Forage Intake and Nutrient Requirements of Fallow Weaner Deer in Southern Australia

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ABSTRACT : Information on nutrient requirements and forage intake of fallow weaner deer is required for the development of feeding strategies during the year. An experiment was conducted in which 60 fallow weaner deer (grazing on medic and ryegrass based pastures) were supplemented with a concentrated diet at three levels. The diet contained 2% minerals, 30% lupin and 68% barley grain. Twelve deer from each treatment were dosed with commercial alkane capsules in May, June, July, September and October to predict nutrient intake. The relationships between body weight gain and intake of metabolisable energy and crude protein were established using a general linear models analysis. Dry matter intake from pastures ranged from 0.137 kg to 0.304 kg in May and June and increased to 1.2 kg in October. Nutrient intake from pastures was strongly influenced by amount of supplementary feed and gender. Digestible energy intake from pastures was 1.3, 3.8 and 6.1 MJ/day higher for males than females in July, August and October, respectively. The protein and energy intake was strongly correlated with body weight gain. The energy requirement for maintenance were 7.3, 8.2, 10.2, 10.2 and 10.7 MJ DE/day and the DE required for each kg body weight gain were 19, 18, 29, 34 and 49 MJ in May, June, August and October, respectively. The protein requirement for maintenance was 12.2, 12.6, 15.0, 11.4 and 8.5 g/W $^{0.75}$ in May, June, July, August and October, respectively. The nutrient requirement defined from this study can be used to assist farmers to explore the possible pasture and stock management practices under southern Australian conditions. However, further research is required to develop rapid and cheap methods for estimating dry matter intake, nutritive value of pastures and to quantify the potential growth rate of fallow deer in southern Australia. ***(Asian-Aust. J. Anim. Sci. 2003. Vol 16, No. 5 : 685-692)***

Key Words : Energy Intake, Weaner Deer, Growth Rate, Supplementary Feeding, Sward Height

INTRODUCTION

Research with subterranean clover indicates that dry matter digestibility can be as high as 80% in winter and early spring, and as low as 40-50% in summer (Ru, 1996). The decline of nutritive value of subterranean clover occurs mainly after initiation of flowering (Ru, 1996). It has been well documented in a Mediterranean environment that the quantity of herbage in winter, quality of herbage in summer, and both quality and quantity of herbage in autumn are the key factors limiting animal production in a number of species.

In southern Australia, fallow deer start fawning in November and generally weaning occurs in March. From March to July, good quality feed is needed to reduce the post weaning stress and to enable deer to reach a market live weight in November. Due to the limited pasture availability at this time of the year, supplementary feeding in early winter and summer is often required. However, the current supplementary feeding for deer production is a hit or miss strategy due to the lack of information on nutrient requirements and seasonal forage intake of grazing deer.

While the seasonal energy requirements for fallow deer have been published in New Zealand by Milligan (1984) and Asher (1992) based on interpolations from red deer data (Fennessy et al., 1981), there has been limited experiments conducted to measure the energy requirement of weaner fallow deer during the grazing season. Preliminary research in Australia by Flesch et al. (1999), using fallow weaner deer fed in pens with imbalanced gender showed that energy intake ranged from 10-11 MJ ME/day between 12 to 20 weeks of age, equivalent to a metabolic body weight energy intake of 0.95 MJ ME/kg $^{0.75}$/day. To develop a supplementary feeding strategy, data on the nutrient intake of grazing deer from pastures is required, but no such data is available in Australia. The current study was conducted to measure seasonal feed intake and to define the energy and protein requirements of fallow weaner deer grazing annual pastures in southern Australia.

MATERIALS AND METHODS

Pasture and grazing management

A paddock of 5 ha was selected for this experiment on the Roseworthy Deer Farm, Roseworthy, South Australia. The paddock was grazed by deer in the previous year in a rotation system. The pastures were dominated with ryegrass, medics and oats. In December, the paddock was fenced into three small paddocks with equal size and pastures were regenerated. In April, 60 fallow weaners (intact), including 30 males and 30 females were selected. Deer were

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Table 1. Daily nutrient intake from pastures by grazing fallow deer from May to October

Treatment	Nutritional component					
	DM (kg/day)		DE (MJ/day)		CP (g/day)	
	Means	SE	Means	SE	Means	SE
May						
High	0.148a	0.025	1.95a	0.30	44.2a	7.3
Medium	0.199a	0.021	2.62a	0.26	57.5a	5.9
Low	0.300b	0.022	3.05b	0.26	83.5b	6.2
Significance	**		**		**	
June						
High	0.137a	0.015	1.75a	0.30	37.7a	4.0
Medium	0.185a	0.016	2.45a	0.31	49.6b	4.2
Low	0.304b	0.018	3.61b	0.35	76.5c	4.7
Significance	**		**		**	
July						
High	0.504a	0.037	8.09a	0.57	137.3a	10.3
Medium	0.297b	0.035	4.29b	0.54	82.9b	9.9
Low	0.534a	0.035	8.06a	0.54	157.3a	9.9
Significance	**		**		**	
Aug-Sept						
High	0.96	0.074	14.00	1.21	213.0	16.3
Medium	0.953	0.081	13.95	1.32	214.8	17.9
Low	0.997	0.078	15.04	1.27	209.5	17.1
Significance	ns		ns		ns	
October						
High	1.153	0.084	15.23	1.37	159.1	13.2
Medium	1.248	0.082	17.28	1.34	173.4	12.9
Low	1.225	0.079	16.76	1.28	183.6	12.4
Significance	ns		ns		ns	

** Values are significantly different between treatments in each month at $p<0.01$, ns, Not significant.

$^{a\ b\ c}$ Values with different letters were significantly different between treatment within each month.

randomly divided into three groups with balanced sex in each group. Three groups were randomly allocated into the three paddocks and supplemented with a diet including 2% minerals, 30% lupin and 68% barley. The diet contained 13.0 MJ DE/kg and 168.8 g/kg protein. Group 1 was fed *ad libitum* (High) and group 2 was fed 400 g/day (Medium) while group 3 was fed 200 g/day (Low). Supplementation ceased on July 27. Body weight of deer was measured fortnightly. Pastures were sampled monthly for *in vitro* dry matter digestibility, digestible energy and crude protein analyses. Sward height was measured using a ruler (to 0.1 cm) monthly on 6 randomly selected locations in each paddock, by placing a ruler at a right angle to the surface of the ground and reading the average sward height.

Forage intake measurement

From May to October, 6 males and 6 females from each group were selected randomly and dosed via the oesophagus with a slow-release alkane capsule (produced by Captec Pty Ltd.). After 10 days, faeces were collected every second day in the morning over 6 days as recommended by Ru et al. (2002a). Faeces collected over three days were bulked, freeze dried and then milled for alkane analysis.

Deer were fasted overnight before dosing alkane capsules. The body weight were measured in the morning when dosing alkane capsules. After finishing faeces collection, deer were fasted overnight and weighed in the morning. The daily body weight gain was calculated for this period for establishing the relationship between growth rate and nutrient requirement.

Before dosing alkane capsules, 4 exclusion cages with a size of 0.5 m^2 were set up randomly in each paddock. After finishing faeces collection, pasture samples were taken by cutting pastures in the exclusion cages at the same height as the grazed area. Pasture samples were freeze dried and then milled for alkane analysis. Daily feed intake was estimated using the following equation, assuming that all deer consumed the same amount of concentrate:

Daily herbage intake (kgDM/day)=(Fi/Fj×(Dj+I×Cj)-I×Ci)/(Hi-Fi/Fj×Hj) (Dove and Mayes, 1991); where Fi and Hi are faecal and herbage concentrations of the odd-chain alkanes; Fj and Hj are faecal and herbage concentrations of the even-chain alkanes; Dj is the daily dosed even chain alkane; I is concentrate intake; Cj and Ci are even-chain and odd-chain alkanes in concentrate supplement.

In vitro digestibility measurement

Fallow deer (male, 8-10 months old) were obtained from Farm Services, University of Adelaide, Roseworthy Campus. For each batch, two deer were slaughtered and the rumen fluid collected for *in vitro* digestibility estimation. CO_2 was passed through the rumen fluid to maintain anaerobic conditions and the container was sealed and kept in a water bath at 39°C before adding to the incubation tubes. The time from collection to completion of the inoculation process was less than 2 h as recommended by Schwartz and Nagy (1972).

The *in vitro* dry matter digestibility (DMD) and digestible energy (DE) content was determined using the Tilley-Terry method (Tilley and Terry, 1963). In brief, a sample of the feed (0.5 g) was weighed into incubating tubes and 10 ml of rumen fluid and 40 ml of buffer (pH=5.8) were added. Tubes were flushed with CO_2 and capped immediately. Ten replicates of each sample were incubated in a shaking water bath at 39°C for 48 h. After the samples were centrifuged at 3,000 rpm for 15 min, and washed with distilled water, 50 ml of pepsin solution was added to each tube and incubated for another 48 h at 39°C. After incubation, the samples were centrifuged (3,000 rpm) for 15 min and the residues dried at 60°C overnight. In each batch, a quality control lucerne sample of known *in vivo* digestibility and DE content was included.

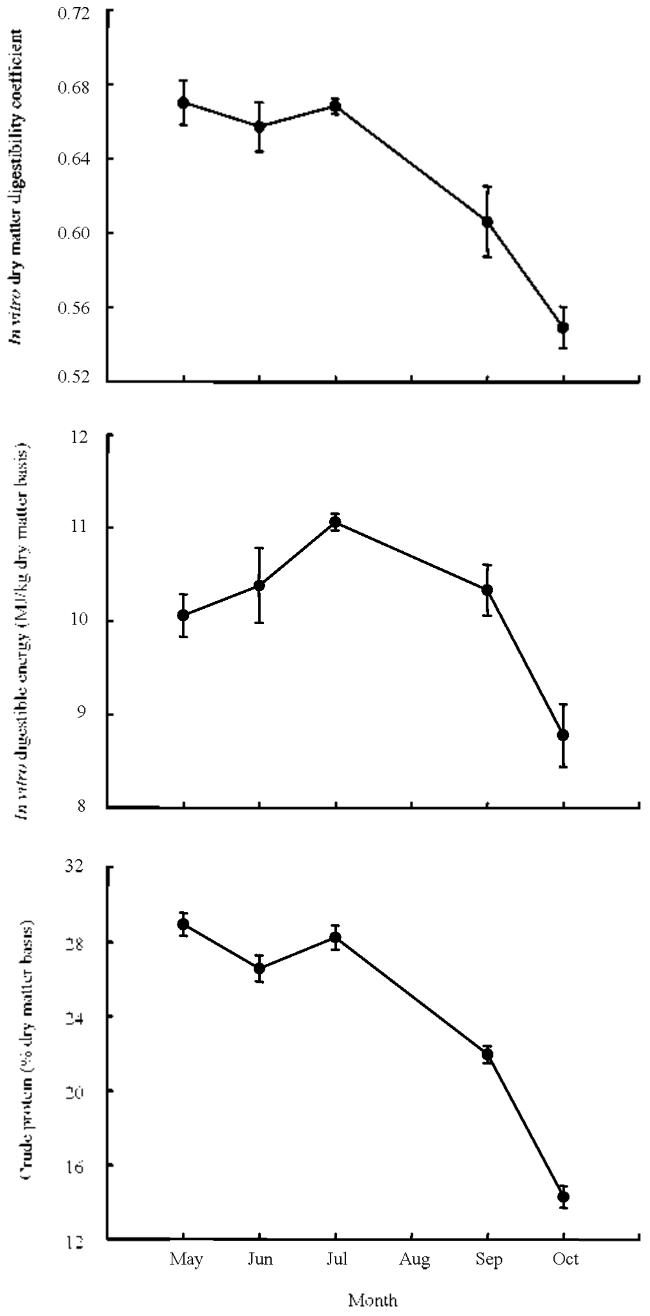

Figure 1. Seasonal changes in *in vitro* dry matter digestibility, digestible energy content and crude protein content of a medic and oats based pasture (error bar=standard error of means).

Chemical analysis

All pasture and faecal samples were freeze dried and milled through a 1 mm screen. Dry matter and gross energy were analysed using standard methods (AOAC, 1980). Alkane concentrations in faeces and pastures were analysed by Animal Science Laboratory at University of New England in Armidale, New South Wales. The analytical method used to determine alkane contents in the samples was a modified method of Dove (1992). In brief, to a dry sample of 100-500 mg, an appropriate amount (50-200 mg) of internal standard ($C_{34}H_{70}$ in dodecane) was added. The samples were then subjected to 1.5 M ethanolic KOH in a heating-block at 90°C for 1 hour with stirring. After cooling, the hydrocarbons were extracted in n-hexane several times, filtered, purified and quantified by gas chromatography. The alkanes analysed included C_{24}-C_{36}.

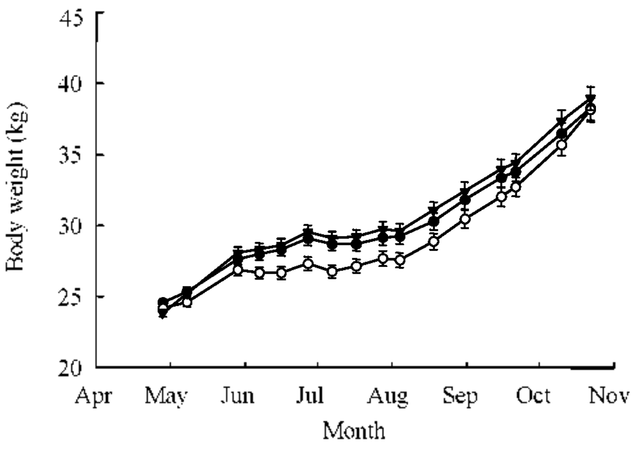

Figure 2. Body weight changes of three groups of deer fed high, medium and low concentrate diets during the season (λ high, τ medium and μ low).

Statistics

The effect of supplementary feeding level and sex on the growth rate of deer was assessed using a general linear model in Systat software (Wilkinson et al., 1992). Individual deer were used as replicates. The simple regression analysis in Systat software was used to establish the relationships between daily weight gain and digestible energy intake for each month, and the relationship between sward height and nutrient intake using all data over the season. Intake and body weight gain data were excluded for the regression analysis if deer lost capsules or their data were outliers.

RESULTS

There was a significant decline in *in vitro* dry matter digestibility, digestible energy content and crude protein after July as the pastures matured (figure 1). Crude protein, *in vitro* DE and DMD declined 0.60, 0.05 and 0.49 unit/week, respectively, from May to October. The decline was more rapid in the last 40 days, where crude protein, *in vitro* DE and DMD dropped at 1.30, 0.27 and 0.90 unit/week, respectively.

There was no difference in body weight between high and medium groups while the low group had a lighter body weight, especially late in the season (figure 2). Female deer

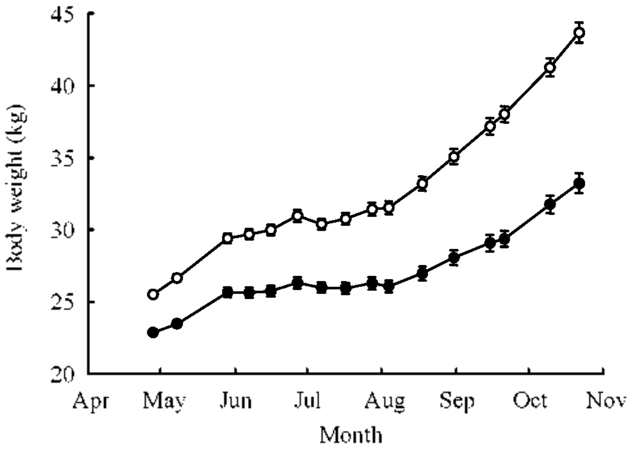

Figure 3. Body weight changes of male (μ) and female (λ) fallow weaner deer during the season.

grew slower than male deer ($p<0.05$). The difference in growth rate between sex was more significant after August (figure 3).

The crude protein, DE and DM intake increased from 40.6 g/d, 1.95 MJ/d and 0.14 kg/d in May to 203.4 g/d, 14.3 MJ/d and 0.9 kg/d in October, respectively. However, the forage intake was influenced by the level of supplementation during early winter. The group with a lower supplementation had a higher forage intake ($p<0.05$) in May and June. However, the difference in forage intake between the three groups was not significant after August when no supplement was offered (table 1). Female deer ingested less pastures than male deer, especially after August (table 2).

There was a strong relationship between intake of dry matter (kg/day), DE (MJ/day) and crude protein (g/day) and sward height (cm) (figure 4). The equations established using a regression analysis are:

DM intake (DMI)=-0.0634+0.3128* ln (sward height) $R^2=0.848$; n=12

DE intake (DEI)=-1.6863+4.9365* ln (sward height) $R^2=0.884$; n=12

Crude protein intake (CPI)=6.711+63.9272* ln (sward height) $R^2=0.812$; n=12.

The digestible energy and crude protein intake were strongly related with body weight gain (table 3). The digestible energy and crude protein requirements for different growth rates are present in tables 4 and 5, respectively. The energy requirement per $kgW^{0.75}$ for maintenance was highest in July.

DISCUSSION

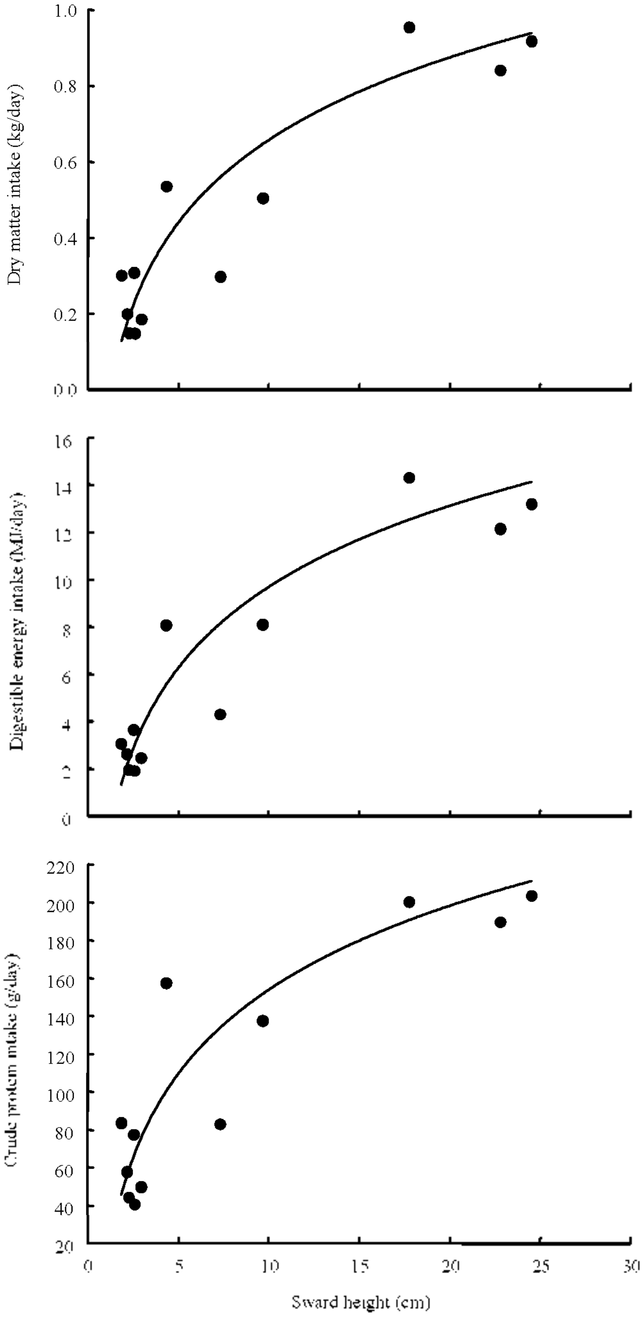

Figure 4. The relationship between nutrient intake from pastures by fallow deer (weaners) and sward height.

Seasonal changes in pasture quality

The seasonal decline in nutritional quality of pastures is the key factor which must be considered for pasture management and supplementary feeding of grazing deer. The decline in pasture quality depends on the pasture species and grazing management, and has a strong impact on the quality of dry residues in early summer. The dry matter digestibility (*in vitro*) of annual pastures (consisting of medics, ryegrass and oats) declined at a rate of 0.49 percentage units/week from May to October in the current

Table 2. Difference in nutrient intake from pastures between sexes

Sex	Nutritional component					
	DM (kg/day)		DE (MJ/day)		CP (g/day)	
	Means	SEM	Means	SEM	Means	SEM
May						
Male	0.213	0.018	2.58	0.22	61.1	5.2
Female	0.217	0.019	2.86	0.22	62.9	5.4
Significance	ns		ns		ns	
June						
Male	0.237	0.014	2.88	0.26	62.2	3.6
Female	0.179	0.013	2.33	0.26	47.0	3.5
Significance	**		ns		**	
July						
Male	0.497	0.029	7.47	0.44	140.8	8.3
Female	0.397	0.028	6.16	0.45	110.9	8.0
Significance	*		*		*	
Aug-Sept						
Male	1.095	0.063	16.23	1.02	239.9	13.8
Female	0.845	0.065	12.44	1.05	185.0	14.2
Significance	*		*		**	
October						
Male	1.417	0.065	19.49	1.06	201.4	10.2
Female	0.999	0.068	13.36	1.11	142.7	10.7
Significance	**		**		**	

* Values are significantly different between sex in each month at $p<0.05$.
** Values are significantly different between sex in each month at $p<0.01$.
ns, Not significant

study. However, Hume and Purser (1972) reported that the rate of decline in DMD for *Trifolium subterraneum* cv Dinninup was 0.5 percentage units/day after maturity, and Radcliffe and Cochrane (1970) reported a rate of decline of 0.43 percentage units/day for barley grass, annual ryegrass and *Trifolium subterraneum* cv Yarloop over a 14-week period. Ru and Fortune (2000) also found a large variation in the rate of decline in nutritive value among cultivars of subterranean clover. The previous and current research indicates that such a decline mainly occurs during flowering, is influenced by grazing intensity, and is associated with the increase in lignin and cellulose content (Hardwick, 1954ab; Ru and Fortune, 2000). This suggests that deer farmers need to select the proper pasture species or varieties. In addition, grazing the pastures at an optimum stocking rate will ensure that pasture quality is maintained by slowing the accumulation of fibre in the plant materials and reducing the dead material in the swards.

Forage intake and its prediction

The amount of supplementary feed required by deer is dependent on the nutrient intake from pastures under grazing conditions. It is difficult to accurately measure feed intake of grazing animals due to the lack of a reliable method. In the current research, the plant alkanes are used as a marker to estimate intake of individual deer and the outcomes of this study show that this methodology can be applied successfully for grazing deer. However, the high costs associated with this method limit its wide adoption by the deer industry. More rapid and cheaper methods need to be established. Ru et al. (2002c) have developed NIR calibrations for measuring alkane content in plant materials and deer faeces. The application of these calibrations will substantially reduce the cost of chemical analysis, but unfortunately the alkanes of C_{32} and C_{36} cannot be predicted accurately by NIR although these two alkanes are essential for estimating intake. However, the nutritive value of pastures (e.g. digestibility) can be estimated by measuring the alkane contents in pastures and deer faeces using these calibrations and EatWhat® software (Dove and Moore, 1995).

Table 3. Relationships between digestible energy (DE MJ/day) and crude protein (CP g/day) intake and body weight gain (g/day) of grazing fallow weaner deer (mixed sex) from May to October

Date	Equation	R^2	P	n*
DE				
May	DEI=7.252+0.019 Gain	0.45	0.014	29
June	DEI=8.220+0.018 Gain	0.66	0.000	26
July	DEI=10.249+0.029 Gain	0.47	0.005	35
Aug-Sep	DEI=10.227+0.034 Gain	0.68	0.000	25
Oct	DEI=10.661+0.049 Gain	0.62	0.000	31
CP				
May	CPI=135.49+0.292 Gain	0.49	0.007	29
June	CPI=148.616+0.262 Gain	0.66	0.000	26
July	CPI=180.218+0.553 Gain	0.52	0.001	35
Aug-Sep	CPI=162.9+0.390 Gain	0.58	0.000	25
Oct	CPI=125.039+0.392 Gain	0.55	0.001	31

Forage intake by grazing deer estimated in the current study cannot be directly extrapolated to other properties until some adjustments have been made. The seasonal trend of the intake would be similar for most southern Australian deer, but the actual nutrient intake is influenced by season (photoperiod), the interaction between season and sex hormones, botanical composition of pastures, stocking rate and supplementation levels. For example, deer grazing 1 kg DM intake from legume or grass dominated pastures will have significantly different daily protein intake. It has been well documented in dairy cattle that with increasing amount of supplementary feeding, the forage intake decreases, which is true for deer as found in the current research. Therefore, it is ideal to measure the forage intake of grazing deer under different types of pastures and under common management systems in southern Australia using a rapid and cheaper method. It could be more practical to measure dry matter intake of grazing deer and assess the digestibility and protein content of the herbage simultaneously to work out the actual daily nutrient intake. The current research has already demonstrated a strong relationship between sward

Table 4. Energy requirement of grazing fallow deer for different growth rates from May to October estimated using the relationship between energy intake and growth rate

Date	Liveweight kg	Gain g/day	DE		ME	
			MJ/day	MJ/day /W $^{0.75}$	MJ/day	MJ/day /W $^{0.75}$
May	24.8	0	7.25	0.65	5.95	0.54
		50	8.20	0.74	6.73	0.61
		100	9.15	0.82	7.50	0.68
June	26.9	0	8.22	0.70	6.74	0.57
		50	9.12	0.77	7.48	0.63
		100	10.02	0.85	8.22	0.70
July	27.4	0	10.25	0.86	8.40	0.70
		50	11.70	0.98	9.59	0.80
		100	13.15	1.10	10.78	0.90
Aug-Sept	32.8	0	10.23	0.75	8.39	0.61
		50	11.93	0.87	9.78	0.71
		100	13.63	1.00	11.17	0.82
		150	15.33	1.12	12.57	0.92
Oct	36.0	0	10.66	0.73	8.74	0.60
		50	13.11	0.89	10.75	0.73
		100	15.56	1.06	12.76	0.87
		150	18.01	1.23	14.77	1.01

Table 5. Crude protein requirement of grazing fallow deer at different growth rates from May to October estimated using the relationship between protein intake and growth rate

Date	Liveweight kg	Gain g/day	Crude protein	
			g/day	g/day/W $^{0.75}$
May	24.8	0	135.49	12.19
		50	150.09	13.51
		100	164.69	14.82
June	26.9	0	148.62	12.58
		50	161.72	13.69
		100	174.82	14.80
July	27.4	0	180.22	15.04
		50	207.87	17.35
		100	235.52	19.66
Aug-Sept	32.8	0	155.52	11.36
		50	175.02	12.78
		100	194.52	14.21
		150	214.02	15.63
Oct	36.0	0	125.04	8.51
		50	144.64	9.85
		100	164.24	11.18
		150	183.84	12.52

height and dry matter intake. If this relationship is further developed and validated on different types of pasture, farmers can easily estimate dry matter intake by measuring sward height. Ru et al. (2002b d) also reported that *in vitro* method could be used to estimate digestibility of feed for fallow deer and near infrared spectroscopy (NIR) showed great potential for predicting these nutritional parameters at low cost and with a rapid turn over. Again, these NIR calibrations need further development and validation before using them commercially.

Nutrient requirement of deer at different growth rates

The daily energy requirement estimated from the current work is lower than those reported by Asher (1992) and Mulley and Flesch (2001). Using the ratio of 0.82 (digestible energy/metabolisable energy) suggested by ARC (1980), the predicted ME requirement for fallow weaner deer is 6.7, 7.5, 9.6, 9.8 and 10.8 MJ ME/day in May, June, July, September and October, respectively, at a growth rate of 50 g/day using the models developed in this study. If the growth rate is 80 g/day, equivalent to Mulley and Flesch's data (2001), the energy requirement in winter is 10.3 MJ ME/day in winter (July), close to values (10-11 MJ ME/day) reported by Mulley and Flesch (2001). This value is lower than the value reported by Asher (1992) for male fawns (11.8 MJ ME/day), but close to the value for female fawns (10.4 MJ ME/day). However, the winter growth rate for deer reported by Mulley and Flesch (2001) might not be achieved in southern Australia under grazing conditions.

Mulley et al. (1999), cited by Mulley and Flesch (2001), reported that energy intake from concentrate-fed weaners from 16 weeks of age was equivalent, if not marginally higher than that of adult does. In another study, Mulley and Flesch (2001) demonstrated that does at the second trimester of pregnancy had a slightly lower ME intake than fallow weaners (10.3 vs 11.5 MJ ME/day). Most farmers also believe that fallow weaners have lower pasture requirement than adult does. The current study further proves that the actual energy intake of fallow weaners is determined by growth rate and gender. Thus it is difficult to compare the nutrient requirement defined in the current study with those reported by Asher (1992) due to the lack of expected growth rate of fawns at the recommended energy requirement. This further indicates the difficulty of the direct application of New Zealand data for the development of a supplementary feeding strategy for Australian deer farmers.

The ME and protein requirements for 1 kg empty body weight gain for fallow weaner deer were 15.6, 14.8, 23.8, 27.9 and 40.2 MJ and 292, 262, 553, 390 and 392 g protein in May, June, July, September and October, respectively, apart from maintenance requirement. The energy utilisation efficiency declines with the season. This decline is associated with pasture quality, the nutrient content in the empty body weight of animals, growth rate and maturity of animals. For example, for a growing castrated Merino sheep with a 30 kg body weight, the energy concentration for empty body weight is 17.5 MJ/kg and 21.7 MJ/kg (ARC, 1980) and protein content is 150 g/kg and 146 g/kg (Langlands and Sutherland, 1969 cited by ARC, 1980) at growth rates of 50 and 200 g/day, respectively. The energy concentration for empty body weight increased from 15.6 to 31.0 MJ/kg, but protein content decreased from 148 to 136 g/kg when body weight of sheep increased from 20 to 45 kg (ARC, 1980). However, no data on the energy and protein content of deer carcass is available for calculating the ME utilisation efficiency for deer. It should be noted that the protein requirement in this study is expressed as crude protein and the values can vary with the quality of feed. While it is ideal to express the protein requirement as degradable and undegradable crude protein, it is impossible to determine the degradability of protein in the current study due to the limited resources.

The energy requirement per unit body weight at 0 growth rate is higher in July than in any other month (tables 5, 4). The energy requirement at 0 growth rate is not the exact maintenance requirement due to the changes in body composition, but is a reasonable indicator of maintenance requirement of grazing animals. In July, deer require more energy to maintain their body temperature, probably due to the low temperature in southern Australia although winter in southern Australia is not very cold compared to Europe. Therefore, the increase in nutrient intake through supplementation is essential for deer to maintain the maximum growth rate during this period of time when the quantity of pasture is limiting. Under commercial situations, most farmers may believe that green pasture should supply enough nutrients for grazing deer due to the high quality, but it should be noted that the low sward height at this stage may limit the intake rate of deer. However, the magnitude of such limitation is dependent on the type of pastures. For medics, subclover and other pasture species with a prostrate growth habit, sward height is a limiting factor for intake, but for some grasses, it may not be the case due to their erect growth (Ru, 1996).

Deer have a lower nutrient requirement than sheep for growth at similar body weight. For sheep with a 30 kg body weight, ME requirements are 11.8 and 13.1 MJ/day for males and 10.8 and 12.5 MJ/day for females for growing 50 and 100 g/day (ARC, 1980). For fallow deer with a similar body weight, the ME requirements were 9.8 and 11.2 MJ/day to achieve the same growth rates. This suggests that deer is a better converter compared to sheep and the nutrient requirements recommended for sheep cannot be directly applied to deer.

CONCLUSION

Forage intake of grazing fallow weaner deer increases from May to October, decreases with the increase in the supplementation and is strongly correlated with sward height. Males have higher nutrient intake and growth rate compared with females. The energy and protein requirement of fallow weaners defined in this study can be used for the development of supplementary feeding strategies. However, the following information is required to assist farmers to explore the possible pasture and stock management practices to ensure that the genetic potential for growth is not limited by inadequate nutrition under southern Australian pasture conditions.

Genetical potential for growth of fallow weaner deer in southern Australian environment. The information on potential growth rate will further define the valid range of the models developed in this study for the predication of energy and protein requirements at different growth rates.

Establishment and validation of the relationship between forage intake and sward characteristics. The development of correlation between DM intake and sward height, plant density or other pasture characteristics for different types of pastures will enable deer farmers to quickly assess DM intake from pastures and adjust the level of supplementation feeding.

Further development and validation of rapid feed evaluation. Based on the current study, it is impossible to estimate ME and protein intake of deer at different grazing systems. While the DM intake can be estimated, it is crucial to have information on the nutritional quality (ME and protein content) of the pastures. The current method for feed evaluation is time-consuming and costing. *in vitro* methods (Tilley-Terry and NIR) showed potential for a rapid assessment of nutritive value of pasture for deer (Ru et al., 2002bd).

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