^{ab}
T_2	0.049 ^{c}	0.049 ^{c}	20.0 ^{a}	20.1 ^{a}
T_3	0.056 ^{ab}	0.056 ^{b}	17.6 ^{bc}	17.7 ^{bc}
T_4	0.059 ^{a}	0.060 ^{a}	16.6 ^{c}	16.4 ^{c}
	OMI/cm HG(kg/cm)		Animal HG/OMI (cm/kg)	
T_1	0.043 ^{bc}	0.047 ^{b}	23.5 ^{ab}	21.6 ^{b}
T_2	0.041 ^{c}	0.041 ^{c}	23.9 ^{a}	24.1 ^{a}
T_3	0.047 ^{ab}	0.047 ^{b}	21.0 ^{bc}	21.2 ^{b}
T_4	0.050 ^{a}	0.051 ^{a}	19.9 ^{c}	19.5 ^{c}
	CPI/cm HG(kg/cm)		Animal HG/CPI (cm/kg)	
T_1	0.0057 ^{b}	0.0061 ^{b}	177.2 ^{ab}	162.4 ^{b}
T_2	0.0055 ^{b}	0.0055 ^{c}	180.1 ^{a}	179.1 ^{a}
T_3	0.0063 ^{a}	0.0062 ^{b}	157.0 ^{bc}	158.8 ^{b}
T_4	0.0067 ^{a}	0.0067 ^{a}	148.6 ^{c}	147.5 ^{c}
	SEI/cm HG(kg/cm)		Animal HG/SEI (cm/kg)	
T_1	0.023 ^{b}	0.025 ^{b}	43.2 ^{a}	39.7 ^{b}
T_2	0.022 ^{b}	0.022 ^{c}	43.8 ^{a}	43.7 ^{a}
T_3	0.026 ^{a}	0.025 ^{b}	38.3 ^{b}	38.8 ^{b}
T_4	0.027 ^{a}	0.027 ^{a}	36.3 ^{b}	36.0 ^{c}
	TDNI/cm HG(kg/cm)		Animal HG/TDNI (cm/kg)	
T_1	0.0288 ^{c}	0.0311 ^{b}	33.1 ^{ab}	32.2 ^{b}
T_2	0.0280 ^{c}	0.0280 ^{c}	35.6 ^{a}	35.6 ^{a}
T_3	0.0320 ^{ab}	0.0317 ^{b}	31.2 ^{c}	31.5 ^{b}
T_4	0.0330 ^{a}	0.0342 ^{a}	29.5 ^{c}	29.2 ^{c}

a, b and c mean of different letters in the same column are significantly different ($P<0.05$).

Table (8): Average daily intake (kg) from CFM, berseem hay and rice straw.

Items	T_1	T_2	T_3	T_4
Av. Animal wt. (kg)	273	277	280	290
Av. Animal HG.(cm)	147	148	148	150
Av. Daily feed intake as fed (kg)				
CFM	5.8	5.5	6.0	6.5
Berseem hay	1.5	1.2	1.4	1.5
Rice straw	1.8	1.8	1.8	2.0
Av. Daily DMI (Kg)	8.28	8.50	8.36	9.099

Table (9): Rations consumption by cm of animal HG (kg/cm) and numbers of cm of animal HG per kg of rations ingredients (cm/kg) through out two experimental periods.

Treatments	Periods		Periods	
	P_1	P_2	P_1	P_2
	CFMI/Anim.HG(kg/cm)		Animal HG/CFMI (cm/kg)	
T_1	0.035^{b}	0.038^{b}	28.4^{a}	26.2^{b}
T_2	0.034^{b}	0.035^{c}	28.7^{a}	28.4^{a}
T_3	0.040^{a}	0.039^{b}	24.9^{b}	25.5^{b}
T_4	0.042^{a}	0.042^{a}	23.6^{b}	23.8^{c}
	Hay intake/Anim.HG(kg/cm)		Animal HG/Hay intake (cm/kg)	
T_1	0.0090^{a}	0.0099^{a}	114.8	101.5^{b}
T_2	0.0082^{a}	0.0081^{b}	121.4	122.4^{a}
T_3	0.0094^{a}	0.0098^{a}	105.6	101.4^{b}
T_4	0.0100^{a}	0.0107^{a}	99.3	92.7^{b}
	Rice straw intake/Anim.HG(kg/cm)		Animal HG/Rice straw intake (cm/kg)	
T_1	0.012^{ab}	0.012^{b}	83.9^{ab}	78.2^{b}
T_2	0.011^{b}	0.011^{c}	85.6^{a}	90.5^{a}
T_3	0.012^{ab}	0.012^{b}	77.9^{ab}	77.2^{cb}
T_4	0.013^{a}	0.014^{a}	73.8^{b}	70.7^{c}

a, b and c mean of different letters in the same column are significantly different ($P<0.05$).

CONCLUSION

The results of this experiment showed the possibility of using the animal HG as an indicator to determine the animal requirements of DM, OM, CP, SE and TDN according the following equation:-

DM requirement (kg) = Animal HG x 0.055
OM requirement (kg) = Animal HG x 0.048
CP requirement (kg) = Animal HGx0.006
SE requirement (kg) = Animal HG x 0.025
TDN requirement (kg)= Animal HG x 0.033

Or, the following equations to obtain the same results:-

DM requirement (kg) = Animal HG / 18.0
OM requirement (kg) = Animal HG / 21.0
CP requirement (kg) = Animal HG / 162.9
SE requirement (kg) = Animal HG / 39.6
TDN requirement (kg)= Animal HG / 30.2

To make the calculation more easy, the following equations could be used (calculated by dividing each of CFM, berseem hay and rice straw intakes on animal HG through the whole experimental period) when the animals fed the same feedstuffs:

The requirements of CFM (kg) = Animal HG x 0.042.
The requirements of berseem hay (kg) = Animal HG x 0.0094.
The requirements of rice straw (kg) = Animal HG x 0.013.

Also, the following equations could be used (calculated by dividing animal HG on each of CFM, berseem hay and rice straw intake through the whole experimental period):-

The requirements of CFM (kg) = Animal HG / 26.1.
The requirements of berseem hay (kg) = Animal HG / 106.7.
The requirements of rice straw(kg) = Animal HG / 76.6.

Table (10): Rations consumption by cm of HG (kg/cm) and centimeters (cm) of HG which consumed kg of rations (cm/kg) of animals in two periods.

	Treatment				Periods	
	T_1	T_2	T_3	T_4	P_1	P_2
CFMI/Anim. HG (kg/cm)	0.036±0.001^{ab}	0.035±0.001^{b}	0.039±0.001^{ab}	0.042±0.001^{a}	0.038±0.0002^{a}	0.039±0.0002^{a}
Hay intake/Anim.HG (kg/cm)	0.0099±0.0002^{a}	0.0082±0.0002^{b}	0.0089±0.0002^{ab}	0.0094±.0002^{ab}	0.008±0.0001^{b}	0.009±0.0001^{a}
Rice straw/Anim.HG (kg/cm)	0.012±0.0002^{ab}	0.011±0.0002^{b}	0.012±0.0002^{ab}	0.013±.0002^{a}	0.011±0.0001^{b}	0.013±0.0001^{a}
Anim.HG/CFMI(cm/kg)	25.6±2.280^{b}	28.4±0.343^{a}	26.2±0.280^{b}	26.1±0.343^{b}	28.8±0.185^{a}	24.3±0.185^{b}
Anim.HG/Hay intake(cm/kg)	101.4±2.499^{b}	123.4±3.061^{a}	112.8±2.499^{ab}	106.7±3.061^{b}	119.9±1.587^{a}	102.2±1.587^{b}
Anim.HG/Rice straw intake(cm/kg)	77.7±1.475^{ab}	85.8±1.807^{a}	81.9±1.475^{ab}	76.6±1.807^{b}	85.4±1.065^{a}	75.6±1.065^{b}

a and b mean of different letters in the same raw are significantly different ($P<0.05$).

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مفهوم جديد لاستخدام محيط الصدر فى حساب الاحتياجات الغذائية
٣- لتسمين عجول الفريزيان الخليط

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أجريت هذه التجربة بهدف حساب الاحتياجات الغذائية للعجول باستخدام محيط صدر الحيوان وذلك بدون معرفة وزن الحيوان وبدون تحويل محيط الصدر الى وزن وأيضا بدون فتح جداول التغذية.
استخدم فى هذه التجربة ٢٠ عجلاً خليط فريزيان وتم تقسيمهم الى أربعة مجاميع بمتوسط وزن ١٨٠كجم وتم تغذيتهم كما يلى:-

- *المجموعة الاولى: وتغذت تبعا لمقررات الـ NRC (عل أساس وزن الحيوان).
- المجموعة الثانية: وتحسب احتياجاتها من الـ TDN بالكيلو جرام على أساس المعادلة:- محيط الصدر X ٠,٠٢٨ .
- المجموعة الثالثة: وتحسب احتياجاتها من الـ TDN بالكيلو جرام على أساس المعادلة:- محيط الصدر X ٠,٠٣٢ .
- المجموعة الرابعة: وتحسب احتياجاتها من الـ TDN بالكيلو جرام على أساس المعادلة:- محيط الصدر X ٠,٠٣٤ .

أوضحت نتائج التجربة أن معدلات النمو اليومى فى المجموعة الرابعة كانت أعلى معنويا من المجموعة الثانية وأعلى بفرق غير معنوى من المجموعة الاولى والثالثة كذلك تفوقت المجموعة الرابعة (بدرجة غير معنوية) على بقية المجاميع فى كل من كفاءة التحويل الغذائى والكفاءة الاقتصادية. كذلك فإنه يمكن استخدام بيانات المجموعة الرابعة فى حساب الاحتياجات الغذائية لتسمين العجول خليط الفريزيان وذلك كما يلى:-

الاحتياج من المادة الجافة (كجم) = محيط الصدر X ٠,٠٥٥

الاحتياج من المادة العضوية (كجم) = محيط الصدر X ٠,٠٤٨

الاحتياج من البروتين الخام (كجم) = محيط الصدر X ٠,٠٠٦

الاحتياج من معادل النشا (كجم) = محيط الصدر X ٠,٠٢٥

الاحتياج من الـ TDN (كجم) = محيط الصدر X ٠,٠٣٣

ويمكن أيضا استخدام المعادلات التالية للحصول على نفس النتائج المتحصل عليها من المعادلات السابقة:-

الاحتياج من المادة الجافة (كجم) = محيط الصدر / ١٨

الاحتياج من المادة العضوية (كجم) = محيط الصدر / ٢١

الاحتياج من البروتين الخام (كجم) = محيط الصدر / ١٦٢,٩

الاحتياج من معادل النشا (كجم) = محيط الصدر / ٣٩,٦

الاحتياج من الـ TDN (كجم) = محيط الصدر / ٣٠,٢

ولتسهيل استخدام هذه المعادلات للمربى الصغير فقد أوضحت نتائج البحث أنه يمكن استخدام المعادلات التالية ليحصل على نفس نتائج المعادلات السابقة وذلك فى حالة تغذية الحيوانات على الثلاثة علائق المستخدمة فى هذه البحث وهم العلف المركز والدريس والقش.

الاحتياجات من العلف المركز (كجم) = محيط الصدر × ٠,٠٤٢ أو محيط الصدر / ٢٦,١

الاحتياجات من دريس البرسيم (كجم) = محيط الصدر × ٠,٠٠٩٤ أو محيط الصدر / ١٠٦,٧

الاحتياجات من قش الارز (كجم) = محيط الصدر X ٠,٠١٣ أو محيط الصدر / ٧٦,٦ وعند استخدام هذه المعادلات الاخيرة فى التسمين تكون نسبة المواد المركزة: المواد الخشنة هى ٦٠:٤٠%.