Use Different Dietray Sources Of Energy In Growing Finishing Sheep Rations

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SUMMARY: Tapioca was including in growing finishing lamb rations for 90 days before marketing ,to study its effect on daily weight gain ,carcass characteristics ,feed intake, Feed conversion and rumen parameters in comparison with barely and corn grains. *Invitro* and *Invivo* digestion trials were conducted to study dry matter disappearance and digestion for tapioca, barely and corn. Thirty ossimi lambs were used in feeding trial through which sample were collected to determent digestion coefficient of experimental diets. Results showed no significant differences(P>0.05) among the three foodstuff . Chemical analysis cleared that ash and ADF contents higher for tapioca while its contents of EE and CP lower than barely and corn. Feeding trials were indicated that diets containing tapioca was the greatest value in daily weight gain and dry matter intake(186.60 and 2195.0 (g/ h/d)) while feed conversion was no significant difference(P>0.05) with experimental diets . Live body weight and carcass weight in diet content tapioca (49.0 and 26.50 kg) were higher than (P<0.05) diet content barely or corn (45.10 and 24.2 or 44.90 and 23.50 kg, respectively). Digestibility indicated that tapioca diet was less DM,OM,ADF and nitrogen than other diets. It was concluded that tapioca can replace barely or corn in growing finishing lamb diets and improve carcass parameters ,average daily gain without adversely affecting daily gain or dry matter intake, with takes economic factors .

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Introduction

F AO, (2006) reported shortages in the production of cereals, a serions issue in many countries. The use of cereal products, especially maize , in feeds lead to increasing cost of feeding**.** There is therefore, the need to exploit cheaper energy sources to replace expensive cereals in feed formulation**(Tewe,2004).**

Cassava or tapioca (*Manihot esculenta*) is grown primarily for its starchy root, also used as livestock feed, and regularly fed to sheep and goats on small-scale subsistence farms in Africa. Cassava is primarily used in ruminant diets as an energy source. In a recent survey of smallholder sheep and goat farmers in southwest Nigeria, a majority of the farmers indicated that cassava products and by-products were regularly fed to their animals as supplementary feed to grass and hay **(Anonymous, 1988).** Both fresh and dried cassava roots and peels are consumed by ruminants such as cows, sheep and goats in different forms (sliced, chopped, ground). Dried cassava roots have given satisfactory, results as the principal energy source for dairy cattle, intensive beef fattening and lamb growth. Cassava can replace almost all of the grain in the diets with little reduction in performance. Inclusion levels of up to 65%, preferably pelleted, do not seem to affect health, carcass quality or overall performance when the diets are carefully balanced. Palatability can be enhanced by the addition of molasses if pelleting is not possible. The whole cassava plant (including root and aerial part) can be chopped and ensiled in simple pit silos for dry-season feeding **(FAO,2006). Therdchai et al**,. **(2001)** reported that 94% of cassava starch was digested in the rumen, thus probably providing the energy required by the rumen microbial population. Rumen degradability of cassava peels and cassava leaves were also found to be 83% and 84% respectively **(Smith et al., 1991).** These observations indicate that cassava as well as its by products could be very beneficial to ruminant livestock.

Dried tapioca roots are a high starch grain substitute which can be used its national forms of pellets. Chips broken pots meek or residual pulp for livestock nutrition. **Zinn and DePeters,(1991)** reported the technique that can be used for tapioca root pelleting. **Moreover, Zinn, (1993)** used tapioca meal as a protein supplement in feedlot cattle diets. Tapioca or cassava plants as it is variously called are amultipurpose crop that can be used tapioca is a dicotyledonous and a perennial shrilly plant. tapioca can for in all kinds of roils. Gross yield range between 5-10 ton **(El- Shewy,1989).** Although ,tapioca has been used extensively as a feed for all classes of livestock, there is no definitive information available regarding its comparative feeding value in diets for finishing sheep. The objectives of this trial were to evaluate the replacement value of tapioca root pellets for corn and barely grains in finishing sheep rations.

Materials And Methods

The present study was carried out at Agriculture Experimental and Research Center, Ain Shams University, Faculty of Agriculture.

Proximate analysis and Cell wall constituents analysis

Proximate analysis for Tapioca pellets, crushed barely , corn grain and CFM, feces and urine were determined according to ***A.O.A.C. (1990).*** The proximate analyses were used to determine dry matter (DM), crude protein (CP), crude fiber (CF), Ether Extract (EE) and ash. The nitrogen free extract (NFE) was obtained by difference. Fiber fraction for experimental diets and feces were analyzed according to ***Van Soest and Breston (1979)*** to determine neutral detergent fiber (NDF), Acid detergent fiber (ADF) and acid detergent lignin (ADL). Hemicellulose and cellulose were determined by difference.

Invitro disappearance

The *In vitro* dry matter disappearance were determined according to method described by **Tilley and Terry (1963).** Three tubes, as a replicate of each sample, were used at different incubation times (2, 4, 8, 24, 48 and 72 hrs.).

Feeding trial and carcass parameters

Thirty ossimi lambs (29.5- 31.0 kg.live wt.) were used in this design and divided into three experimental groups . all groups were offered berseem hay as basal diet with a mixture of 50% concentrate feed mixture and 50% tapioca pellets ,crushed barely or corn grain . experimental period continued for 90 days . At the end of the experimental period 5 lambs from each group were chosen randomly and used to determine carcass characteristics . animals were weighed fasting, then slaughtered after which empty body weights were recorded and dressing percentage was calculated by dividing carcass weight by live body weight. Fat around kidney, heart and in pelvic region was gathered and weighed . Subcutaneous fat at longissimus dorsi muscle was used as an index for fat thickness.

Metabolism trial

At the end of the experimental period, three digestion trials were carried out to evaluate nutrients digestibility, feeding values and nitrogen balance of tested ration by using metabolic cages. Digestion coefficient were calculated using acid detergent lignin(ADL) as an internal marker **(Metwally,1989).** Fecal samples were collected from animals rectums three times daily then samples were composted for each experimental group. Animals were fed at maintenance requirements using the allowances of **NRC, (1985).** Rumen liquor samples were taken from each animal at the end of experimental periods at 0, 2, 4 and 6 hours after morning feeding by stomach tube. Ruminal pH and ammonia nitrogen (NH3-N) were immediately determined by steam distillation according to **Bremmer and Keeney(1965).** Blood serum were collected from three animals per group once every other week. Blood serum was analyzed using special kits for urea **(Fawcett and Scott,1960).**

Statistical analysis

The data of *In vivo*, digestibility, carcass parameters, performance parameters , rumen and blood parameters were statistically analyzed according to statistical analysis system User's Guide**, (S.A.S.,1998).** Separation among means was carried out by using Duncan Multiple test, **(Duncan, 1955)**. The following model was used:

$$Y_{ij} = \mu + T_i + \alpha_{ij}$$

Where:
Y ij = the observation of the model.
μ = General mean common element to all observation.
Ti = the effect of the treatment (i = 1... 3)
α ij = The effect of error.

RESULTS AND DISCUSSION

Chemical composition and fiber fraction

The data of Table (1) clearly indicate that crude protein values in barely and corn were almost double those of in tapioca. Ether extract of barely was more than three times that of tapioca while its value in corn was more than four times those of tapioca.

Table (1): chemical composition and cell wall constituents of feed ingredient (% on DM basis).

Item	Tapioca	Barley	Corn	CFM*
DM	88.50	90.50	91.00	88.90
OM	90.00	91.20	91.80	90.80
CP	4.50	10.80	10.20	13.80
CF	10.60	6.60	2.90	17.20
EE	0.70	2.40	4.70	4.70
NFE	74.80	71.40	74.00	55.10
Ash	10.00	8.80	8.20	9.20
NDF	21.00	20.20	10.20	47.00
ADF	9.00	8.80	2.90	8.50
ADL	3.10	-	-	5.20
Hemicell.	12.00	11.40	7.30	38.50
Cellulose	5.90	-	-	3.30

***CFM:** commercial concentrate feed mixture

Crude fiber was the highest value in tapioca and the lowest value in corn. However , NFE was the same value almost in tapioca and corn while less 3 units in barely. In tapioca ,ash , NDF,ADF, ADL and hemicellulose content were higher than barely and corn while ADL and cellulose were not detected in barely and corn in the present study . Cassava roots contain high levels of energy and have been used as a source of readily fermentable energy in ruminant rations **(Khampa et al., 2009).** Because of the low protein of cassava root, its use in animal feeding requires supplementation of such diets **(Iyayi and Losel, 2001).**

Invitro dry matter disappearance

Data in Table (2) showed that after 2 , 4 and 24 hrs the highest significant increase ($P<0.05$) was found in tapioca (29.30 , 39.30 and 60.00 %,respectively), while the lowest significant increase was noted in barely (21.00 ,30.00 and 54.70%, respectively). After 8hrs, the same trend was noticed but the lowest value was in corn. There were no make changes in IVDMD after 48 and 72 hrs between tapioca or corn (61.00 and 60.90 or 60.00and60.00%, respectively). These results can be explained by higher degradability of tapioca carbohydrates than barely and corn while the three ingredients feed testes were high content of NFE due to higher in dry matter disappearance during the first 24 hrs and satiability afterward. **Con,(1991)** reported that the *Invitro* starch degradation was faster for tapioca than 21 other feedstuffs including maize ,millet, sorghum and barely which support our suggested explanation for obtained results. It is concluded that dry matter digestibility is positively correlated to CP content and negatively correlated to CF, ADF and NDF **(Sawe *et al.*, 1998).**

Table (2): *Invitro* Dry matter disappeared after incubation of tapioca pellets, crushed barley and corn grains (% on DM basis).

Item	Tapioca	Barley	Corn
DM%	88.50	90.50	91.00
2hrs	29.30 ^{a}	21.00 ^{c}	22.70 ^{b}
4hrs	39.30 ^{a}	30.00 ^{c}	32.80 ^{b}
8hrs	55.60 ^{a}	50.40 ^{b}	48.30 ^{c}
24hrs	60.30 ^{a}	54.70 ^{c}	58.90 ^{b}
48hrs	61.00 ^{a}	55.00 ^{b}	60.00 ^{a}
72hrs	60.90 ^{a}	55.10 ^{b}	60.00 ^{a}
mean	51.06 ^{a}	44.36 ^{c}	47.12 ^{b}

-a, b &c means within the same row with different superscripts differ significantly ($P<0.05$)

Feed intake

Significant ($P<0.5$) differences were observed in average daily gain(g/ h/d) and daily dry matter intake DMI (g/ h/d) among the different experimental rations , which mean that barely and corn have approximately the same palatability Table (3). While, tapioca had higher significantly DMI and ADG (2195.0 and 186.60 g/h/d, respectively) than other rations contained barely or corn(1972 and 168.90 or 1950 and 163.30 g/h/d, respectively) . On the other hand, final live body weight (47.80 kg) was significantly higher for tapioca than corn then barely (45.20 and 44.70, respectively). Moreover, although no significant differences among diets in feed conversion ,corn group tended to consume more dry matter units to gain as one unit of live body weight(11.94 g/g) than tapioca and barely diets (11.76 and 11.68 g/g) . This results due to higher level of hemicellulose and crude fiber in tapioca diet than other rations. **Zinn and DePeter, 1991** found that feed conversion decreased linearly as the percent of pelted tapioca and increased as a substitute for steam-flaked corn in diets of feedlot steers. Animals, physical form of the feed and stage of growing may be the reason of disagreement with results obtained in the present study. This disagreement with **Mekasha et al., (2002)** who observed that the high DM intake could result from the lower fiber content and high CP content in basal diet. **Jabbar et al., (1997)** studying the benefits of Leucaena and Gliricidia as supplements for small ruminants reported that at any level of supplementation sheep grew twice as fast as goats. This performance could be attributed to better utilization of the feed by sheep than goats, thus reflecting the greater potential of the sheep for improved productivity.

Apparent digestibility coefficients and Rumen liquor parameters

Data of digestion coefficient (Table, 4) showed that the highest ($P<0.05$) values of DM,OM , ADF and nitrogen digestibility were found for diets content barely or corn than tapioca diet. Results indicated that tapioca diet had the lowest digestibilities of DM,OM,NDF ,ADF and apparent nitrogen. However , the slightly lower NDF digestibility of the cassava-based diets may have contributed to higher degradation and substantial decrease in fiber digestibility **(Hoover,1986).** Although chemical composition of barely and corn diets content of protein was the same value ,the digestibility of DM,OM ,ADF, NDF and nitrogen non significant differences between barley and corn. Reasons of decreasing DM,OM , ADF and nitrogen digestibility in tapioca may be due to the increase content of the ration from CF **(Ali, 2005). Baiden et al.,(2007)** reported that dry matter and organic matter digestibilities were similar ($P>0.05$) for all treatments (0%,15%and 30% level). However, there is the possibility that higher inclusions (above 30%) of the pulp in the diet might reduce digestibility. The cassava pulp has high fiber content and this could inhibit digestibility. This is because the rate of microbial colonization of a feed with high fiber content is lower compared to another with low fiber content **(Silva and Ørskov 1988).**

Rumen parameters which recorded were illustrated in Table (4). It is apparent that, the pH values were within the normal range(6.64-6.71) with no significant differences among the rations at mean of zero, 3 and 6 hours post feeding. Such range is suitable for growth and activity of cellulolytic bacteria **(Prasad et al., 1972). McAllan et al.,1988** reported that tapioca level in diet did not affect rumen pH but increased rumen ammonia when it replaced by other dietary protein sources. **Zinn and DePeter, (1991**) recorded that no differences in the rumen pH values between steers fed flaked corn or pelted tapioca . Many studies found that the mean pH value of strained rumen liquor (SRL) ranged from 6.99 to 7.3 in healthy animals and 5.5 to 8.9 in digestive disorder cases. On the basis of pH value, the clinical cases were categorized into four kind of indigestion, viz., bloat (pH 5.52 to 5.72), acidic indigestion (pH 5.73 to 6.99), impaction (pH 7.00 to 7.49) and alkaline indigestion (pH 7.5 to 8.9). The above categorization on the basis of pH corroborates with the reports of **Bhaskar (1971) and Choudhary *et al.*,(1981).** Also, serum urea nitrogen did not show significant differences among experimental diets. In addation, results indecated that NH_3-N was the lowest value in tapioca diets (14.70 mg/100ml)compared barely and corn diets(16.80 and 16.20 mg/100ml).

Table (3): Finishing lamb performance when fed tapioca pellets, crushed barley or corn grains plus CFM

Item	Tapioca	Barley	Corn	S.E
No. of animals	10	10	10	-
Initial live body weight, kg	31.00	29.50	30.50	± 0.175
Final live body weight, kg	47.80 [a]	44.70 [b]	45.20[b]	± 0.114
ADG, (g/ h/d)	186.60 [a]	168.90[b]	163.30[c]	± 0.179
DM Intake, (g/ h/d)	2195.00[a]	1972.00 [b]	1950.00b	± 0.043
Feed conversion Ratio , (kg feed / kg gain)	11.76	11.68	11.94	± 0.450

-a, b &c means within the same row with different superscripts differ significantly ($P<0.05$)

Table (4): Digestion coefficients ,rumen and blood serum parameters of dietary nutrients in lambs fed tapioca pellets, crushed barley or corn grains plus CFM

Item	Tapioca	Barley	Corn	S.E
Digestibility ,%				
DM	58.20 [b]	64.50[a]	65.20[a]	± 0.03
OM	59.80 [b]	65.00 [a]	65.90[a]	± 0.15
NDF	45.40	44.70	45.00	± 0.12
ADF	40.10 [c]	43.40 [b]	44.70 [a]	± 1.25
Apparent digestibility of Nitrogen	66.00 [b]	70.00 [a]	69.00[a]	± 1.45
Rumen parameters				
pH	6.67	6.71	6.64	± 1.80
NH3,mg/100ml	14.70 [b]	16.80 [a]	16.20 [a]	± 1.75
Serum urea-N ,mg/100ml	11.50	12.00	12.10	± 1.90

-a, b & c means within the same row with different superscripts differ significantly (P<0.05)

NH3-N is regarded as the most important nitrogen source for microbial protein synthesis in the rumen. The optimal ruminal NH3-N at 14-30 mg/100ml for increasing microbial protein synthesis,feed digestability and voluntary feed intake in ruminant fed on low-quality roughages **(Wanapat and Pimpa,1999** and **Chanjula et al.2004). Khampa et al., (2009)** showed that the combined use of concentrates containing high levels of cassava (70%DM) in the concentrate lead to the highest improvement in rumen fermentation efficiency and digestibility of nutrients in beef cattle.

Carcass characteristics

Data of carcass characteristics (Table, 5) indicated that the highest (P<0.05) values of live body weight and carcass weight were found (49.00 and 26.50 kg, respectively)for tapioca diets compared barely or corn diets(45.10 and 24.20 or 44.90 and 23.50 kg, respectively). Although tapioca diet produced a heavier carcass, results indicated that no significant differences among diets in dressing percentage, fat thickness and internal fat (kidney, pelvic and heart fat). In addition, proportion of fat in the carcass increases, while these of bone and lean decreases with increasing slaughter weight **(Moron-Fuenmayer and Clavero 1999).**

Table (5): Carcass characteristics of animal groups fed tapioca pellets, crushed barley or corn grains plus CFM

Item	Tapioca	Barley	Corn	S.E
No. of animals	5	5	5	
Live body weight, kg	49.00 [a]	45.10[b]	44.90[b]	± 0.175
Carcass weight, kg	26.50 [a]	24.20[b]	23.50[b]	± 0.114
Dressing percentage,%	54.10	53.70	52.30	± 0.179
Fat thickness, cm	0.50	0.40	0.50	± 0.043
Kidney, pelvic and heart fat, %of carcass	2.77	2.72	2.69	± 0.450

-a &b means within the same row with different superscripts differ significantly (P<0.05)

Meat as the consumer buys often contains relatively high amounts of fat . in the lead , can be found between 1 and 2% fat,which is an excellent source of energy **(Warris,2003).** The dressing percentage observed in this study was no significant differences among diets which disagreement with **Macit et al.(2002). Koyuncu ,2008** found that the dressing percentages recrded of 46.2 and 48.2 kg for Kivircik and Karacabey Merino lambs.

Conclusion

Results of the present study suggested that tapioca can replace barley or corn safely in finishing lamb diets under Egyptian condition with improve dry matter intake, average daily gain, final live weight, live body weight and carcass weight, without any side effect on performance a healthy of animals. However, prices that changes from time to time will be the major factor to make that decision. More research is needed to investigate the best level of replacement, best physical form and the optimum stage of animal growth to use tapioca in ruminant diets.

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