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UTILIZATION OF BANANA, TOMATO AND POTATO BY-PRODUCTS BY SHEEP

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SAMMARY

Eleven metabolism trials were carried out to investigate the digestibility and nutrive value of rations fed to sheep and containing three proportions (25, 50 and 75%) of three non-conventional feed resources banana, tomato and potato by-products; to replace concentrate feed mixture (CFM) and/or hay in the rations.

The average feeding values as SV of berseem hay, CFM, banana, tomato and potato by-products, were 32.78, 53.01, 31.75, 11.23 and 48.25% respectively. The corresponding values as TDN were 49.66, 58.99, 47.26, 36.92 and 52.17% on DM basis, respectively.

It was found from all the results obtained concerning the feeding values, ruminal parameters (pH, NH3, total VFA's and VFA's fraction and some haematological and biochemical blood traits of sheep fed the experimental rations that banana by-product could be used at 25% to replace same percent of berseem hay. However, tomato by-prooduct could be used at a percentage lower than 25%. Potato by-product could be incorporated up to 75% of the ration if another protein supplement is added.

Keywords: Utilization, banana by-product, tomato by-product, potato by-prodduct, sheep

INTRODUCTION

In Egypt, animals suffer from under feeding and mal-nutrition due to shortage of locally produced feeds which are not sufficient to cover the nutritional requirements of the existing livestock. The feeds shortage are also unevently divided between summer and winter. In winter season, berseem (Trifolium alexandrinum L.) the major forgage crop, covers 60 and 75% of yearly animal requirements from energy and protein respectively (Abou-Raya, 1967, El-Shazly, 1983, Abou-Akkada et al., 1984 and Dessoky and El-Nouby, 1990). However, in summer season, the available feeds (mainly concentrate and straws) cover only 39% and 22% of animal requirements for energy and protein, respectively (El-Serafy, 1991).

Agro-industrial by-products (AIBP) refer to the by-products derived in the industry due to processing of the main products. They are less fibrous (potato by-products) and have a higher nutrients content (tomato by-product) than straws, also some agricultural by-products like banana by-product (leave and pseudostems) have nutrients nearest to hay. They can play an important role in meeting nutrient requirements of the animals as well as maintain a high intake of the roughage.

The objectives of the present study are to investigate the digestibility and the nutritive values, ruminal parameters and some blood haematoological and biochemical traits with sheep fed rations contained banana by-product (leaves and pseudostems), tomato and potato by-products.

MATERIALS AND METHODS

This study was undertaken during the year, 1991 at the animal house belonging to Animal Nutrition Department. Animal Production Researcch Institute, Ministry of Agriculutre and Land Reclamation. Eleven metabolism trials (21 days as a prelimanry and 7 days as a collection period for each) were undertaken to investigate the digestibilities and feeding values of the different experimental rations. In each trial three adult Barki x Merino cross breed rams of about one year old and 35 kg of body weight were used. They were housed

individually in stainless steel metabolic cages.

Three non conventional feed resources (NCFR) were fed to sheep in different proportions with berseem hay and concentrate feed mixtures (CFM). Control ration was 50% hay + 50% CFM. Each NCFR was used at rate of 25, 50, or 75% from tested ration replacing 50 or 100% from hay or 100% hay and 50% from CFM. The used NCFR in this study were collected as they are produced, from factories and farms. Banana by-product are collected from banana farm near El-Kanater. Tomato by-product are collected from Kaha factory. They are mostly skins and little seeds. Potato by-product was collected from Chipsy Factory near Pyramids, Giza. It contains potato skins and the discarded potatoes. They were chopped and sun dried before fed to animals. The animals were fed at nearly maintenance level (Abou-Raya, 1967). A commercial mineral and vitamin mixture were added daily to the ration of each animal during the whole experimental periods to meet their requirements. Records for daily feed and water consumption, urine and faeces voided were kept for all trials.

Feeds, faeces and urine samples were analyzed according to the Official Methods of Analysis Proceedures (A.O.A.C., 1980). Samples of used feedstuffs were analyzed for nutral detergent fiber (NDF), acid detergent fiber (ADF) and acid detergent lignin (DAL), by the Van Soest (1967) procedures. Cellulose and hemicellulose were determined by difference.

Rumen Liquor samples were taken from each animal during the last two days of the collection period of each experimental ration. They were taken before feeding, 2 hours, 4 hours and 8 hours post feeding using a rubber stomach tube. The rumen juice samples were strained through four folds of cheese cloth. As soon as the samples were taken, pH was measured and ammonia nitrogen was determined according to Conway method (1962). The total VFA's were determined as described by Abou-Akkada and El Shazly (1964) and individual VFA's were determined using a Perkin Elmer Model 3920 BGLC apparatus.

Blood samples were taken from each animal at the end of the collection period of each trial. Blood samples were taken from jugular vein and allowed to flow into acid washed heparinized tubes. Haematocrite value (PCV) and haemoglobin were determined using the whole blood

(Maxine M. Benjamin, 1985). Blood plasma was used for determination of total protein, plasma urea, cholesterol glutamate oxalo-acetate transaminase (GOT) glutamtate pyruvate transaminase (GPT), and albumin (Pointe scientific inc. Laboratory reagent and instrument) creatinine (bio-Merieux Laboratory reagent and insturuments) were analysed using the colorimetric methods. Globulin was determined by difference as follows:

Globulin = Total protein - Albumin.

The data were analysed using general linear models using ANOVA procedures of SAS (1982). Means were separated using Duncan's Multiple range test when the main effect was significant.

RESULTS AND DISCUSSION

Chemical composition of the experimental feedstuffs and formulated rations

Chemical analysis of experimental feedstuffs on DM basis are presented in Table (1). Banana by-product showed similar chemical composition to that of berseem hay, but it contained low CP (11.66 vs 17.54%) and high ash (20.26 vs 14.46%).

Tomato by-product was similar in CP content to berseem hay, but it showed low NFE and ash and high CF content.

Potato by-product contained low CP, EE and CF and high NFE comparing to either berseem hay or concentrate fed miture (CFM).

Concerning fiber fractions contents, tomato, by-product had the highest values of acid dtergent fiber (ADF), and lignin comparing to either hay, CFM or other experimental by-products. Banana by-product was similar with hay in ADF and lignin content. On the other hand, potato by-product had ADF and lignine content similar to those of CFM content.

Banana by-product had higher contents of CP and ash than those reported by Gohl (1970) which might be due to the higher ratio of leaves to pseudostems of banana plants used in this sutdy. Chemical composition of tomato and potato by-products are in agreement with some deviations, with those reported by Abaza et al. (1987) for tomato by-product, Hulan et al. (1982) and Dickey et al. (1971) for potato by-product.

Table (1): Chemical composition, digestibilities and feeding values of feedstuffs used in formulating the experimental rations (DM basis).

Nutrient	Experimentaal feedstufs				
	Berseem hay	CFM	Banana by-product	Tomato by-product	Potato by-product
Dry matter	89.74	90.00	92.22	93.96	88.85
Organic matter	85.54	88.68	79.74	94.51	82.92
Crude protein	17.54	17.75	11.66	16.11	12.25
Ether extract	2.56	4.42	2.24	5.49	0.86
Crude fiber	26.65	13.41	25.85	44.18	10.59
Nitrogen free extract	38.79	53.40	39.99	28.73	59.27
Ash	14.46	11.32	20.26	5.49	17.08
Fiber fractions:					
Acid detergent fiber	44.31	22.01	49.62	56.63	23.92
Neutral detergent fiber	85.53	42.98	73.56	68.74	66.54
Hemi-cellulose	14.20	20.97	23.94	12.11	44.28
Cellulose	28.38	15.72	32.94	27.42	7.58
Lignin	8.98	3.98	9.22	23.90	4.80
Digestion coefficients %:	*	**	***	***	***
Dry matter	54.92^{a}	67.02^{a}	45.46^{b}	27.34^{c}	41.92^{b}
Organic matter	56.34^{b}	67.64^{a}	54.95^{b}	35.67^{c}	64.12^{a}
Crude protien	62.21^{a}	69.61^{a}	67.06^{a}	47.10^{b}	41.37^{c}
Ether Extraict	40.55^{ab}	80.62^{ab}	44.49^{b}	54.53^{a}	26.03^{c}
Crude fiber	37.48^{b}	40.99^{a}	49.38^{a}	32.96^{b}	25.58^{c}
Nitrogen free extract	66.78^{ab}	72.04^{b}	62.54^{b}	34.68^{c}	73.99^{a}
Feeding value %.					
TDN	49.66^{a}	58.99^{b}	47.26^{a}	36.92^{b}	52.17^{a}
SV	32.78^{b}	53.01^{b}	31.75^{b}	11.23^{c}	48.25^{a}
DCP	10.91^{a}	12.34^{b}	7.56^{b}	7.49^{b}	5.07c

* Obtained directly.

** Obtained indirectly using 50% of the feedstuff or the by-products and 50% berseem, hay.

** Obtained indirectly using 50% of the feedstuff or the by-produced 50% CFM.

Banana , Tomato and potato by-prduct were compared with berseem hay.

a, b, c: means in the same line with different superscript differ significantly ($P<0.05$).

Digestion coefficients and feeding value of experimental feedstuffs

The results are summarized in Table (1), comparing the results of digestioon coefficients of banana, tomato and potato by-products as roughage feedstuffs (AIBP) with that of the hay, it could be seen that banana had significantly higher CP and CF digestibilities than tomato and potato by-products. On the other hand, potato by-product showed the highest values of OM and NFE digestibilities. Regarding the feeding value as TDN and SV, banana by-product showed a close value to that hay, while potato by-products was highest and tomato by-product was the lowest. Banana and tomato by-products had nearly the same value of DCP. However, they were significantly higher than potato by-product but significantly lower than hay.

Tomato by-product used the present study had less CP and higher CF content than those reported by other workers (Abou-Akkada et al., 1975 and Abaza et al., 1987). This might be responsible for decreasing the digestion coeffients and its feeding value. The digestion coefficients for the different nutrients of banana by-product were lower, except CP, than those reported by Gohl (1970) for the whole banana plant and that reported by Blaha and Mudrik (1981) for leaves, leaf stems and part of banana pseudostem. The differences in the ratio of banana plant components may be responsible for these differences. The TDN of potato by-product was similar to that reported by Dickey et al, (1971).

Digestioon coefficients and feeding value of the experimental rations

The results are summarized in Table (2) using 25% of banana by-product in the ration to replace berseem hay did not affect practically the feeding value of the ration compared to the control ration (50% berseem hay and 50% or 75% CFM). However, the DCP was significantly reduced from 12.33% for control ration to only 9.69%. Increasing the percentage of banana by-product in ration to 50% significantly decreased the digestion coefficients and feeding value of the rations than that of control ration.

Table (2) Chemical composition, digestibilities and feeding value of formaulated rations

Ration	Level of by-Product	DM	OM	EE	CP	CF	NFE	Ash
		DM Composition						
(100%hay)								
50% hay+	-	89.74	85.54	17.54	2.56	26.65	38.79	14.46
50% CFM								
Banana	-	89.84	87.54	18.18	3.04	20.82	45.50	12.46
by-	25	91.99	83.21	14.09	2.80	19.59	46.73	16.79
Product	50	91.07	81.40	14.36	2.88	23.09	41.07	18.60
Tomato	75	92.13	80.65	12.94	2.17	27.16	38.38	19.35
by-	25	90.87	91.18	17.27	4.71	22.01	47.19	8.82
Product	50	91.57	93.18	16.75	5.27	27.23	43.93	6.82
Potato	75	92.69	93.41	16.95	4.41	35.67	36.38	6.59
by	25	88.37	87.72	15.37	2.59	16.08	53.68	12.28
Product	50	89.89	86.34	14.90	2.54	11.02	57.88	13.66
	75	89.66	85.89	12.94	1.92	11.19	59.84	14.11

Hay+CFm	hay-CFM	DM	OM	CP	EE	CF	NFE	DCP	SV	TDN
	Average digestion coefficient %					Average feeding value				
	50:50	62.22a	65.12a	67.86b	63.56cde	42.47de	76.96cdef	12.33h	44.66a	58.16bcdf
Control	25	60.78ab	65.72a	68.75ab	59.65egf	47.89bc	73.67dcbe	9.69dfcl	44.75a	57.26acd
Banana	50	54.67bc	60.60ab	65.43b	31.41hgf	52.12ab	65.31hgf	9.16dfe	37.26f	51.77gfh
by-Product	75	45.44d	50.21de	55.99dce	31.41j	49.61b	51.2h4	6.99hg	25.32g	41.7h
	25	47.67d	55.03cd	52.89dc	67.75bcd	25.57g	62.24hg	8.12fg	35.74f	50.95ghf
Tomato	50	47.3cd	53.53de	58.01dc	67.86bcd	30.81fg	59.38h	8.43fg	33.44f	49.67ghf
By-Product	75	43.42d	47.19e	54.68dc	55.43b	27.9g	61.20hg	9.27dfe	24.92g	46.99h
	25	57.87abc	64.75ab	57.19dc	54.66hg	37.51de	76.05abcd	8.79fe	48.24acd	58.91bcd
Ratato	50	55.21bc	56.89c	58.19c	62.21edf	30.61fg	[illegible]	8.67f	54.44ab	61.94bc
by-product	75	53.32bc	60.39a	45.09f	37.98h	24.59g	80.71a	5.86hi	51.46bc	58.55bcd

a, b, c, d, e: Means in the same column with different superscripts differ significantly ($P < 0.05$)

Replacing half of the berseem hay (25%) of the ration by tomato by-product in sheep ration decreased significantly the digestion coefficients and the feeding value of the ration than those of the control ration (50:50 hay: CFM). Increasing the percentage of tomato by-product in the ration to 50 or 75 on the expense of berseem hay and CFM increased significantly the reduction in the feeding values of the fed rations. These adverse effect may be due to the high CF content and lignine content in tomato by-product. This by-product contained high percentage from tomato skins and less percentage from tomato seeds, this composition reflected on increasing CF especially lignine contents.

Incorporating up to 75 of potato by-product in the ration at the expense of hay and part of the CFM (25%) had a beneficial effect on the feeding value as SV and TDN. However, the feeding values as DCP were significantly reduced than those of control ration which was due mainly to the reduction of CP digestibility compared to the control ration. Increasing potato by-product level in the ration decreased CF digestibility. This may be due to its higher content of soluble carbohydrate (NFE) compared to hay or CFM. Feeding high levels of carbohydrates stimulated growth of starch-digesting microbes at the expense of cellulotoc microorganisms (El-Shazly et al. 1961).

Positive nitrogen balance were found for all experimental rations fed to sheep. This indicated that the nitrogen content of all rations was enough to meet the nitrogen requirement of adult sheep.

Effect of feeding experimental rations on some ruminal parameters

A significant effects of sampling time and the type of ration on ruminal pH, ammonia -N and total volatile fatty acids (TVFA) were found for all the fed rations (Table 3). Ruminal pH values were decreased and those of ammonia -N and TVFA were increased as the sampling time advanced post-feeding. Most of the decrease and increase occurred during the first 2-4 hours after feeding then stsarted to change towards the figures recorded before feeding.

Table (3) Effect of type of rations fed to sheep on ruminal pH, ammonia-N and TVFA

Type of by- Produc -		pH					Ammonia-N(mg/100 ml)					TVFA (mgg/100 ml)				
% of the by-products		0	2	4	8	Av.	0	2	4	8	Av.	0	2	4	8	Av.
Control	-	6.64b	5.61cbd	5.67bcd	5.96b	5.97	24.03a	27.86bc	32.85ab	22.99a	26.93	1.69fe	3.46bcd	4.32abcd	3.53dec	3.25
Banana	25	7.48a	6.48a	6.13ab	6.43a	5.03	15.85bcd	22.39cdefgd	19.54d	16.63b	18.60	2.54ba	3.32bcd	4.16bcd	3.67de	3.42
By - product	50	7.50a	6.51a	6.13ab	6.43a	6.64	13.83ed	21.11fgefdfg	16.34d	14.28bed	16.42	2.25bdac	3.04bcd	3.93bcd	3.19dce	3.10
"	75	7.47a	6.69a	6.23a	6.44a	6.71	9.39e	17.99fg	13.81d	12.23edc	13.63	2.72a	3.15bcd	3.64dc	3.26dce	3.19
Average		7.48	6.56	6.16	6.43	6.66	13.02	20.53	16.56	14.38	16.12	2.50	3.17	3.91	3.37	3.24
Tomato	25	6.02e	5.15gfe	5.32de	5.36ad	5.46	16.17bcd	25.12cebd	28.17cebd	19.65ab	22.35	1.38fg	2.57d	3.61dc	3.54dce	2.76
By - product	50	5.92e	4.87g	5.12e	5.16e	5.27	17.00bcd	21.47fbegd	26.00fbegc	16.80bc	20.32	1.07g	2.69cd	3.45dc	2.82de	2.51
"	75	5.99e	5.06af	5.38dc	5.09e	5.38	22.01abc	24.36fbebd	30.27cebd	13.00ed	22.16	1.36fg	3.16bcd	3.79de	2.71a	2.76
Average		5.18	5.03	5.27	5.20	5.37	18.06	23.65	28.25	16.48	21.61	1.27	2.81	3.62	3.02	2.60
Potato	25	6.42bc	5.47ced	5.71abcd	5.74abcd	5.83	23.65a	27.16bc	19.19d	15.81bc	21.45	2.09bdac	4.64a	4.61abcd	3.82	3.80
By - product	50	6.48bc	5.43cfed	5.49bcd	5.49bcd	5.79	21.07abc	29.17b	18.56d	15.09bcd	20.97	1.76fde	5.86b	5.85abc	4.77	4.56
"	75	6.11ed	5.29fed	5.42de	5.42de	5.57	11.53ed	19.41fhg	16.02d	12.29cd	14.81	1.41fg	2.81bcd	3.29d	2.96dce	2.62
Average		6.23	5.40	5.53	5.64	5.73	18.74	25.25	17.92	14.40	19.08	1.75	4.36	4.60	3.85	3.66

a, b, c, d, e: Means in the same column with different superscripts differ significantly (P< 0.05).

The vlues of pH in the present study are in harmony with those of Rakha (1988) who summarized the work of several workers and reported that the normal value of ruminal pH of sheep ranged between 4.96 and 7.92. In this connection Koufmann (1972) stated that the regulation mechanism of the ruminant are not directed towards maintaining a medium or normal pH, but rather for adjusting the pH according to the composition of the ration of that value most appropriate for the degradation of specific type feed. The average of ruminal NH2-N for all the experimental fed rations ranged between 16.12 and 21.61 compared to 26.93 mg/100 ml for control ration. These value insure reasonbale supply of N for rumen microorganism and host animal. These results are in harmony with those of Satter and Roffler (1977) and Mehrz et al. (1977). Tomato by-product rations showed the least overall average for TVFA compared to control or other, experimental rations.

Conserning the molar proportions % of the individual VFA (Acetic, propionic and butyric acids and acetic/propionic ratio), a significant affect of sampling time and type of ration were found (Table 4). The values are within the range reported by Rakha (1988). In this connection El-Shazly (1952) and Reid et al. (1957) pointed out that the nature of the feed had considerable influence both on the total concentration of VFA in the rumen and on the proportion of the individual acids.

As the levels of VFA and ammonia-N (as product of fermentation and breakdown of dietary proteins) have been used as parameters of ruminal activity by Abou-Akkada and Osman (1967), it could be concluded that the tomato by-product rations had the lowest ruminal activity compared to other experiment and control rations which might be responsible for their lower digestibility and feeding value.

Effect of feeding the experimental rations on some blood parametrs of sheep

The results are summarized in Table (5). No significant differences between rations containing the non-conventional feed resources used compared to control ration concerning some haematological parameters (Hb and PCV) and biochemical constitutents (albumin, glubulin, total protein, urea -N, cholesterol and creatinine) and

Table (4): Effect of type ration molar percentage of VFA and acetic/proionic acid ratio.

Type of by-Produc / % of the by-products	Acetic				Propionics				Butyric				Ac/Pre-ratio.			
	0 hr	2hr	4hr	8hr	0 hr	2 hr	4 hr	8 hr	0 hr	2 hr	4 hr	8 hr	0 hr	2 hr	4 hr	8 hr
50 % hay + Control 50% CFM	59.74a	48.76fe	52.09edf	49.42dc	23.15fbedc	22.44bc	22.62ebdc	23.21bac	17.11fgh	28.48be	25.29ed	25.11cab	2.58b	2.17j	2.30e	2.13i
Banana 25	48.46ah	58.72bc	59.72b	60.38ab	27.69ab	26.12abc	25.10ebdac	23.76ba	13.25h	15.17g	15.25fg	15.87g	1.75l	20.25c	2.38d	2.54b
By - product 50	5814ab	57.24bc	60.23b	58.41abc	27.03abc	25.90abc	24.64ebdac	24.33ebdac	14.83gh	16.86fgh	15.12fg	17.15fg	2.51i	2.21e	2.44c	2.40e
" 75	60.20a	64.01a	66.52a	64.52a	27.64ab	27.43ab	26.11ebdac	26.41edbac	12.16h	8.56h	7.18h	9.07h	2.18h	2.33b	2.53b	2.44d
Average	60.20	59.99	62.16	61.14	27.45	26.48	25.35	24.83	13.41	13.53	12.52	14.03	2.03	2.62	2.45	2.46
Tomato 25	52.99bdac	50.52fed	49.68egdf	54.99bdc	20.87fed	25.03abc	27.57abed	23.80ba	26.15bdec	23.03bdec	22.74cde	21.24foegd	2.54d	2.02i	1.80k	2.31f
By - product 50	48.66fdec	47.67fg	49.32egf	51.78bdc	30.74a	29.53ab	28.05abed	27.88a	20.59fgde	22.80fbdec	22.63cde	20.38fcgd	1.58m	1.61m	1.76l	1.86m
" 75	41.29f	45.82fgh	49.83eghdf	55.41bdc	20.08f	30.71a	29.30a	25.46a	42.50bdec	24.00bdac	20.77fde	19.13fegd	2.06g	1.47n	1.70n	2.18h
Average	47.65	42.82	46.61	54.06	23.90	28.42	28.31	25.71	23.75	23.82	22.05	20.23	2.06	1.70	1.75	212
Potato 25	50.47bdec	49.06fe	46.81g	49.35dc	19.56f	22.55bc	21.92ed	19.99bc	29.97ba	28.039b	31.26b	30.65d	2.58b	2.18f	2.14f	2.47c
By - product 50	47.80fdec	54.93cbd	53.69ed	50.53de	25.37bdc	19.41c	21.3e	19.27c	27.52bac	25.65bac	24.40cde	30.20b	1.88k	2.83a	2.55a	2.62a
" 75	48.22fdec	46.98fgh	47.90gf	46.77d	20.24fc	27.50ab	28.17abc	25.22a	31.54a	25.36bac	23.92cde	27.41cb	2.38g	1.17k	1.70n	1.85h
Average	48.83	50.32	49.47	48.88	21.71	23.15	23.71	21.49	29.68	26.47	26.53	29.42	2.28	2.24	2.13	2.31

a. b. c. d. e: Means in the same column with different superscripts differ significantly ($P< 0.05$).

Table (5) Effect of feeding the experimental rations to sheep on some blood parameters.

Type % of the by - Produc	Haemoglobin (Hb) g/100 ml	P. C. V. %	Albumin g/dl	Globulin g/dl	Total protein g/dl	Urea - N mg/dl	Cholesterol mg/100ml	creatinine mg/100ml	G. P. T. iu/L	G. O. T. iu/L
50 % hay +50% CFM										
Control	13.79^{a}	38.33^{bac}	3.60^{bac}	0.52^{e}	4.12^{bac}	16.43^{ba}	135.01^{b}	1.76^{a}	34.97^{ba}	24.56^{bac}
Banana 25	12.74^{a}	33.67^{bdc}	3.73^{bac}	1.26^{edc}	4.99^{bac}	14.00^{bac}	144.15^{ba}	1.44^{a}	31.49^{bc}	22.03^{bdac}
By - product 50	12.45^{a}	33.00^{bdc}	3.60^{bac}	1.74^{ebdc}	5.34^{bac}	12.30^{bac}	147.31^{ba}	1.68^{a}	34.36^{ba}	14.26^{ebdc}
75	13.45^{a}	28.00^{d}	3.04^{bdc}	2.31^{ebdac}	5.35^{bac}	13.87^{bac}	135.31^{b}	1.62^{a}	25.91^{bcd}	19.39^{abdc}
Average	12.88	31.22	3.46	1.77	5.23	13.39	142.27	1.58	30.59	18.56
Tomato 25	14.29^{a}	30.00^{dc}	3.39^{bac}	1.43^{a}	4.82^{ba}	14.73^{bac}	131.14^{b}	1.61^{a}	26.07^{bcd}	29.02^{a}
By - product 50	13.35^{a}	36.33^{bdac}	3.98^{ba}	0.80^{ed}	4.79^{bc}	16.33^{ba}	141.16^{b}	1.47^{a}	27.17^{bcd}	26.11^{ba}
75	13.50^{a}	40.33^{ba}	3.60^{bac}	0.99^{ed}	4.59^{c}	10.67^{bc}	134.35^{b}	1.91^{a}	32.35^{bc}	28.37^{a}
Average	13.71	35.55	3.66	1.07	4.73	13.91	135.55	1.66	28.53	27.83
Potato 25	13.16^{a}	38.67^{bac}	3.29^{bac}	2.17^{ebdac}	5.46^{bac}	12.92^{bac}	133.88^{b}	1.54^{a}	26.82^{bcd}	15.91^{ebde}
By - product 50	14.06^{a}	38.00^{bac}	2.99^{dc}	3.29^{ba}	6.28^{a}	19.50^{a}	133.63^{b}	1.62^{a}	16.04^{d}	14.96^{ebde}
75	14.72^{a}	42.67^{a}	4.26^{a}	1.87^{ebdac}	6.13^{a}	14.32^{bac}	135.06^{b}	1.53^{a}	16.52^{d}	18.02^{ebdad}
Average	13.98	39.78	3.51	2.44	5.95	15.58	134.19	1.56	19.79	16.30

a, b, c, d, e: Means in the same column with different superacripts differ significantly ($P< 0.05$).

serum enzymes (GOT and GPT) of blood serum of sheep, which insures no harmful effect on nutrition status and kidney or liver functions. The values obtained in the present study were within the range reported by Rakha (1988) taken from several studies on normal sheep blood.

From all the results obtained concerning the digestibility coefficients and feeding values, ruminal parameters and haematological and biochemical parameters of blood and blood serum, the following could be concluded:

a) Banana by-product could be used at 25% in the ration to replace the same percentage of berseem hay. b) Tomato by-product could be used at a percentage lower than 25%. c) Potato by-product could be used up to 75% of the ration, if a high protein supplement is added.

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إستفادة الأغنام من مخلفات الموز، الطماطم والبطاطس

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أجريت ١٢ تجربة هضم على الأغنام لدراسة معاملات الهضم و القيمة الغذائية لعلائق تحتوى على ثلاث نسب (٢٥، ٥٠ و ٧٥٪) من ثلاثة من مصادر الغذاء الغير تقليديه هىمخلفات الموز، الطماطم والبطاطس لتحل محل المخلوط المركز والدريس أو أيهما.

كانت القيمة الغذائية كمعادل نشا على أساس المادة الجافة لدريس البرسيم ، ومخلفات الموز، الطماطم والبطاطس ٣٢,٧٨ و ٥٣,٠١ و ٣١,٧٥ و ١١,٢٣ و ٤٨,٢٥٪، على الترتيب. والقيم المقابلة كمركبات مهضومة كلية (م م ك) كانت ٤٩,٦٦ و ٥٨,٩٩ و ٤٧,٢٦ و ٣٦,٩٢ و ٥٢,١٧٪ .

وأضحت نتائج القيمة الغذائية و مقاييس سائل الكرش (درجة الحموضة، الأمونيا، الأحماض الدهنية الطيارة الكلية و مفرداتها) و بعض القياسات الهيماتولوجية و البيوكيمائية لدم الأغنام المغذاة على العلائق التجريبية أنه يمكن استخدام مخلف الموز بنسبة ٢٥٪ ليحل محل دريس البرسيم بنفس النسبة. أما مخلف الطماطم فيمكن إستخدامه بنسبة أقل من ٢٥٪ و مخلف البطاطس يمكن إستخدامه حتى ٢٥٪ فى العلائق بشرط إضافة مركز بروتينى مناسب.