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Effect of Feeding Chayote *(Sechium edule)* and Bottle Gourd *(Lageneria siceraria)* as Source of Fiber on Biological Utilization of Diet in Rats

R. Modgil and M. Modgil

INTRODUCTION

Fruits and vegetables are good sources of fiber and dietary fiber (1,2,3,) and many of these have been found to posses significant effect on lipid metabolism. Dietary fiber from many food sources significantly decrease serum cholesterol concentration. Fiber from differe nt plant sources while asserting the hypocholestrolemic action also affects the biological utilization of diet (Ranni, 1990; Sharma and Kawatra, 1990). Bottle gourd *(Lagnaria siceraria)* and chayote *(Sechum edule)*, belonging to family cucurbits are cultivated extensively in world. Bottle gourd is a widely consumed summer vegetables as compared to chayote. These two vegetables are good sources of fiber. But no much data is available on biological value and biological utilization of the diet containing bottle gourd and chayote as fiber source. So present study was taken upto see the effect of feeding fiber from bottle gourd and chayote on biological utilization of diet.

MATERIAL AND METHODS

Bottle gourd *(Lageneria siceraria)* and chayote *(Sechium edule)* were procured from the local growers of Palampur, Himachal Pradesh (H.P.) India. Vegetables were washed with water and left on a table for aeration and drying. These were then cut into small pieces and dried in a dehydrator a 46±3° C for 6 hours. Samples were then ground in a willy mill to pass through a 40 mesh sieve, and stored in plastic air tight containers. These were kept in a refrigerator till further analysis. Crude fiber and crude protein content was determined by standard method of A.O.A.C. (1990). Nitrogen was multiplied with factor 6.25 to obtain crude protein value.

Preparation of Diet: The diets were isoprotennious (Table 1). The bottle gourd and chayote were incorporated in diets so that diets contained 1.5%, 2.5% fiber from these vegetables, the protein content was adjusted at 10% with casein after taking into account, protein content of vegetables (bottle gourd and chayote contained 4.41 and 4.45% crude fiber and 6.04 and 6.62% crude protein respectively),

Feeding Experiment: Sixty male albino weanling rats weighting 28±5 gm were obtained from the Germ Free Small Animal House of the College of Veterinary Science, Chaudhary Charan Singh, Haryana Agricultural University, Hisar, India. Rats were equally divided into six groups and housed in individual cages Feed and water were provided *ad libitum.* Feeding lasted for 40 days. However feeding trial for PER lasted for 28 days.

Table 1: Composition of experimental diet (gm/100gm)

Ingredients	*Control*	*Fiber Diet*			
	Diet	*Bottle F1*	*% Fiber F2*	*Chayote % F1*	*Chayote % F2*
Casein	11	7.95	6.58	7.77*	6.23*
Ground Nut Oil	5	5	5	5	5
Sucrose	4	4	4	4	4
Cellulose	5	5	5	5	5
Mineral*** Mixture	4	4	4	4	4
Vitamin*** Mixture	1	1	1	1	1
Cholin Chloride	0.2	0.2	0.2	0.2	0.2
Starch	69.8	38.84	17.53	39.33	17.59
Chayote	-	-	-	33.70	56.98
Bottle gourd	-	34.01	56.69	-	-

* F1 : 1.5% fiber from the vegetable sources
* F2 : 2.5% fiber from the vegetable sources
*** According to NAS recommendations (5).

Ten days before the expiry of feeding the rats were transferred to metabolic cages for estimation as recorded in (Table 2). Diet, residues, faecal matter and urine were collected daily and weight gain was recorded. Faecal nitrogen and urinary nitrogen was estimated by micro kjedghal method.

Protein efficiency ratio (PER); Feed efficiency ratio (FER); Dry Matter Digestibility (DMD); True Protein Utilization (NPU); Protein Retention Efficiency and Net protein ratio were computed using standard equations (Binder and Doell, 1957; Chapman et al., 1959; Chick et al., 1959). Data were subjected to statistical analysis of variance (Sendecor and Cocharan, 1966).

RESULTS AND DISCUSSIONS

Feed Intake and Weight Gain: Feed and protein intake by different groups ranged between 146.64g to 232.34g and 14.68g to 23.23g/day respectively. The feed and protein consumption was significantly higher in the both vegetable (Chayote & Bottle Gourd) fed groups. Feed and protein consumption was slightly less with increase in fiber in the diet from vegetables sources. No significant difference was observed in between the groups of rats fed on vegetables diet. Ranni (1990) and Sharma (1995) reported similar pattern for feed and protein consumption.

Significantly higher weight gain was observed in the groups of rats fed on control diets. Lowest weight gain was by the rats fed on diets prepared from bottle gourd at 1.5% fiber similar results have been reported earlier Ranni (1990). by feeding rats on different vegetables sources.

Feed Efficiency Ratio and Protein Efficiency Rat: Feed efficiency ratio and protein efficiency ratio ranged between 0.14 to 0.30 and 1.25 to 3.10 in groups of rats fed on bottle gourd (2.5% fiber) and control diets. With increase in the fiber in the diet from vegetables, feed efficiency ratio and protein efficiency ratio decreased. This can be due to reason that with increase in the fiber in the diet protein utilization and digestibility of protein decreased (Agarwal and Chouhan, 1989: Shah et al., 1979: Wojcik and Delromc, 1982: Mitaru and Blain, 1982: Jain et al., 1981).

Dry Matter Digestibility Biological Value and True Protein Digestibility: Higher dry matter digestibility was observed in the control group (85.50%) lowest DMD was there in the groups of rats fed on bottle gourd diet containing (1.5% fiber) Table 2 significant difference (P>0.05) was observed in DMD of different dietary groups. Biological value was highest in the control groups (87.50%) and lowest in bottle gourd (2.5% fiber) groups (77.45%). Significant difference (P>0.05) was observed in biological value of different groups except in between two groups of rats fed on bottle gourd at two different fiber levels. With increase in fiber content true protein difestibility (TPD) decreased. It was maximum in the control dietary group and minimum in the bottlw gourd (2.5% fiber group) Table 2. Increase in the fiber resulted in the decreased protein utilization Ranni (1990). Addition of fiber from vegetable sources resulted in a decrease in DMD, BV and TPD this might be due to poor utilization of protein by rats (Agarwal and Chouhan, 1989: Shah et al., 1982:

Table 2: Effect of feeding chayote and bottle gourd fiber on FER, PER, DMD, TPD, NPR and PRE.

	Control diet	*Chayote*		*Bottle Gourd*		*CD(P<0.05)***
		*F1**	*F2**	*F1**	*F28*	
Feed consumed (g)	146.6	229.3	229.6	232.3	218.7	11.9
Protein consumed (g)	14.6	22.9	22.9	23.2	21.8	1.2
Weight gain (g)	45.4	44.9	37.2	37.4	32.3	3.15
FER	0.30	0.19	0.16	0.15	0.14	0.11
PER	3.10	1.9	1.6	1.6	1.2	0.11
DMD%	85.5	83.6	81.7	82.2	80.6	0.59
TPD%	94.8	87.5	85.7	85.7	83.9	0.71
B.V.%	87.5	80.5	78.8	77.9	77.4	1.01
NPU%	82.9	70.4	67.6	66.6	64.9	1.46
PRE%	54.2	33.6	31.7	31.5	28.0	2.91
NPR%	3.40	2.1	2.0	1.9	1.7	0.10

*F1 : 1.5% fiber from the vegetable sources

*F2 : 2.5% fiber from the vegetable sources

All values are means of 10 independent determinations

** Critical difference at 5% level.

Mitaru and Blain, 1982: Jain et al., 1981).

Net Protein Utilization: Highest net protein utilization was there in cholesterol control group (82.93%) Table 2. NPU was minimum & significantly less in bottle gourd group 2.5% fiber level (64.97%). Significant difference (P>0.05) was also observed in the net protein utilization by different dietary groups when compared with each others. Increased fiber level resulted in the decreased net protein utilization which might be due to the reason that increased fiber hinders the absorption of different nutrients including the protein. Poor protein absorption resulted in the poor protein utilization (Agarwal and Chouhan, 1989; Shah et al., 1982; Mitaru and Blain, 1982; Jain et al., 1981).

Bottle gourd and chayote had poor net protein ratio but it had significantly higher NPR when compared with bottle gourd. With increase in fiber level protein retention efficiency (PRE) decreased Table 2. Among the two vegetables PRE was more for the chayote group. Fiber from vegetables lowers the biological value of food. Increase in fiber results in lower values for DMD, TPD, NPU, PRE and NPR. This can be due to the reason that after digestion fiber which also includes dietary fiber are fermented by colonic microflora (Cummings et al., 1979; Shah et al., 1982; Wojcik and Delromc, 1982; Mitaru and Blain, 1982). Cholesterol diet had higher biological value which can be due to reason that cholesterol acts as precursor for synthesis of steroids in the body, which may enhance the protein utilization.

SUMMARY AND CONCLUSION

Chayote had better biological value then the bottle gourd. Increase in fiber even from vegetable sources resulted in the decreased PER, DMD, BV, TPD, NPU, PRE and NPR in rats. As reported earlier vegetables can be used for lowering the cholesterol level in rats but they may adversely affect the biological utilization of diet. Further studies are required to see effect of chayote and bottle gourd in human system.

KEYWORDS Fiber, Chayote, Bottle Gourd, Net Protein Utilization, Protein. Efficiency Ratio.

ABSTRACT Isoprotienous diets containing 1.5% and 2.5% fibre derived from two vegetables viz, bottle gourd and chayote were fed to rats for 40 days. Effect of incorporation of these vegetables on feed intake, weight gain, feed efficiency, ratio protein efficiency ratio, true protein digestibility, dry matter digestibility, net protein utilization and biological value were studied. The inclusion effected all above mentioned parameters and resulted in the decrease in the value of these parameters. Increase in fiber in the diet affects the biological value of dies.

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Authors' Address: **R. Modgil** and **M. Modgil,** Department of Food Science and Nutrition, College of Home Science, CSK HPKV, Palampur 176 062, Himachal Pradesh, India