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Short Communication

Effect of feeding dried whey on the efficiency of Iraqi Awassi lambs

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ABSTRACT:

This research was conducted to evaluate different levels of dried whey in the production performance of Awassi lambs. Estimation of daily and total weight gain was systematically done by using completely randomized design. Twenty male Awassi lamps were used with initial weight of 23.77±1.52 kg and aged 2-3 month old, randomly distributed to five treatments with individual pens in the animal field of University of Baghdad, College of Agriculture, Abu Ghraib. Lambs fed on experimental diets at different levels of whey powder (WP) 0, 25, 50, 75 and 100% instead of soybeans meals were studied. The concentrated feed was determined based on dry matter at 3% of the body weight, while the green alfalfa was provided *ad libitum*. The trial continued for 74 days, including adaptation period of 14 days. The results showed that the fourth treatment (T_4) (75% WP) was higher than the others ($P<0.05$) with regard to daily weight gain, which was 166.66 g / day compared with others (106.24, 139.58, 124.99 and 158.33) g/day for T_1,T_2,T_3 and T_5 respectively. The same treatment showed higher total weight gain ($P<0.05$) of 10 kg compared with other treatments. To conclude, the use of dried whey at 75% and 100% instead of soybean reduced the economic cost of producing 1 kg gain by 7.22% and 7.08% respectively.

Keywords:

Weight gain, Awassi lambs, Dried whey, Soybean meal, Daily gain.

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INTRODUCTION

Due to the importance of concentrated fodder in ruminants feeding, and a large shortage of fodder crops area and semi area as well as the scarcity of water and reliance on imported crops, the cost of the production was increased (Carvalho, 2004). The importance of replacement meals increased by contents of energy and protein is unavoidable. For years whey or whey residue has been used as a functional component in a wide range of food products, and can be used as a protein source in the fodder feed (ZoBell and Burrel, 2002). The fate of dairy industry by-product in Iraq is dumping with sewage water, which is dangerous with regard to spread of diseases and public health. To reduce this pollution we can collect by-product of milk and extract the whey from them and use as a protein source of ruminants (Ahlam, 2016). The whey is being eliminated in the dairy factories as by-product of the cheese industry (Dayani *et al*., 2011). At present, whey is considered a great challenge and cattle nutrition experts suggested it in several different ways, such as liquid, dried or concentrated (Ahlam, 2016). All economic and technical aspects of using whey in livestock feeding were studied by nutritionists. And the whey is a good source of feed for ruminants (Modler *et al*., 1980). This separated liquid milk (whey) is rich in proteins, elements and sugars, including lactose, which is separated from casein (milk protein) during the cheese manufacturing processes. This separate usually ends with pH 4.5 - 4.8 (Foegeding *et al*., 2002) . In addition, liquid whey is a good source of calcium, phosphorus, sulfur and water in which vitamins were dissolved. Whey contributes 40% calcium and 43% total phosphorus present in the whole milk (Price *et al*., 1944).

MATERIALS AND METHODS

Experimental animal and management

Twenty *Awassi* male lambs were used (2-3 months old and weight 23.77±1.52 kg). The animals were distributed randomly in five treatments with four replicates for each in individual cages measuring 1.5×2 m^2. They were provided concentrated and roughage feed and clean water. The animals were given vaccines and kept under continuous veterinary supervision throughout the experimental days. The concentrated feed was given at 7 a.m. at 3% of live body weight on basis of dry matter and roughage feed *ad libitum*. The remaining feed were weighed daily to ensure the free consumption of roughage feed, and adjusting the amount of concentrate feed weekly.

Table 1. Primary proportion of experimental diets (%)

S. No	Ingredients (%)	Treatment				
		T_1	T_2	T_3	T_4	T_5
1	Barley	40.00	40.00	40.00	40.00	40.00
2	Bran	48.00	45.00	42.00	39.00	36.00
3	Dried whey	0.00	5.5	11	16.5	22.00
4	Soybean meal	10.00	7.5	5.00	2.5	0
5	Salt	1.00	1.00	1.00	1.00	1.00
6	Vitamins	1.00	1.00	1.00	1.00	1.00
7	Total percentage	100%	100%	100%	100%	100%
8	A protein of soybean meal (44 %)	4.4	3.3	2.2	1.1	0
9	A protein of whey powder (20%)	0	1.1	2.2	3.3	4.4
10	Percentage of replacement	0%	25%	50%	75%	100%
11	Barley protein (12%)	4.8	4.8	4.8	4.8	4.8
12	Bran protein (13%)	6.24	5.85	5.46	5.07	4.68
13	Total protein	15.44	15.05	14.66	14.27	13.88

Treatment 1 (T_1): 100% soybean meal: 0 % dried whey (control); Treatment 2 (T_2): 75% soybean meal: 25 % dried whey; Treatment 3 (T_3): 50% soybean meal: 50 % dried whey; Treatment 4 (T_4): 25% soybean meal: 75 % dried whey; Treatment 5 (T_5): 0% soybean meal: 100 % dried whey.

Table 2. Chemical composition for experimental diets and roughage feed (% as dry matter basis)

S. No	Approximate analysis (%)	Concentrated experimental diets (%)					Green Alfalfa
		T_1	T_2	T_3	T_4	T_5	
1	Dry matter	96.07	96.25	96.25	96.21	96.44	27.00
2	Organic matter	92.70	91.58	91.58	91.68	91.85	91.00
3	Crude protein	14.96	14.05	14.05	13.96	13.73	18.00
4	Ether extract	5.56	6.47	6.47	8.14	9.73	3.00
5	Crude fiber	12.95	8.76	8.76	9.75	7.79	27.00
6	Ash	7.30	8.42	8.42	8.32	8.15	9.00
7	Nitrogen free extract	59.23	62.31	62.31	59.83	60.60	43.00
8	*Metabolic energy (MJ/kg dry matter)	12.458	12.853	12.853	13.062	13.537	10.461
9	pH	7.35	7.30	7.30	6.90	6.88	6.70

* metabolic energy (MJ/kg dry matter) = 0.012*crude protein + 0.031*ether extract +0.005*crude fiber + 0.014* nitrogen free extract …….(MAFF,1975).

Growth trial

The effect of the replacement of dried whey with soybean meal in natural curve for animal growth should be studied using some parameters :

1. Average of total weight gain (kg) = final weight of live animal – initial weight.
2. Average of daily weight gain (g) = total weight gain / number of experimental days (Tawfeeq and Hassan, 2014).

Treatments of concentrated feed

Five treatments of balanced concentrated feeds were introduced to experimental lambs (Table 1) and analyzed as approximate analysis according to AOAC, (2005) as given in Table 2. The percentage of replacing soybean meal with dried whey was as following:

Treatment 1 (T_1): 100% soybean meal: 0 % dried whey (control)

Treatment 2 (T_2): 75% soybean meal: 25 % dried whey

Treatment 3 (T_3): 50% soybean meal: 50 % dried whey

Treatment 4 (T_4): 25% soybean meal: 75 % dried whey

Treatment 5 (T_5): 0% soybean meal: 100 % dried whey

Statistical analysis

One way ANOVA analysis was performed to determine significant differences ($P<0.05$ and $P<0.01$) among treatments, which was carried out using statistical program (SAS, 2010) and Duncan test (Duncan, 1955).

$Yij = \mu + ti + \delta ej$

RESULTS AND DISCUSSION

The Table 3 shows the initial and final weight of the lambs. There were no significant differences among treatments because there are a right random distribution at the beginning of experiment that led to reduce the random error between the treatments (Dayani *et al*., 2011). On the other way the results showed the daily gain (DG) g/day to the exceeded of fourth treatment (T_4) ($P<0.05$) 166.66 g/day on the first treatment

Table 3. Effect of the replaced dried whey with soybean meal on final weight (kg), daily gain (g/day) and an average of total gain (g) ± standard error

S. No	Treatments	Initial weight (kg)	Final weight (kg)	Average of daily gain (g/day)	Average of total gain (g)
1	T_1	23.87 ± 0.96^{a}	30.250 ± 1.73^{a}	106.24 ± 13.34^{b}	6375.00 ± 800.39^{b}
2	T_2	23.75 ± 1.26^{a}	32.125 ± 1.32^{a}	139.58 ± 24.62^{ab}	8375.00 ± 1477.26^{ab}
3	T_3	23.75 ± 2.46^{a}	31.250 ± 3.11^{a}	124.99 ± 13.60^{ab}	7500.00 ± 816.49^{ab}
4	T_4	23.75 ± 1.29^{a}	33.750 ± 1.31^{a}	166.66 ± 20.69^{a}	10000.00 ± 1241.64^{a}
5	T_5	23.75 ± 1.63^{a}	33.250 ± 1.19^{a}	158.33 ± 14.02^{ab}	9500.00 ± 841.62^{ab}
6	Significance	n.s	n.s	*	*

n.s : non significant; Different litters in same column means significant differences; * significant differences at level 0.05
Treatment 1 (T_1): 100% soybean meal: 0 % dried whey (control); Treatment 2 (T_2): 75% soybean meal: 25 % dried whey;
Treatment 3 (T_3): 50% soybean meal: 50 % dried whey; Treatment 4 (T_4): 25% soybean meal: 75 % dried whey;
Treatment 5 (T_5): 0% soybean meal: 100 % dried whey.

Table 4. Effect of the replaced dried whey with soybean meal on feed efficiency and dry matter intake (mean ± SE)

S. No	Treatments	Dry matter intake (g)	Total feed intake (g/day) / daily gain (g/day)	Concentrated feed intake (g/day) / daily gain (g/day)	Metabolic energy (KJ/day) / daily gain (g/day)	Crude protein intake (g/day) / daily gain (g/day)	Metabolic energy (KJ/day) / Crude protein intake (g/day)
1	T_1	1028.05±102.24^a	9.87±1.00^a	5.98±0.72^a	0.11±0.013^a	1.60±0.15^a	0.071±0.001^b
2	T_2	1168.95±30.39^a	9.12±1.56^a	5.93±1.08^a	0.11±0.018^a	1.40±0.23^a	0.077±0.0004^a
3	T_3	1098.62±99.45^a	8.89±0.51^{ab}	5.60±0.30^{ab}	0.10±0.006^a	1.37±0.08^a	0.079±0.001^a
4	T_4	1155.93±51.44^a	7.22±0.85^{bc}	4.70±0.57^c	0.08±0.011^a	1.10±0.13^a	0.078±0.00025^a
5	T_5	1083.81±51.03^a	7.08±0.96^{bc}	4.53±0.76^c	0.08±0.013^a	1.08±0.14^a	0.080±0.0007^a
6	Significance	n.s	*	*	n.s	n.s	**

n.s : non significant; Different litters in same column means significant differences; * significant differences at level 0.05; ** significant differences at level 0.01;
Treatment 1 (T_1):100% soybean meal: 0 % dried whey (control); Treatment 2 (T_2): 75% soybean meal: 25 % dried whey; Treatment 3 (T_3): 50% soybean meal: 50 % dried whey;
Treatment 4 (T_4): 25% soybean meal: 75 % dried whey; Treatment 5 (T_5): 0% soybean meal: 100 % dried whey.

(T_1 control), which was 106.24 g/day. This results are agreement with the researchers (Lynch *et al*., 1975) who have given the acidic whey powder for the calves that consumed about 28-31% of the dry matter present in the whey where the researcher obtained a rapid increase in the weight compared with the calves fed on the control diet, which does not contain whey powder. On the other hand, the results showed that in the study of total gain (TG) g/day exceeded the fourth treatment (T_4) significantly ($P<0.05$) in contrast with the first treatment (T_1 control), which amounted to a total gain 10,000 g compared with the first treatment (T_1 control), which was a total gain (6375 g). The results of the study of Frizzo *et al*. (2010) were also consistent with the accompanying results, In his study on small calves to test the growth performance the Milk Replacer (MR) was used and compared with large amounts of dried whey powder. The increase in the daily gain was observed 4.9 kg/week compared with the treatment containing milk replacer at 2.7 kg/week.

Figure 1 shows the weekly live weight (kg) for lambs fed on whey powder. It showed a linear significant difference in weekly gain compared with T_1 (control), and the same for final weight for the experimental animals in Figure 2. This may be due to the availability of digestible carbohydrates, especially sugar, including high lactose found in the whey partially degradable compared with soybean meal feed, indicating the possibility of replaced whey powder in the provision of concentrated feed for ruminants in conditions where soybean meal have higher prices. Dry Matter Intake (DMI) in the experimental group was shown in Table 4. Insignificant difference for dry matter intake was for T_1 (control) 1028.05 g/day compared with other treatments which were 1168.95, 1098.62,1155.93 and 1083.81 g/day for the treatments T_2, T_3, T_4 and T_5 respectively. The results showed that when *Awassi* lambs consumed dried whey, it led to significant decrease ($P<0.05$) in dry matter intake for one unit of daily

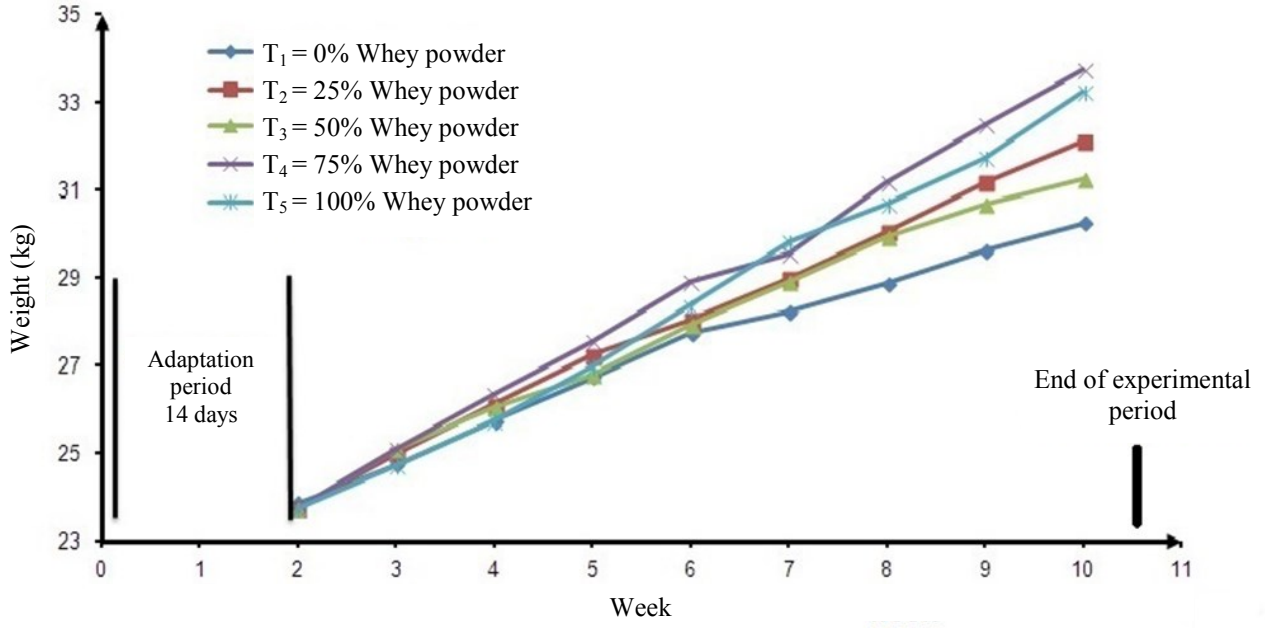

Figure 1. Weekly live weight (kg) of animals for treatments

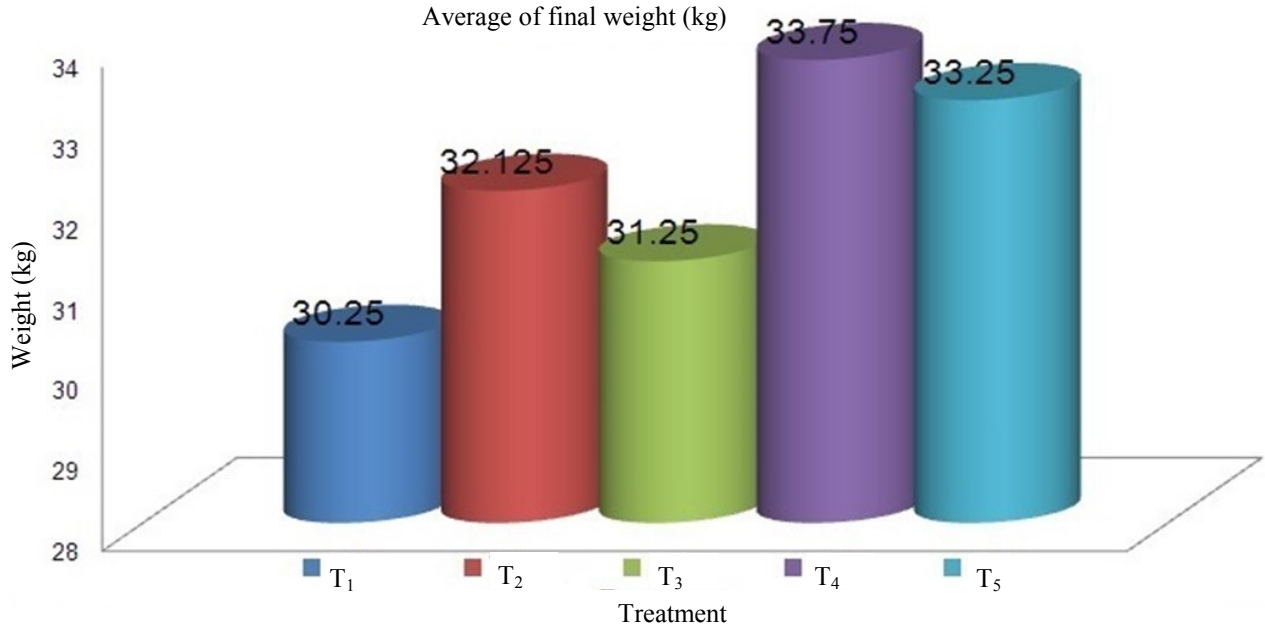

Figure 2. Final live weight (kg) of animals after treatments

weight gain (increase of feed conversion efficiency). The feed conversion efficiency for concentrated feed fed lambs showed significant decrease ($P<0.05$) in concentrated feed for one unit of daily weight gain (increase of feed conversion efficiency). These results coincided with a study by ZoBell and Burrel (2002) who reported Feed Conversion Efficiency (FCE) for steer calves when used a growth diet containing maize straw with sweet liquid whey compared with the control treatment. All treatments gave a significant increase for feed conversion efficiency (5.19) compared with control treatment which gave 6.34.

CONCLUSION

The results of the replacement of dried whey powder with soybean meal can be concluded that there is a possibility to expand the trend towards the use of dry whey powder in the components of the large in are-

as where concentrated feed is difficult to obtain despite the presence of milk factories. Partial replacement of dry whey powder with soybean meal can be substituted for ruminants to reduce rheumatic acidity due to the high consumption of concentrated feeds. The replacement ratio in the fourth diet (T_4), which contains 75% dry whey powder compared to 25% of the soybean meal, which gave best results in the experiment.

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