

Nutritional Studies on the Evaluation of the Safety of Squilla Protein

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Safety evaluation of squilla protein was carried out by feeding it at 10 and 20% protein levels to weanling rats for 24 weeks. Growth rate and reproductive performance of them were compared to the control animals, fed on casein at 10% protein level. Fertility of the group fed 20% squilla protein was comparable to that of the control while that of the 10% squilla protein group was lower. Average number of pups born alive was also lower for the 10% squilla protein fed group than the other two. Significant differences were not observed in the gestation index and lactation index between the experimental and control animals. The average weight of pups at birth and on 21st day for control and 20% squilla protein group were similar while it was lower for the 10% squilla protein group. No adverse changes in appearance, behaviour and survival of the rats on experimental diets were observed.

Production of protein powders from squilla and their nutritional quality evaluation have been reported earlier (Garg *et al.*, 1977; Mathew *et al.*, 1982). Safety and suitability for human consumption of new foods are usually tested by administering different dosage levels of the food to the laboratory rat and finding out whether adverse/abnormal effects are manifested. A study was performed on weanling rats using squilla protein at 10 and 20% protein levels as the sole source of protein for 24 weeks. This paper reports the results of studies on the safety and influence on reproduction of squilla whole protein powder.

Materials and Methods

Squilla collected from departmental boats was iced and brought to the laboratory, stored in ice and was processed on next day. The cleaned and washed squilla was passed through a meat bone separator and the aqueous extrudate was collected, any chitinous matter present was removed by filtration through proper sieve. The extract was warmed to 60-70°C for 5

min with stirring, blended well, filtered through nylon sieve and the filtrate was spray dried. This powder was used for the preparation of the experimental diets. Casein (SRL) was used as the reference protein.

Proximate composition of the squilla protein powder was determined using AOAC (1975) procedure. Squilla protein powder at 10 and 20% protein levels and casein at 10% protein level were used respectively as the experimental and control diets. The diets were prepared according to the method of Chapman *et al.* (1959). Fresh batches of diet were prepared monthly and stored at 0°C during the experimental period.

Two groups of 10 male and 20 female weanling albino rats of the Wistar strain (Laboratory bred) weighing about 30-35 g were divided into groups of five and housed in wire mesh screen bottom cages at ambient temperature. Food and water were given *ad libitum*. Total body weight of the animals housed in each cage was recorded weekly.

After 12 weeks on the test diets, the animals were mated and kept as subgroups of 2 males and 3 females. Pregnancy was recognised either visually or by palpation. The females were caged individually throughout pregnancy, delivery and weaning. Lactation was permitted for 3 weeks. The mothers were fed cooked liver and milk powder during lactation period.

The physical appearance and behaviour of the animals were observed throughout the experimental period. The number of matings resulting in pregnancy and the number of pregnancies resulting in the birth of live litters in each group were recorded. The pups were weighed at birth, 7th, 14th and 21st day. The number of pups which died during the weaning period was recorded. Fertility index, FI (the percentage of matings resulting in pregnancy), Gestation index, GI (the percentage of pregnancies resulting in the birth of live litters), Lactation index, LI (the percentage of pups that survive the 21 days lactation period) were determined.

Results and Discussion

The squilla protein powder used for the studies had moisture 5.1-6.2%, fat 2.2-2.8%, ash 11.8-13.5% and protein 60.2-68.0%. Growth rates of the control and experimental rate are shown in Fig.1. Statistical analysis using t-test for gain in weight showed no significant difference for the three diets on both sexes at 5% level. The coefficient of variations of growth in squilla protein (20%) was found to be lower than the other two in both sexes indicating that the growth was more consistent with the former diet.

Table 1 shows the organ weights expressed as g per 100 g of body weight after 12 weeks. Significant differences were not observed between the control group and experimental group on 20% squilla protein.

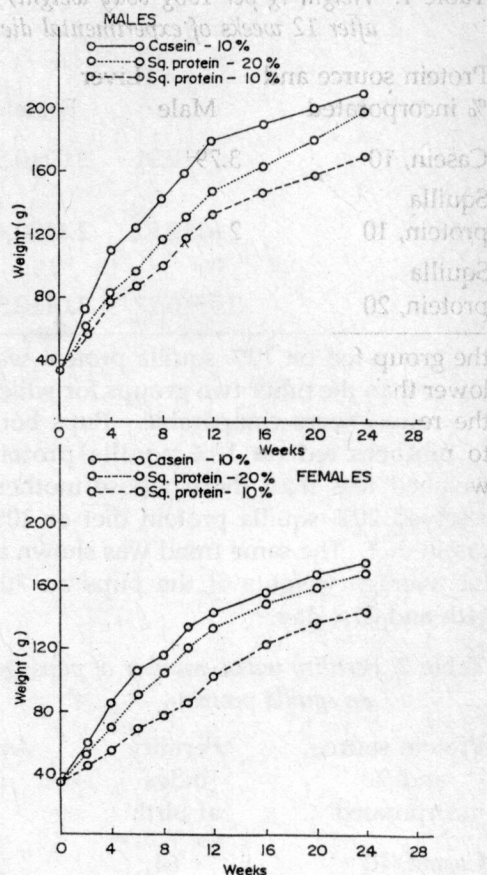


Fig. 1. Growth of rat fed squilla protein at 10% and 20% levels and casein.

Organ weights of the group fed 10% squilla protein were lower than those of the control. This is in conformity with the growth rate curves obtained.

The reproductive response of rats fed on different diets are summarised in Table 2 and weight of pups at different intervals of weaning are given in Table 3. The fertility index for the control group was higher than the group fed on experimental diets. Gestation index was similar for all groups. Lactation index was also similar except that mortality was observed in two cases for the group fed on squilla protein at 10% level. The average number of pups per litter for

Table 1. *Weight (g per 100g body weight) of liver, kidney and spleen of rats after 12 weeks of experimental diet*

Protein source and % incorporated	Liver		Kidney		Spleen	
	Male	Female	Male	Female	Male	Female
Casein, 10	3.79±0.31	3.02±0.52	0.90±0.33	0.74±0.51	0.30±0.04	0.28±0.02
Squilla protein, 10	2.61±0.52	2.41±0.40	0.71±0.24	0.62±0.38	0.24±0.04	0.22±0.03
Squilla protein, 20	3.95±0.22	3.01±0.36	0.83±0.22	0.70±0.42	0.36±0.03	0.29±0.04

the group fed on 10% squilla protein was lower than the other two groups for which the results were comparable. Pups born to mothers fed on 10% squilla protein weighed less than those whose mothers received 20% squilla protein diet or 10% casein diet. The same trend was shown in the average weights of the pups on 7th, 14th and 21st day.

The results indicate that squilla protein powder has average protein quality. Its ingestion at the proper level promotes satisfactory growth in rats. Deleterious effects were not apparent when the protein was administered at 20% level upto 24 weeks. It did not induce any obvious toxic effect and fertility and reproduction seemed unaffected.

Table 2. *Fertility index, number of pups, gestation and lactation index of rats fed on squilla protein*

Protein source and % incorporated	Fertility index at birth	Average No. of pups/litter	Gestation index	Lactation index
Casein, 10	64	7.2±2.0	100	100
Squilla protein, 10	56	5.8±1.2	100	99.4
Squilla protein, 20	62	7.2±1.9	100	100

Table 3. *Average weight of pups at different intervals of weaning*

Protein source and % incorporated	Weight (g) at day			
	0	7	14	21
Casein, 10	5.0±0.1	10.4±0.8	17.0±1.3	25.0±1.8
Squilla protein, 10	4.2±0.3	8.2±0.3	14.2±1.1	20.4±2.2
Squilla protein, 20	4.9±0.3	11.2±1.0	18.4±1.5	25.8±2.4

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