OPTIMUM ENERGY AND PROTEIN REQUIREMENTS OF BROILER RABBITS

By

P. GANGA DEVI

THESIS

Submitted in partial fulfilment of the requirement for the degree

DOCTOR OF PHILOSOPHY

Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Animal Nutrition
College of Veterinary and Animal Sciences
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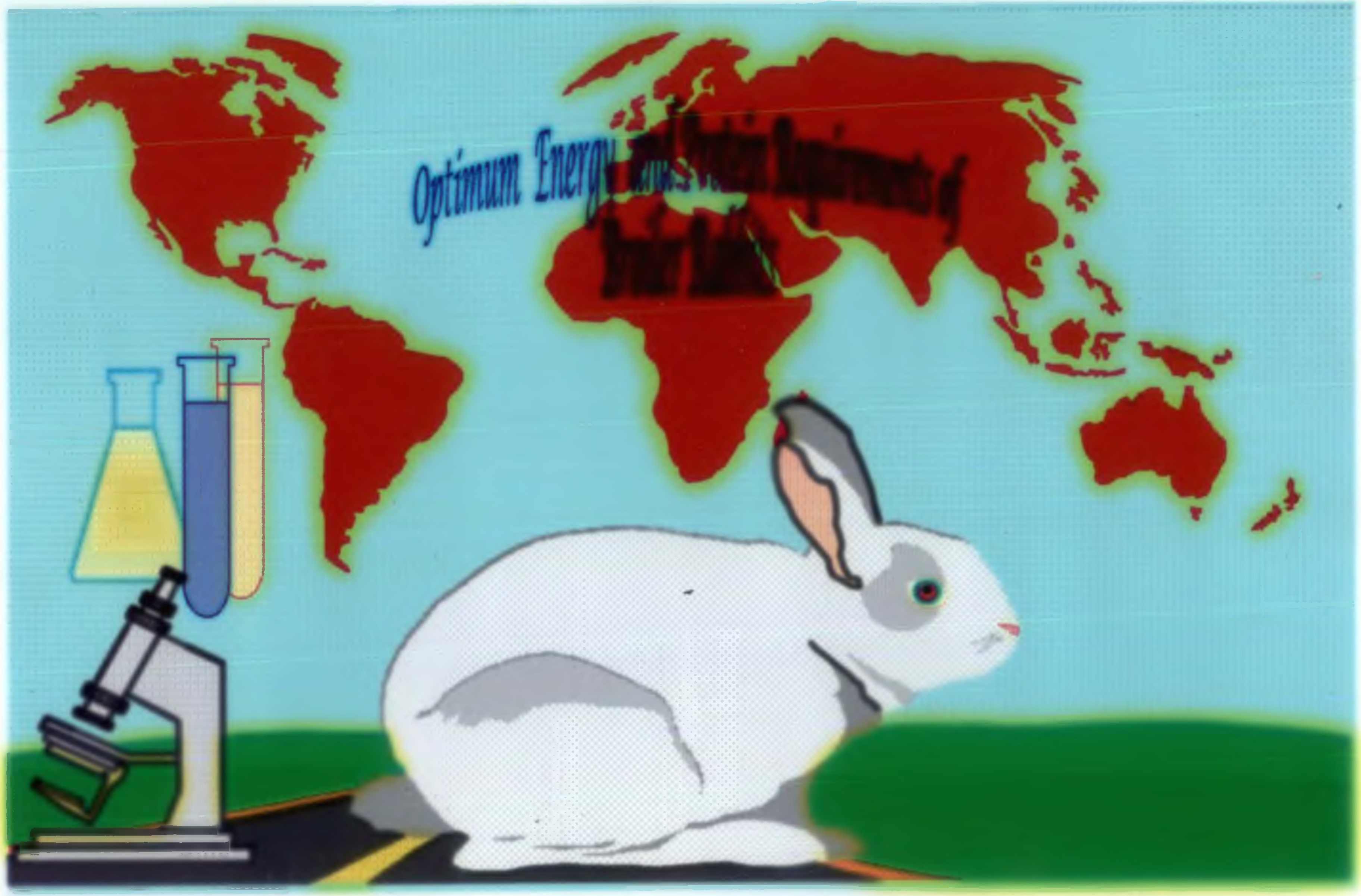
Optimum Energy

DECLARATION

I hereby declare that this thesis entitled **OPTIMUM ENERGY AND PROTEIN REQUIREMENTS OF BROILER RABBITS** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Mannuthy,
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Certified that this thesis entitled **OPTIMUM ENERGY AND PROTEIN REQUIREMENTS OF BROILER RABBITS** is a record of research work done independently by Dr. P. GANGA DEVI under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to her.

Mannuthy,
16.3.95

Dr. C.S. JAMES,
Chairman, Advisory Committee,
Professor, Department of Animal Nutrition
College of Veterinary & Animal Sciences, Mannuthy.

CERTIFICATE

We, the undersigned members of the Advisory Committee of Dr. P. GANGA DEVI, a candidate for the degree of Doctor of Philosophy in Animal Nutrition, agree that the thesis entitled **OPTIMUM ENERGY AND PROTEIN REQUIREMENTS OF BROILER RABBITS** may be submitted by Dr. P. GANGA DEVI in partial fulfilment of the requirement for the degree.

10/3/95

Dr. C.S. JAMES
Chairman, Advisory Committee,
Professor, Department of Animal Nutrition,
College of Veterinary & Animal Sciences, Mannuthy.

14/3/95

Dr. C. T. THOMAS
Professor & Head
Department of Animal Nutrition
College of Veterinary & Animal Sciences
Mannuthy

Dr. P. RAMACHANDRAN
Professor
Livestock Research Station
Thiruvazhamkunnu

10/3

Dr. G. MUKUNDAN
Director, Centre for Advanced
Studies in Animal Breeding and Genetics

K. C. George 10/3/95

Dr. K. C. GEORGE
Professor & Head
Department of Statistics

EXTERNAL EXAMINER

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Dedicated to

LORD KRISHNA

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ABBREVIATIONS

ADG	Average Daily Gain
ADF	Acid detergent fibre
BF	Burgandy Fawn
Ca	Calcium
CB	Cross Bred
CP	Crude Protein
CF	Crude Fibre
CRD	Completely Randomized Design
CW	Californian White
DCP	Digestible Crude Protein
DE	Digestible Energy
DEI	Digestible Energy Intake
DM	Dry Matter
DMI	Dry Matter Intake
DP	Digestible Protein
E/P	Energy/Protein
FE	Feed Efficiency
GG	Grey Giant
HE	High Energy
HPHE	High Protein High Energy
LE	Low Energy
LLM	Leucaena Leaf Meal

ABBREVIATIONS (Cont'd....2)

LPLE	Low Protein Low Energy
ME	Metabolizable Energy
MJ	Mega Joule
Mn	Manganese
NDF	Neutral Detergent Fibre
NFE	Nitrogen Free Extract
NPNE	Normal Protein Normal Energy
NRC	National Research Council
NZW	New Zealand White
P	Phosphorus
PE	Protein Efficiency
PER	Protein Efficiency Ratio
RBD	Randomized Block Design
SC	Soviet Chinchilla
TDN	Total Digestible Nutrients
UFA	Unsaturated fatty acid
WG	White Giant
WT	White Termonde
Zn	Zinc

INTRODUCTION

INTRODUCTION

The first record in the history of man's relationship with the rabbit starts with the Phonecians at the end of the second millennium B.C. (Sandford, 1992). Rabbits belonging to the class Mammalia, order Lagomorpha, family Leporidae and Genus Oryctolagus and species cuniculus, were first domesticated in Africa. There is evidence that, they were used for food as early as 3000 years ago in Asia and 2000 years ago in Europe. In most part of the world, rabbits have been domesticated for various purposes, but rabbit as an animal of agricultural utility became important from the recent past. The rabbit offers an alternative to other meat producing species to cope up with the increasing demand of animal protein requirement of human being.

Lukefahr (1985) estimated the total world rabbit population as 700 million. This is comparable to the global total for swine and in numerical terms ranks the rabbit as one of the most numerous domestic animals.

Total Number of Major Livestock species in the world

Species	*Estimated number (1000's)*	*Source*
1. **Chicken**	63,93,470	a
2. **Cattle**	12,09,833	b
3. **Sheep**	11,30,751	b
4. **Swine**	7,79,324	b
5. **Rabbits**	7,08,800	c
6. **Goats**	4,68,705	b
7. **Ducks**	1,49,672	a
8. **Buffaloes**	1,21,636	b
9. **Turkeys**	1,16,202	a
10. **Camels**	16,773	b

a. FAO Expert consultation on Rural Poultry and Rabbit Production, 1982
b. FAO production year book, 1981
c. Lukefahr (1985)

In summary, a reasonable estimate of world rabbit number is about 700 million ranking rabbits fifth in total numbers compared to other livestock species.

Rabbit meat is a staple food in European diets. Estimated annual per capita consumption is, Hungary, 3.99 kg; France, 3.58 kg; Spain, 3.58 kg, Italy 2.81 kg and Portugal, 2.00 kg. By comparison the estimated annual per capita rabbit consumption in the United States is only 56.70 g. World production of rabbit meat was estimated as 12,00,000 tonnes. Of this total, 43.6 per cent are produced through 'rural' management methods and 56.4 per cent (6,75,000 tonnes) through rational ones. The five major producers are Italy, France, CIS (ex. USSR), China and Spain in that order. Together they total 70 per cent of the world production (Lebas and Colin, 1992).

The very important aspect of rabbit industry at present is meat production, pelt being a bye-product. The basic reason for their usefulness in contributing animal proteins are high feed conversion rate, lower energy and protein requirement per unit live weight gain, considerable degree of diversity in the gene pool, fast production rate and quick growth with short gestation period.

In the past, rabbit producers routinely produced four litters per doe annually. Today with high cost of labour, feed and facilities, commercial breeders must produce eight litters per doe annually to make a profit. To attain the eight litters per doe level of production, young rabbits are to be weaned at 4 to 5 weeks of age and raised separately from their mother until they reach market weight, generally 8 to 9 weeks of age. These intensive breeding programmes require that does be rebred any where from 7 to 14 days after kindling, since one doe can produce eight litters per year, she has the ability to produce 58.97 kg to 113.40 kg of live weight per year through her reproductive ability. In large operations one buck is kept for as many as 20 to 30 does and produces more than 1,000 offsprings annually. From this it can be seen that four does can produce 317.51 kg live weight or 181.44 kg of dressed carcass weight annually - as much as an average beef cow can produce in one and half years - and produce it on less feed. (Ensminger et al., 1990).

Also, it is note worthy that rabbits have the potential for a constant state of reproduction. Does can be rebred on the day they kindle and the young can be weaned at 28 days, since the gestation period is 31 days, a doe can have a litter three days after weaning. Thus, it is theoretically possible to have a doe with three litters simultaneously, one weaned litter (four weeks), one litter in the nest box and one litter in utero.

Cheeke (1986) discussed the potentials of rabbit production in tropical and substropical agricultural systems and the attention is drawn to the fact that, small body size, short generation interval, high reproductive potential, rapid growth rate, genetic diversity and the ability to utilize forages and by-products as major diet components, makes rabbit suitable as meat producing small livestock in developing countries. Rabbit meat is high in protein and low in fat content and the production can be integrated into small farming systems.

From all these stand points rabbits can serve the third world people very well to combat malnutrition and hypoproteinaemia. Thus, Egypt, China, Tansania, Zaire, Zimbabwe, Malawai, Mexico, Brazil and Peru are very much interested in rabbit for meat production.

Through the years, rabbits have been accorded little attention in Indian Agriculture; yet large numbers of these are being used in medicinal and biological research and for meat, fur and as pets, and even in the tiny state of Kerala according to the livestock Census 1987, it was estimated a rabbit population of 77198. Very little is known about their nutrient requirements and little research is presently being conducted concerning their nutritional needs.

A pre requisite for the realization of genetic potential of a breed is the satisfying of its nutritional needs. This requires both a feeding system which provides the necessary nutrients and a consideration of factors affecting feed intake (Schlolaut, 1987). Greater productivity through nutrition can only be achieved through a better knowledge of (a) the nutritive value of locally available ingredients with respect to the rabbits, since comparable animals vary in their digestibility of nutrients under identical conditions (Crampton and Harris, 1969) and (b) the exact dietary nutrient requirements of different classes of rabbits grown under tropical environments and fed on locally available ingredients. Although plenty of information are available on the nutritive value of the locally available feed stuffs for pigs and poultry and reports from elsewhere for rabbits, similar information on rabbits reared under our agroclimatic condition is scarce. Consequently accurate formulation of diet for different classes of rabbits is hampered.

At present there is no definite standard in our country to be used for the scientific feeding of different meat purpose breeds of rabbits. Almost the same feeding standards (NRC, 1977 and Lebas, 1983) and dietary regimen are being followed for different categories and breeds of animals and it has been found that in practice, some of these standards are not even adequate to cover the needs of many of the meat purpose rabbits.

Since the basic environmental and managemental factors are widely different in our country as compared to western countries and the same vary from place to place with in the country itself, it is necessary that extensive feeding trials are to be carried out under controlled conditions. Moreover, age and production may influence the digestive processes in the animal and consequently the digestibility of nutrients in the ration, altering the protein and energy requirements. Positive information in this regard is however, yet to be gained.

Further, different varieties of meat purpose rabbits both pure bred and cross bred, are popularized by the Kerala Agricultural University, but their full genetic potential can be exploited only by maintaining them under optimum nutritional standards. Hence, the nutritional requirements of meat purpose rabbits are to be specifically established.

From the foregoing introduction, it is evident that there is a great need to undertake studies on the area suggested to evolve an optimum energy and protein requirements for broiler rabbits and to have a better concept of these requirements suited to the agroclimatic condition of Kerala.

The investigations proposed under this experimental programme encompass the following

1) Establishment of digestible energy and protein requirement for optimum growth in broiler rabbits.

2) To ascertain the optimum age for economic slaughter.

REVIEW OF LITERATURE

REVIEW OF LITERATURE

A prerequisite for the realization of genetic potential of a breed is satisfying of its nutritional needs. This requires not only a feeding system which provides the necessary nutrients but also a consideration of factors such as production potential of rabbits, digestive strategy with special reference to fibre utilization, significance of caecotrophy (coprophagy), varying levels of energy and protein on nutrient utilization and also the dietary influence on meat characteristics, each aspect is reviewed under separate heads.

2.1 Production potential of rabbits

Rabbit rearing for meat, fur and wool is fast emerging and finding an important role in Indian economy. The rabbit has a capacity for producing meat and wool from absolute feed, that is, feed which cannot be converted by other economically useful animals or that is insufficient for them.

As far as rabbit is concerned, feeding habits offer no competition to man and that is the reason why rabbit is so suitable for meat production, even under the conditions of developing countries. Moreover, what is far less well known is the fact that, the rabbit is the most promising meat producing animal among all domesticated animals (Schlolaut, 1981).

The rabbit production is dynamically spreading all over the world. This fact is substantiated not only by the increasing rabbit population and the increasing amount of products like meat, wool, fur, etc., but also by the number of publications dealing comprehensively with the production performances of rabbit (Cheeke, 1976; Davidson, 1977; NRC, 1977; Evans, 1982; Lukefahr, et al. 1982; Butcher et al. 1983; Lebas, 1983; Partridge et al. 1983; Fekete, 1984; Fekete et al. 1986; Ozimba and Lukefahr, 1991 and Gupta et al. 1993). The reason for this phenomenon is that, the meat of the domestic rabbit is outstanding both for its chemical composition and dietetic effect while rabbits do not compete with man, poultry and pigs as consumers of the valuable cereals and leguminous proteins (Fekete, 1985).

From an investigation on comparative performance of rabbits and broilers Reddy et al. (1977) proved that the rabbit incorporates more protein in its body than do broilers and that its feed protein utilization is more favourable.

The rabbit has a relatively short gestation period, the daily weight gain is high in proportion to body weight and early sexual maturity, which are the factors contributing rabbits, reaching the weight of sexually mature animals 30 per cent faster than other mammals. The short generation interval, moreover, favours the adjustment to seasonal variations in the availability of feed and fluctuations in consumer demand (Schlolaut, 1981).

The potential of forages is particularly significant for an emerging meat purpose species like rabbit (Cheeke and Patton, 1979) which are capable of digesting leaf proteins effectively (Slade and Hintz, 1969 and Cheeke and Mayer, 1975).Hypothetically, Cheeke and Patton (1979) computed that rabbits can produce five times more meat than cattle from the same amount of an alfalfa based diet. High fibre materials which is usually a constraint in poultry diet is beneficial to rabbits for preventing enteritis (Cheeke and Patton, 1980). That is why Cheeke has suggested that the domestic rabbit has the potential to become one of the most important livestock species.

The role of fibre in rabbit nutrition is discussed elsewhere (Lang, 1981; Cheeke, 1983 and Raharjo et al., 1986 b). Further more, Lebas (1983) noted that, although rabbits are not able to obtain as much energy from the fibre as ruminants, they can consume a large quantity of feed sufficient to meet their energy requirement.

Because of the excellent genetic properties, rabbits can convert roughages with high fibre content, including numerous non-traditional feeds and tropical plants, without deteriorating the quality of the meat (Fraga et al., 1983). It's meat is often superior to that of animals fed ad libitum with valuable concentrate feeds even when rabbits are reared at a slower growth rate, on green forage and wheat bran (Schlolaut et al., 1984).

Among meat producing animals, the rabbit has the greatest reproduction rate. By employing postpartum inseminations, an insemination interval of 33 days is possible. This represents a maximum of 11 litters per year or with an average conception rate of 70-75 per cent about 8 litters with 50-60 young reared per doe.

Despite the brief litter interval, the useful life of the doe is 18-24 months. This combines with its high growth intensity, results in a meat production level which, relative to the weight of the doe, lies far above the performance of the other herbivorous domesticated animals. Under intensive conditions, it would be possible to use an average of 6 female offspring from the first two litters for breeding, the offspring of these would still be able to reach a final fattening weight of 4 kg. This represents the additional production of 36 fattened animals, ready for slaughter, for each doe of the stock, at the beginning of the year.

The high growth intensity of the rabbit is basically due to an energy consumption per kg of growth, which is low in comparison to cattle and sheep, and also to a high degree of utilization of the digestible nitrogen for protein formation. Thus for example at an age of 6 to 15 weeks the rabbit builds 45 per cent more protein from digestible nitrogen than the lamb. The capacity for forming fat from starch is 14 per cent above the values noted for cattle, and in the case of protein, it is as much as 45 per cent higher (Schlolaut, 1981).

The area productivity of the rabbit for meat production is higher than that of any other farm animal (Schlolaut, 1981). It was observed that annual live weight gain in pasture farming attained by young animals weaned at four weeks is 20-25 g/day or 2000 kg/ha. Reckoning with a carcass yield of 55 per cent and a carcass protein content of 22 per cent, this represents about 240 kg of protein per hectare.

The carcass yield varies according to the final fattening weight, from 53 per cent at 1.8 kg live weight to 60 per cent at 3.0 kg (Butcher et al., 1983). The composition of carcass depends on the feeding intensity (Schlolaut, 1981). Pote et al. (1980) reported a significantly higher carcass fat level in rabbits fed high energy diets than those fed low energy diets. Spreadbury and Davidson (1978) could also observe similar trends. Rabbit meat is high in protein and low in fat, particularly when the animals are raised on a high forage, low energy diet (Holmes et al., 1984).

With regard to wool production an Angora rabbit of 4 kg live weight with an average yield of 800g wool per year representing 225 g raw wool per kg live weight, which is about three times as high as a sheep of 65 kg live weight, which will yield an average of 4.5 kg raw wool, representing 69 g per kg live weight. Considering that Angora wool has a pure wool content of 99 per cent when compared to that of sheep wool, the difference is seven times as high. The heat retaining properties of Angora wool are at a level about twice that of sheep with high electrostatic charge (Schlolaut, 1981).

From the foregoing paragraphs it can be well appreciated that, compared to other meat and wool producing animals, the rabbit is a much more efficient feed converter; the area productivity is also much higher for both meat and wool. This area productivity, and the fact that the rabbit converts feed which is mainly or entirely unsuitable for human consumption, makes it particularly suitable for developing countries like India.

2.2 Digestive strategy with special reference to fibre utilization

Numerous investigators have recently studied the digestibility of feed stuffs in rabbits, particularly utilization of fibrous feeds (Beltran et al., 1984; Battaglini and Grandi, 1984; Maertens and Degroote, 1984; Toscano et al., 1986). There is a great deal of interest in the fibre content of rabbit feeds, because the fibre level can in either way positively or negatively affect palatability and digestibility of the ration and is important in preventing enteric disease (Cheeke, 1983 and Lange et al., 1991).

Rabbits are herbivorous animals consuming high roughage diets based on alfalfa (Lucerne) meal, grass meal or other forage products. The use of these fibrous feed stuffs in rabbit feeding might lead to the conclusion that, rabbits utilize dietary fibre efficiently (Cheeke et al., 1986) as against the observation made by Voris et al. (1940) that, the digestibility of crude fibre fraction of roughages is remarkably low.

Herbivores have a number of digestive strategies for the utilization of fibrous diets. Ruminants have the most highly developed anatomical system for maximizing the efficiency of fibre utilization. Here, the fibrous components are fermented by bacterial enzymes in the rumen. There is a selective retention of large particles in the rumen, until they have been degraded by rumination and fermentation to a sufficiently small size to pass through the omasal orifice. This degradation involves digestion of the fibre (Mc Donald et al., 1977). In contrast, rabbits are hind gut fermenters, and the selective retention is of small, rather than large, particles. The process of selective retention of small particles in the caecum has been described by Ehrlein et al. (1983). Normal peristaltic movements propel the larger, less dense fibre particles through the colon, while contractions of the colon move fluids and small particles (the higher density components) in a retrograde manner, to the caecum. Small particles and fluids are retained for prolonged periods in the caecum (Pickard and Stevens, 1972), allowing extensive fermentation. The caecal contents are expelled at intervals and consumed directly from the anus (soft faeces, caecotropes). In effect, the digestive strategy of rabbit is to separate fibre and non-fibre components in the hind gut, with the rapid excretion of the fibre in the hard faeces, and the retention of non-fibre constituents for fermentation in the caecum. The non-fibre components are digested efficiently because, they are reingested as the caecoptropes and thus subjected to more than one passage through the digestive tract. Fibre on the other hand, is very poorly digested in the rabbit, because it is rapidly propelled through the colon and excreted in the hard faeces. The selective excretion of fibre and caecal retention of small particles are well observed in the investigation on fibre digestion and utilization in rabbits by Cheeke et al. (1986).

Smith (1965) observed that digestion of fibre in rabbit require the presence of cellulolytic bacteria in the cecum and colon and that rabbit is unique in that, the flora of the large intestine is almost entirely bacteroids. Hall (1952) and Hungate (1966) observed in rabbits and ruminants respectively, that many bacteroids are cellulose digesters and so, it is likely that, rabbit does have a population of cellulolytic organisms. This observation is substantiated by Abou-Ashour and Ahmed (1986) that, VFA production (which is an index of microbial activity) in the caecum of rabbit fed with the high fibre diet was significantly ($P<0.01$) higher; which was more than three-fold than that of rabbits fed on the low fibre diet (1607 Vs 471 u mol/g DM of cecal content) and this finding agrees with the extent of crude fibre digestibility in the caecum. Likewise, ammonia production decreased significantly ($P< 0.01$) from 24.72 mg/g DM of caecal contents, reported for rabbits fed the low fibre diet to 14.21 mg/g DM for those rabbits fed the high fibre one, which could be attributed to the higher microbial activity in the caecum which require more nitrogen, as observed in ruminants by Hungate (1966).

Inspite of the fact that fibre is poorly digested, development of the methods to improve fibre utilization could be significant in improving the efficiency of rabbit production. Also fibre plays an important role in maintaining normal functioning of the digestive tract and in preventing enteritis (Colin, et al., 1976; Laplace, 1978; Spreadbury and Davidson, 1978).

When compared to other species, Proto (1964) and Woznica (1964) showed that sheep have higher ability to digest crude fibre than rabbits. Cheeke (1977) reported that the digestibility of fibre by the rabbit is lower than for most of the other animal species, including pigs and rats. Some investigators (Cheeke and Amberg, 1972; Hoover and Heitmann, 1972) concluded that, rabbits performed better on the lower fibre diet than on the higher one, while De Blas et al. (1981) reported that crude fibre content did not appear to have much influence on the digestible energy intake (DEI) or average daily gain (ADG).

Hoover and Heitmann (1972) from their investigation on effect of dietary fibre levels on weight gain, cecal volume and volatile fatty acid production in rabbits, observed significant decrease in average daily gain, when used a diet containing 30 per cent crude fibre.

Davidson and Spreadbury (1975) studied the performance of fattening rabbits maintained on six different diets in which crude fibre content ranged from three to 19 per cent. Their results indicated that, the rabbits adjust their intake to keep growth rate constant. NRC (1977) reported that rabbits, like most other animals, voluntarily adjust their feed intake to meet their energy needs.

Lebas (1975 a) from an investigation on influence of dietary energy content on the growth performance of the rabbit observed that, using diet containing 11 and 19 per cent crude fibre, no differences in growth rate of rabbits could be appreciated.

De Blas et al. (1981) from their investigation on effect of diet on feed intake and growth of rabbits from weaning to slaughter at different ages and weights, observed no difference in growth rate of rabbits maintained on diets containing varying levels (6 to 17 per cent) of crude fibre.

Average daily gain, as observed from an investigation on effect of dietary fibre levels in growing rabbits (Abou- Ashour and Ahmed, 1986) was significantly (P <0.05) higher when rabbits fed with the high fibre diet which was recorded as being 13.4 Vs 11.9 g/day for those maintained on the low fibre diet.

Abou-Ashour and Ahmed (1986) during the course of their investigation on the effect of dietary fibre levels in growing rabbits observed that the dry matter intakes significantly increased (P< 0.01) from 56 to 64 g/day, on increasing the dietary fibre level. This result supports the finding of De Blas et al. (1981) who observed that dry matter intake increased linearly by 2.97 g/day with each percentage unit increase in crude fibre.

With regard to crude fibre digestibility Maynard and Loosli (1969) cited an apparent digestion coefficient of only 14 per cent in rabbits. Hoover and Heitmann (1972) reported a higher level of digestibility of 34 per cent. Abou-Ashour and Ahmed (1986) observed a still more higher digestibility of 44 per cent for crude fibre. The difference in crude fibre digestibility observed by these authors may be attributed to the difference in crude fibre constituents (cellulose, hemicellulose and lignin) which may have different digestion coefficients.

With respect to crude fibre digestibility in the hind gut, Abou-Ashour and Ahmed (1986) observed a significantly (P<0.01) higher crude fibre digestibility in those animals fed a high fibre diet (16.8 Vs 11.2 per cent) with a relative digestibility of 39.11 Vs 24.9 per cent for rabbits fed the low fibre diet, and also observed that the total amount of crude fibre digested in the whole digestive tract (g/day) by rabbits fed the high fibre diet was about 2-fold than that of the low fibre group (6.52 Vs 3.47g/day, respectively), while the respective value digested in large intestine was three fold. The extent of digestion in vivo is related to competition between rate of passage and rate of digestion. Thus, the relative digestibilities of diets with similar digestion rates will depend on the rate of passage. Therefore, the high fibre diet, with a longer retention time in the large intestine than low fibre diet, would be expected to show a greater extent of crude fibre digestion

In some aspects, hind gut fermentation is superior to the ruminant digestive tract in the utilization of fibrous feeds. The retention of low quality forage in the rumen can be prolonged, thus limiting nutrient intake. With hind gut fermentation a high intake of high fibre diet can be achieved, with nutrient requirements met by the high digestibility of non-fibre components (Hintz et al., 1978). Coprophagy (caecotrophy) in the rabbit appears to be particularly important in the digestion of the protein fraction of forages and less important in fibre utilization, as would be expected because of the selective retention of non-fibre components in the caecum (Cheeke, et al. 1986).

The digestibility coefficients for crude fibre vary considerably depending upon the feed stuffs involved. Feeds high in cellulose and lignin generally have a crude fibre digestibility of less than 15 per cent in rabbits, whereas non-lignified materials such as beet pulp, crude fibre digestibility can be as high as 60 per cent, (Voris et al., 1940, Maertens and De Groote, 1984).

Grinding of feeds to reduce the particle size results in an increased cecal retention time (Laplace and Lebas, 1977). Reduction of the fibre particle size by grinding, presumably would increase the amount of fibre retained in the cecum, and subjected to bacterial digestion. However, this process may interfere with the protective effect of fibre against enteritis.

De Blas et al. (1979) reported that, alkali treatment of cereal straw increased the digestibility of crude fibre. Similarly, Omole and On Wudiki (1981) observed that, alkali treatment of saw dust improved its utilization. The effect of alkali is probably due to a reduction in lignin content, and possibly to increased degradation to small particle sizes by mastication resulting in increased cecal retention of the fibre fraction. The digestibility of fibre of grain milling bye-product such as rice bran is high (Cheeke et al 1986), resulting in these products having higher digestible energy content for rabbits, than for other non-ruminants like swine and poultry.

Other factors associated with fibre which may influence its utilization include, bulk density and swelling capacity. Some feed stuff, such as alfalfa meal and beet pulp, absorb large quantity of water and swells up to several times to their original volume. Other feeds such as cereal grains and rice hulls, have very little swelling capacity. It is plausible that, feeds of the same fibre and energy contents, but differing in bulk density and swelling capacity, could have different transit rates through the digestive tract, and differentially affect feed intake through swelling effects on stomach capacity.

There are pronounced differences in the digestibilities of tropical legumes and grasses in rabbits. Akin (1979) has noted that tropical grasses are of low nutritional value to ruminants, because of their structure. They have a high content of poorly digested components such as vascular tissues, parenchyma bundle sheaths and epidermis and a low content of the highly digestible mesophyll cells. Cheeke et al., (1986) noted that, the digestibility of the protein, fibre and energy of tropical grasses is very low in rabbits, whereas, many of the tropical legumes are as digestible as temperate forages.

From an over all assessment of the results reviewed in the above paragraphs on the topic it may be construed that, perhaps a diet with sufficient fibre to maintain cecal mobility, as well as an abundance of fermentable substrate to maintain acidic condition in the hind gut is the optimum dietary condition for rabbits for evincing maximum growth, prevention of enteritis, cecal impaction and also prevention of hair pulling.

2.3 Significance of caecotrophy in rabbits with special emphasis on nutrient utilization

The concept on the occurrence of caecotrophy (pseudo- rumination) in rabbits hypothesize the possible explanation of the peculiar characteristics of rabbits that, increasing the dietary fibre level has no adverse effect on the digestibility coefficient of protein, lies mainly in the regulation of caecotrophy (Fekete and Bokori 1986). Various scientists (Lebas, 1975 a; Collin and Allain, 1979; Dehalle, 1981 and Fekete et al., 1986) have shown that contrary to earlier assumptions (Schurch, 1969; Besedina and Pereldik , 1970) an increase in the crude fibre level in the feed of rabbits does not influence the digestibility coefficient of crude protein. It is similarly well known that the prevention of coprophagy exerts a significantly unfavourable effect on the apparent digestibility of protein (Proto, 1965; Stephens, 1976; Fraga and De Blas, 1977).

According to Dehalle (1981) increasing the level of crude fibre in the ration given to collard rabbits that were prevented caecotrophy (inhibited caecotrophy) has no appreciable influence on the actually discharged soft faeces. According to Kalugin (1980), rabbits fed small amounts of feed consume 97 per cent of the soft faeces, while the animals fed ad libitum, leave a considerable portion of it uneaten.

From the new Hungarian system for evaluation of feed energy for rabbits, Fekete (1988) reported that a decrease in digestible energy concentration increased the voluntary dry matter intake, the phenomenon is one of the inherent mechanism of the domestic rabbit to meet its energy requirements. A second line of self regulation is the control of soft faeces intake or caecotrophy. If there is deficiency of dry matter or energy, the rabbit consumes the total number of caecotropes produced (Kalugin, 1980). In the case of ad libitum feeding, where dry matter and energy requirements can be satisfied, protein and fibre concentration of the daily ration determine the soft faeces intake. A relative protein deficit or fibre surplus increases cecotrophy and conversely a protein surplus or fibre deficit decreases caecotrophy (Fekete and Bokori, 1986)

The basis of the caecotrophy of rabbit according to Fekete (1985) is that they produce two different kinds of faeces in their intestinal canal, one of which the animal consumes regularly. The faeces suitable for consumption is called soft faeces or since it originates from caecum caecotroph, while the other which the rabbit does not eat is called hard faeces. The two types differ both in their chemical composition and their consistency (Fekete and Bokori, 1986).

Both soft and hard faeces originate in the caecum where, similar to the fermenter, microorganisms thrive on the material passing through ileal digestion, and synthesise proteins, vitamin B complex and vitamin K. The existence and activity of their intestinal flora are basic conditions for this biological coprophagia. During the production of soft faeces, the material coming from the caecum passes along the colon without any major transformation. The only change that takes place is the production of the mucous sheath holding the globules together when hard faeces are produced, while passing through the relatively short colonic section behind the caecum, the matter originating from the latter undergoes a more serious conversion. Some 70 per cent of micro organisms disintegrate and the smaller part of their decomposition products are absorbed by the intestinal wall. After that the mass becomes increasingly fibrous in a passive way in the rear portion of the colon; the water content decreases and the independent faecal globules take shape (Bonnafous and Raynaud, 1967).

The soft faeces in the stomach is for a time protected by its mucous sheath against the effect of the gastric acid, while inside it, there is lactic acid fermentation (Griffiths and Davies, 1963).

A bacteriolytic substance, not identical with pepsin secreted by the portion of the stomach closest to the small intestine causes 40 per cent of the micro organisms to dissolve (Villard and Raynaud, 1968) and the feed and the materials in the soft faeces to mix thoroughly. The importance of coprophagy is shown by the fact that, if it is prevented, the growth rate of rabbit decreses by 12 to 25 per cent (Barnes et al., 1963), and they show symptoms even of vitamin B complex deficiency (Kulwich et al., 1953).

Caecotrophy cannot be observed in new born rabbits. It develops gradually from the third week of their life onwards, simultaneously with the transition to solid feed. The production of both hard and soft faeces might be determined by the alteration of days and nights. The evacuation and consumption of soft faeces take place after midnight, in the early hours of the day (Proto, 1965). The rhythm of its production at night is regulated by the adrenal glands. The extirpation of adrenal gland upsets the rate at which the two different masses arise, but the rhythm can be restored by hydrocortisone injections (Bonnafous and Raynaud, 1963).

Kalugin (1980) proved in his experiments that the quantity of soft faeces is greater in rationing than at ad libitum feeding. Fekete and Bokori (1986) have established that at ad libitum feeding, the degree of spontaneous caecotrophy depends on the fibre and protein levels in the ration. Rabbits kept on feed containing less protein and more fibre, take up more of the soft faeces.

In conclusion, what has been reviewed about the significance of caecotrophy, it may be stated that, it contributes to the vitamins B and K supply, provides essential amino acids, continuously regenerates the gastric microflora and ensures a more efficient and more economical utilization of nutrients, particularly of proteins and also explains why rabbits practically are insensitive to the quality of dietary proteins.

2.4 Influence of dietary protein and energy on nutrient utilization and productivity in rabbits

Less information exists on the growth, pregnancy and lactation performance of rabbits fed on different protein and energy levels. The values of various protein supplements for rabbits have been reported by several investigators (Cheeke and Amberg, 1972; Cheeke, 1974; Colin, 1975 ; Davidson and Spreadbury, 1975; Colin and Lebas, 1976). Current recommendations suggest, crude protein levels of 160 g/kg diet for growth, 120 g/kg diet for maintenance, 150 g/kg diet for gestation and 170 g/kg diet for lactation with digestible energy contents of 10.5 MJ/kg diet (NRC, 1977). The concentrations suggested for the breeding animal are based on diets found acceptable in practice rather than experimentally determined requirements for optimum milk production, and pup growth and maintenance of doe's body condition throughout several reproductive cycles.

Several studies over the last decade have shown that for optimal growth, the rabbit requires an adequate supply of 11 essential amino acids (Adamson and Fisher, 1971) and quantitative estimates for lysine, sulphur containing amino acids and arginine have been made to ascertain the requirements for growing rabbits. (Cheeke, 1971; Adamson and Fisher, 1973; Spreadbury, 1978). Despite the rabbits ability to contribute its dietary crude protein (CP) supply through coprophagy, it has been estimated that, this satisfies approximately one tenth of the daily requirement of growing animals (Davidson, 1977). In its nutritional requirements, the rabbit is therefore more akin to other simple stomached species than it is, to ruminants. Protein requirements for optimum growth and reproduction was studied by Cheeke et al. (1985) with three CP levels viz. 20.5 per cent, 19 per cent and 17.5 per cent. The performance of the does was slightly inferior with 17.5 per cent dietary protein and there were no differences in post weaning performance on different protein levels studied and concluded that a level of 17.5 per cent crude protein seems adequate for satisfying reproductive performance and growth of commercial meat rabbit.

Effect of dietary level of protein and methionine on growing rabbits have been studied in detail by Coan et al. (1988) and observed that, the young ones weaned from does fed on diets containing 20 or 26 per cent crude protein were significantly heavier than those weaned from dams given diet with 20 per cent CP + methionine or 23 per cent CP + methionine and higher weekly weights were observed for the groups fed on 20 and 26 per cent crude protein.

Effect of different levels of dietary protein (16, 18 and 20 per cent cp) were studied by Abdella, et al. (1988) and concluded that 16 per cent crude protein diet was the most cost effective one for the growing rabbits.

Growth studies on cross-bred rabbits with varying levels of crude protein in the diet were carried out by James and Thomas (1988) and suggested that, in cross-bred rabbits 16 per cent of crude protein is sufficient to support satisfactory growth up to seven to eight weeks after weaning, but for overall growth 20 per cent crude protein in the concentrate mixture is required to support optimum growth.

Studies on the effect of dietary protein level, rearing environment and season on growth and carcass traits in rabbits have been carried out by Lebas and Ouhayoun (1988) and from a scrutiny of the data on the growth of New Zealand White and NZW x Californian rabbits weaned at 28 days and slaughtered at 77 days of age, it was observed that the body weight, daily gain, feed consumption, slaughter weight, skin weight as a percentage of carcass weight, were significantly higher for rabbits maintained on a high protein diet than for those on low protein diet.

On feeding New Zealand White rabbits weaned at 30 days with pelleted diets having 16.05, 18.05 and 21.05 per cent crude protein upto 60 days of age, reared at 15, 10-20, 15- 20 and 15-25C, Centoducati et al. (1991) reported that live weights and yield at slaughter were significantly greater in groups fed on diets containing 16.05 per cent protein at environmental temperatures of 15C and 10-20C.

Omole (1982) conducted a comprehensive study on the effect of level of dietary protein on growth and reproduction performance in rabbits and observed that 18 to 22 per cent of dietary protein is optimal for efficient tropical rabbit production in Nigeria, similar to values reported by Sanchez et al. (1985)

From a study of the energy value of rabbit feeds Raharjo et al. (1986 b) reported that cereal by-products such as rice bran have a high digestible energy content for rabbits, and hence the use of supplements of by-products such as rice bran can adequately increase the energy content of a forage based diet.

Effect of varying levels of energy [8 MJ (LE) and 10 MJ (HE) of metabolizable energy] on growth and carcass characteristics in rabbits have been studied by Butcher et al. (1983) and found that rabbits fed the LE diet consumed more dry matter and ME, but grew more slowly than those fed the HE diet. They could also observe that the rabbits fed the LE diet were less efficient at converting DM to live weight gain than those fed the HE diet, HE rabbits had higher dressing percentage, liver weight and higher carcass fat content than LE rabbits.

The utilization of low, medium and high energy diets by Dwarf (Netherland dwarf), Intermediate (Mini Lop, New Zealand White) and Giant (Flemish Giant) was studied by Grobner et al. (1985 a). Three diets calculated to contain 2000, 2500 and 3000 kcal DE per kg of diet represented low, medium and high energy diets. On the low energy diet, the Netherland Dwarfs showed a weight loss, while the other breeds showed a weight gain. Feed intake and daily DE intake were highest on the low energy diet.

Partridge et al. (1989) estimated the degree of DE transformation above maintenance for body gain to be 47 per cent.

From an investigation on effect of diet on feed intake and growth of rabbits from weaning to slaughter, De Blas et al. (1981) observed that the energy to protein ratio (kcal DE / gram DCP) was related to growth traits ($P < 0.001$), DE intake ($P < 0.05$) and rate of mortality ($P < 0.05$). The relationship between growth traits and DE intake reached a maximum at an energy-protein ratio of about 23.5 kcal DE/g. DCP, at which mortality rate was minimum.

Dehalle (1981) studied the effect of dietary energy - protein ratio (49 or 56 g digestible protein /1000 kcal DE) in rabbits using two dietary energy levels (2320 and 2730 kcal DE/ kg) where energy concentration was changed by straw and starch supplementation and the animals under the four treatments were slaughtered at about 2 kg body weight. Rabbits of the high energy diets retained more fat (24.4 Vs 23.1 per cent of DM) in their body. Dry matter concentration of rabbits on the high energy diet was higher, 0.95 - 2.61 per cent units.

Chawan et al. (1982) from their studies on the influence of energy, protein and fibre on the performance of weaned NZW rabbits reported that average weekly weight gains were significantly influenced by the level of dietary protein, which showed increasing trend with increase in dietary protein level.

Fraga et al. (1983) reared growing rabbits on 12 diets of variable energy to protein ratio ranging from 20 to 30 kcal DE/g DCP from weaning to slaughter, both at different ages and weights and reported that dietary Energy/Protein (E/P) affected the rate of live weight gain, the greatest rate of weight gain (35 g/ day) was achieved with dietary E/P values of about 23.5 where, the crude protein percentage of diet was 16 per cent whereas the rate of weight gain was 5 g/ day lower for diet containing 18 per cent crude protein with E/P of 20. They could also observe that high dietary E/P increased ($P < 0.001$) the proportion of body fat and reduced the proportion of body protein.

Sankhyan et al. (1990) from their investigation on the effect of varying levels of dietary protein and energy on rabbit performance for a period of 126 days using weaned cross-bred male rabbits observed that, the dry matter and crude protein digestibilities of HPHE (high protein high energy - 15 per cent higher than NRC, 1977 (CP 18.73 per cent) and NPNE (normal protein normal energy -100 per cent NRC, 1977, CP 16.21 per cent) were significantly higher (P< 0.05) than those of LPLE (low protein low energy - 15 per cent lower than NRC, 1977, CP 13.42 per cent) rations. The NFE digestibility was significantly higher (P< 0.05) for the HPHE diet than the LPLE diet, and rabbits fed HPHE retained more nitrogen (2.34 g/day) than those fed NPNE and LPLE. Although total cost of the diet was highest for the HPHE groups the cost of feed per kg live weight gain was lowest in this group, suggesting that rabbits can be raised on HPHE diets and have potential as meat producing animals.

Hemid et al. (1991 a) from their studies on effect of two levels of protein and energy for weaned Californian, New Zealand White and cross-bred rabbits maintained on diet containing 15 or 17.5 per cent crude protein and DE 2500 or 2800 kcal/ kg until 2 kg live weight and reported that best growth, feed conversion and dressing percentage was obtained with 15 per cent protein and energy 2500 kcal DE.

Growth performance and nutrient utilization by New Zealand White rabbits as influenced by different plane of nutrition was investigated by Desmukh and Pathak (1993) using six dietary treatments having three protein levels viz. 13 per cent (low) 16 per cent (medium) 20 per cent (high) and two energy (TDN) levels viz. 56-57 per cent (low) and 63-65 per cent (high) in two phases, phase I being period from weaning (5 weeks) to 1 kg body weight and phase II upto 1.5 kg body weight. The result indicated that during phase I the overall performance of rabbits in low protein low energy group was significantly (P< 0.01) poor compared to that in all other treatments. During phase II no significant effect of dietary treatment was reported and it had been concluded that the active growth period in pure-bred New Zealand White rabbits under Indian climatic condition was 13 weeks of age and diets containing 16 - 20 per cent crude protein and 60 - 65 per cent TDN may provide adequate nutrients for optimum performance of growing pure-bred New Zealand White rabbits.

Information on the response of does to varying levels of dietary crude protein and energy during pregnancy and lactation is scanty in literature. Hafez et al. (1967 a) and Hafez et al. (1967 b) investigated the effect of food restriction during gestation on neonatal body composition and the subsequent ability of the pups to survive on continued starvation. They observed that reducing the maternal food intake during gestation significantly depressed the birth weight of pups and the total hepatic glycogen content of the pups.

French workers (Lebas and Laplace, 1974; Lebas, 1975 b and c) gave ad libitum and restricted (140 g/ day) quantities of the diet to does during pregnancy, and examined subsequent lactation performance and body composition changes of the doe. They observed further that level of food intake during gestation appeared to have little influence on milk out put in the subsequent lactation period. Changes in weight of doe's visera during pregnancy and lactation were also similar in restricted and ad libitum groups.

The effect of different intakes of crude protein on nitrogen utilization in the pregnant and lactating rabbits was studied by Partridge and Allan (1982) and observed that the total milk yield in a 28 day lactation period was higher for does received high protein diet (21 per cent CP) over low (13.5 per cent CP) and medium (17.5 per cent CP) protein diet, while the proportion of digested nitrogen utilized for milk protein synthesis was maximum with low protein diet.

Reddy and Moss (1982) investigated the reproductive performance of New Zealand White does on four levels of dietary protein viz. 14, 16, 18 and 20 per cent with isocaloric diets and could observe that the feed consumption, litter size, litter weight at birth and weaning weight were lowest for does fed on 14 per cent protein diet, best superior feed gain ratio were found in 16, 18 and 20 per cent dietary protein groups.

Effect of dietary protein on productivity of meat type rabbits was studied by Lara (1988) who found higher conception rate in female New Zealand White rabbits fed on 21.5 per cent crude protein diet than those fed on low protein diet (17.5 per cent CP). Does fed on high protein diet produced more young ones than those fed on 17.5 per cent crude protein diet.

Effect of two levels of protein in rations on the performance of some strains of rabbits under intensive production was studied by Hemid et al (1991 b) by maintaining pregnant and lactating rabbits on diets containing 15.0 and 17.5 per cent crude protein and digestible energy 2500 kcal/ kg and observed that 17.5 per cent protein diet gave better litters, lower mortality and increased number of parities due to reduced gestation length and reduced litter intervals compared to that of 15.0 per cent protein diet.

Lebas (1991) from studies on energy and nitrogen nutrition in breeding rabbits concluded that a digestible protein (DP) of 43 to 45 g/1000 kcal DE may be adequate for growing rabbits, but is insufficient for breeding does. Minimum requirements for intensive and less intensive reproduction programmes are probably about 51 to 52 and 48 to 50 g DP/1000 kcal DE

Liu et al. (1993) estimated the nutrient requirements of Angora rabbits at various physiological stages and reported that the daily requirements of DE, CP and DCP were 118 - 338 kcal, 10.1 - 20.2 g and 7.8 - 14.7 g for rabbits weaned at 3 months old; 370 -406 kcal, 23 - 28 g and 16 - 19 g for rabbits at 4 - 6 months old; 405 kcal, 28 g and 20 g for pregnant females; 350 kcal, 28 g and 20 g for mating bucks.

From the foregoing review of work carried out by various authors it is seen that the requirements in terms of crude protein, DCP and energy for various physiological functions like growth, reproduction and wool production are inconclusive, controversial and warrants further investigations on these lines.

2.5 Meat characteristics of broiler rabbits

Information on carcass quality and composition of rabbit meat is limited in contrast to that available for other meats (Ziegler, 1968). Research on rabbit meat includes carcass yield (Hiner, 1962, Templeton, 1968) boning yields and meat bone ratios (Broadbent and Bean, 1952; Powell, 1973; Paul, 1973), chemical composition Casady, 1963; Gilka and Hornick, 1975), meat digestibility (Gilka, 1975), organ weights (Hiner, 1962; Rao, et al., 1977) and nature of muscle fibres (Cassens and Cooper, 1971).

Bensley (1938), Cassens and Cooper (1971) and USDA 1973) reported that rabbits had a very thin and light bone structure comparable to that of chicken.

Hiner (1962) reported a meat/ bone ratio of 2.8 to 3.7 which was essentially in agreement with the values of Paoli (1975) who reported a meat/ bone ratio of 3.0 for chicken, while Rao, et al. (1978) recorded a meat/ bone ratio ranged from 2.86 to 4.06 for rabbits and concluded that weaning age had no significant effect on meat / bone ratio and suggested that the young rabbits can be weaned at any of the ages studied (4th, 6th and 8th week) without altering the meat/ bone ratio to a greater extent.

Hiner (1962) reported a dressing percentage from 50.7 to 58.5 depending on the grades of the rabbit carcass. Templeton (1968) reported that an average fryer weighing 1.5 to 2.0 kg had a carcass yield of 56.3, while USDA (1973) indicated a carcass yield of 56 per cent. In chemical composition, rabbit meat is comparable to chicken and is higher in protein content and lower in fat content than most of the other meats (USDA, 1973) Gilka (1975) observed that digestibility of protein in rabbit meat was found to be 98.9 per cent and Casady (1963) reported that rabbit meat is low in cholesterol and is listed as a low sodium meat.

Chen et al. (1978) from their investigations on effect of weaning and slaughter ages upon rabbit meat production have reported that weaning at four weeks and slaughtering at eight weeks is most economical for rabbit production.

In an effort to find out the effect of various weaning and slaughter ages on protein, moisture and fat contents of rabbit meat, Rao et al. (1978) reported that protein content (18.6 to 19.4 per cent) was not influenced by slaughter age; whereas fat (7.9 to 10.9 per cent) and moisture (68.5 to 72.0 per cent) contents of rabbit meat were significantly ($P < 0.05$) affected by the slaughter age. The moisture content tended to go down while the fat content went up as the slaughter age increased and concluded that rabbits can be weaned at four weeks of age without affecting the meat quality

Investigations on effect of weaning and slaughter ages on rabbit carcass quality and meat composition by Rao et al. (1978) revealed that the carcass percentage was significantly influenced by slaughter age, with rabbits slaughtered at eight weeks having lower carcass yield than those slaughtered at 12 and 16 weeks, the average dressed yield ranged from 45.6 per cent to 50.2 per cent of live weight.

Sastry and Mahajan (1982) investigated the performance of New Zealand White rabbits on supplementation of white clover hay with tree leaves and whole grain and observed that diet had a significant influence on the dressing percentage with and without pluck and the weight of empty carcass, pluck, various physical cuts (shoulder, chest, loin and legs) and offals ($P < 0.01$). The dressing percentage both with and without pluck was significantly higher in rabbits supplemented with barley grains ($P < 0.05$) and bengal gram ($P < 0.01$) than those supplemented with tree leaves

Though rabbits can live and survive on bulky-type of roughage feeds as suggested by Arrington and Kelly (1976), the investigation on comparative adequacy of supplementation of white clover hay with tree leaves and whole grains on the performance of New Zealand White rabbits reveal the necessity of adequate concentrate in their diet for efficient growth and meat production (Sastry and Mahajan, 1982)

Butcher et al. (1983) studied in detail, the effect of slaughter weight upon growth and carcass characteristics of rabbits fed with diets of different metabolizable energy concentration of 8 (LE) and 10 (HE) MJ/ kg dry matter and reported that the dressing percentage increased progressively for rabbits slaughtered from 1.5 to 3.0 kg and on chemical analysis of the meat, the moisture and ash content decreased with increase in live weight, while the fat content showed a linear increase with live weight. The carcasses of rabbit slaughtered at 3.0 kg had lower moisture, total ash and acid insoluble ash and greater fat content than that slaughtered at 1.5 and 2.25 kg.

Abou-Ashour and Ahmed (1983) in their study on carcass and meat characteristics of Baladi rabbits fed with different dietary fibre levels (13.9 per cent and 23.9 per cent) and energy concentrations of 3.42 and 2.85 kcal/g dry matter could observe significant differences in weight of omental fat and weight of heart, liver, lungs, spleen and kidney, but the dressing percentage were not affected by diet.

Comparative study of certain qualitative characteristics of domestic and wild rabbit meat in terms of muscle fibre diameter, shear force value, cooking loss and taste panel evaluation of rabbit meat have been made in detail by Nath and Narayana Rao (1983) and on a subjective evaluation it was concluded that the tenderness, texture, juiciness and flavour characteristics of wild rabbit meat were markedly superior to domestic one.

The chemical composition of rabbit meat as affected by age, sex and carcass cuts were investigated in detail by El Gammal et al. (1984) and observed that regardless of carcass part and sex, the moisture content decreased with increase in age, while fat percentage increased progressively. The protein content on dry basis decreased upto five months of age, then it became nearly constant, but on wet basis no specific trend could be detected on relation to age. The percentage of ash (on dry basis) decreased gradually with the advancement of age. The values of protein content were the highest in hind limb followed by that in loin and forelimb, possibly because the parts having higher growth rate had more protein and moisture content than those having lower growth rate. This supports the observation of Abdel-Naby (1979) that the hind limb had the fastest rate of growth followed by loin and then the forelimb. The overall average of fat content in flesh of female on wet and dry basis was higher than that of male. Protein content on dry basis was higher in males than in females and ash content was nearly the same in males and females (El. Gammal et al., 1984). Similar results were reported by Sottllo Ramos (1968) who observed that the ash content was 1.3 per cent and 2.0 per cent in the flesh of male and female respectively, while Wilson and Morris (1932) in their studies on the composition of rabbit carcass concluded that the flesh of females contained 4 to 6 per cent more fat than that of males.

Holmes et al. (1984) have investigated the proximate composition and sensory characteristics of meat from rabbits fed three levels of alfalfa meal and concluded that, the three levels of Alfalfa meal used in the study for young New Zealand White rabbits influenced dressed yield, moisture content of raw rabbit meat, lipid or cholesterol content in raw meat, which contribute the potential of rabbit as meat source.

Deltoro and Lopez (1986) in their studies on development of commercial characteristics of rabbit carcass during growth upto 20 weeks of age observed that dressing percentage, lean and fat content and lean/bone ratio in the carcass increases with age although they showed a decreasing rate of increase until reaching a period of stabilization and also reported that the dressing percentage did not change significantly from 11 weeks of age (around 1900 g empty body weight) onwards.

Prasad and Sahu (1989) in their investigation on carcass and meat quality traits of SC fryers maintained on diets supplemented with animal meals indicated that a trend of increased meat, edible offal and fur skin production in SC fryer rabbits fed with ration containing 10 per cent of meat meal as against 6 per cent maximum meat meal, recommended by Beynen (1986), the difference probably due to meat meal used in this investigation might be without any bones.

An average dressing percentage of 53.51 and 54.72 was recorded by Kuttinarayanan and Nandakumar (1989) for pure bred SC and NZW rabbits having a pre-slaughter weight of 2.59±0.15 kg and 2.37±0.12 kg respectively.

Effect of age on carcass traits of SC rabbits were investigated by Salroo et al. (1989) and observed that pre- slaughter weight, empty live weight, carcass weight and carcass yield increased significantly with age which confirms the results reported by Damyanova (1973) in his study on growth and meat production of some rabbits breeds and Rivera and Madlangsacay (1978) in their study on carcass yield and product characteristics of rabbit meat.

As a part of the investigation on the dietary fat level and carcass quality of rabbits, Beynen et al. (1990) reported a slaughter yield (percentage of live weight) of 60.7 per cent to 62 per cent and concluded that rabbits fed the diet containing either 21.1 per cent or 42.1 per cent of energy as fat had the highest group mean carcass weights and slaughter yield when compared to 5.3 per cent or 10.5 per cent fed groups.

Gupta et al. (1993a) from their studies on meat traits of some broiler rabbits reported that the average dressing per cent ranged from 42.0 for white giant pure bred to 49.21 for Grey giant X Chinchilla cross-breds.

The qualities of meat as observed by various scientists and in addition to rapid growth rate and carcass yield reported by various authors make rabbit a useful meat animal.

MATERIALS & METHODS

The same experimental programme was followed in the two series of growth studies.

3.2.2 Experimental Diet

Experimental rations have been computed as envisaged in the technical programme. With respect to the ingredient composition of rations the DE and CP content is adjusted in such a way that three levels of DE (2000 kcal/kg, 2500 kcal/kg and 3000 kcal/kg) and three levels of crude protein (12, 16 and 20 per cent) are maintained factorially so that nine experimental rations are evolved.

Percentage ingredient composition and chemical composition of the nine experimental rations are given below in table 1 and 2 respectively.

Table 1 - Percentage Ingredient Composition of Experimental Rations

Rations / Ingredients	A	B	C	D	E	F	G	H	I
Groundnut Cake (Expeller)	30	15	7	25	14	5	-	-	-
Groundnut Cake (Deoiled)	-	-	-	-	-	-	32	22	11
Gingelly Oil Cake	-	5	5	15	10	6	-	-	-
Bengal Gram	10	7	5	8	8	6	-	-	-
Wheat	30	40	40	5	8	16	-	-	-
Rice Polish	-	5	-	5	18	20	6	16	27
Tapioca	8	6	21	-	-	5	-	-	-
Guinea Grass Hay	20	20	20	40	40	40	60	60	60
Mineral Mixture	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Salt	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cost/Quintal (Rs)	497.68	473.75	464.22	429.66	408.16	387.26	356.84	327.34	294.89

Vitablend AB_2D_3 was incorporated at the rate of 20 g per 100 kg of each of the experimental ration so that each kg of the ration had 8,000 i.u. of Vitamin A, 5mg of Vitamin B_2 and 1,200 i.u. of Vitamin D_3. Each gram of vitablend AB_2D_3 (Glaxo) contains 40,000 i.u. of vitamin A; 25 mg of vitamin B_2 and 6,000 i.u. of vitamin D_3.

Table 2 - Percentage Chemical Composition of Experimental rations

Ration / Nutritional Moiety	A	B	C	D	E	F	G	H	I
Dry matter	91.96	91.65	92.01	90.85	90.39	90.24	89.56	90.02	89.90
Crude Protein	20.17	16.14	12.20	20.43	16.27	12.23	20.36	16.25	12.31
Ether Extract	4.48	4.41	3.76	5.87	6.41	6.16	5.08	5.76	5.64
Crude Fibre	10.02	10.03	9.87	16.25	16.80	16.41	20.75	21.53	22.19
Total Ash	6.82	6.98	6.63	10.02	10.84	10.02	10.51	10.98	11.72
Nitrogen Free Extract (NFE)	58.51	62.44	67.54	47.43	49.68	55.18	43.30	45.48	48.14
Neutral Detergent Fibre (NDF)	21.01	23.15	19.93	35.30	38.48	37.81	44.69	49.38	53.07
Acid Detergent Fibre (ADF)	10.80	12.01	9.72	19.54	22.52	22.36	26.30	28.68	32.01
Hemicellulose	10.21	11.14	10.21	15.76	15.96	15.45	18.39	20.70	21.06
Cellulose	8.62	10.18	7.78	16.21	18.03	16.77	19.76	21.10	23.16
Lignin	1.54	1.43	1.31	2.05	3.17	4.18	4.54	5.55	6.45
Calcium	0.75	0.83	0.89	1.15	1.04	0.99	0.86	0.90	0.91
Phosphorus	0.69	0.70	0.61	0.81	0.80	0.75	0.63	0.64	0.66
Magnesium	0.20	0.30	0.27	0.30	0.30	0.31	0.39	0.41	0.43

3.2.3. Determination of Digestible Energy (DE) Content of Experimental Rations

Prior to conducting the actual growth studies, DE values of the nine experimental rations were determined by digestion trial with four adult SC rabbits for each diet and finding out the gross energy value of feeds and faeces using adiabatic bomb calorimeter. Knowing the Gross energy value of feed and faeces and the dry matter intake and out go recorded from the digestion trial, the DE value of each ration was calculated and the results are presented in table 3.

Table 3 - Determination of Digestible Energy Value of Experimental Rations

Rations / Parameters	A	B	C	D	E	F	G	H	I
Dry matter Consumption g/day	178.5	171.2	175.2	172.5	176.8	171.5	168.5	170.2	165.4
Gross Energy Consumed (Kcal/day)	798.6	751.2	758.3	773.5	778.8	744.5	710.4	714.3	683.8
Gross Energy Excreted through faeces (Kcal/day)	251.4	243.5	229.8	340.3	325.5	303.9	358.8	363.5	338.6
Gross Energy digested (Kcal/day)	547.2	507.7	528.5	433.0	453.3	440.6	351.6	350.8	345.2
Percentage of Gross Energy Digested	68.52	67.59	69.70	55.98	58.20	59.18	49.49	49.11	50.48
Gross Energy of Experimental Diet (Kcal/kg)	4474	4388	4328	4483	4405	4341	4216	4197	4134
Digestible Energy (Kcal/kg) of Experimental Diet	3065	2966	3017	2511	2564	2570	2087	2061	2088

3.3 Growth Studies in Soviet Chinchilla and Cross Bred Rabbits

One hundred and eight healthy pure bred Soviet Chinchilla (SC) and Soviet Chinchilla X New Zealand White cross bred (CB) weanling rabbits of 28 days of age were divided into nine groups of 12 animals each homogeneous with respect to sex, age and weight and maintained factorially, on three different levels of Crude Protein (12, 16 and 20 per cent) and Digestible Energy (2000, 2500 and 3000 kcal) as shown below for a period of 24 weeks.

Group	I	II	III	IV	V	VI	VII	VIII	IX
Ration	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
DE (Kcal/kg) (anticipated)	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP per cent (anticipated)	20	16	12	20	16	12	20	16	12
No. of Weanlings allotted									
Soviet Chinchilla									
Male	6	6	6	6	6	6	6	6	6
Female	6	6	6	6	6	6	6	6	6
Cross bred (SC X NZW)									
Male	6	6	6	6	6	6	6	6	6
Female	6	6	6	6	6	6	6	6	6

3.3.1 Management

The experimental animals were housed individually in metallic cages with facilities for feeding and watering. Weighed quantities of respective feed were offered daily to each rabbit and the balance feed were also weighed to know the actual dry matter intake.

Weekly once all the experimental animals were weighed before feeding and increased the quantity of feed given, by calculating the DM intake on percentage of body weight, taking into consideration the increased nutrient requirements of the animals commensurate with the growth increment and on this basis the rabbits were fed ad lib. All the rabbits were provided with fresh water ad libitium. The animals were maintained on their respective feeding regimes for a period of 24 weeks.

The following observations were made and procedures followed during the course of the experiment.

3.3.2 Growth pattern and efficiency

Daily feed intake and weekly body weight of individual animals in each group were recorded during the entire period of experiment and the observations were utilized to arrive at, the following in every week.

1. Total Drymatter consumption (g)
2. Daily Drymatter intake (g)
3. Feed conversion efficiency as feed - gain ratio
4. Protein efficiency ratio (Wt.gain (g)/Protein intake(g)
5. Feed cost per unit gain (Rs.)

3.3.2.1 Biometric Measurements

Body measurements including length, height and chest girth of the experimental animals were taken at fortnightly intervals, upto 0.1 cm accuracy. The animal was made to lie on the table in the sternal recumbent posture for measuring body length and chest girth. To measure the height, the rabbit was laid on its lateral recumbent posture. Body length was measured as distance between shoulder joint and point of ischium in cm. Body height was measured as the distance from shoulder joint to the toe in cm. Chest girth was taken as the body circumference behind the elbow joint in cm.

3.3.3 Haematological Studies

Blood samples of the experimental animals were collected monthly from the ear vein and used for the estimation of haemoglobin, serum calcium, inorganic phosphorus, mangnesium and serum protein.

Haemoglobin concentration of the whole blood was estimated by cyanmethaemoglobin method (Benjamin, 1979). Biuret method (Gornall et al., 1949) was employed for the determination of serum protein.

Serum calcium and magnesium were determined by using Atomic Absorption Spectrophotometer (Perkin Elmer-Model 2380). Serum inorganic phosphorus content was estimated by colorimetry (Fiske and Subba Row, 1925).

3.3.4 Metabolism Studies.

Three metabolism trials at eight weeks interval were conducted with each breed during the experimental period of 24 weeks.

During the 8th, 16th and 24th week of experiment, four animals from each group were used for the digestion cum balance trial involving five days collection period.

During the trial, the animals were kept in special metabolism cages with facilities for feeding, watering and collection of urine and fecal pellets, uncontaminated by any feed residue or dirt.

Weighed quantities of respective feed were offered daily to each rabbit. Water was provided *ad libitum*. Representative samples of experimental feed and balance feed were taken daily for moisture estimation to calculate the drymatter intake.

3.3.4.1 Collection and Sampling of Faeces and Urine

All precautions were taken to ensure the collection of faeces and urine quantitatively uncontaminated with any feed residue or dirt. The faecal pellets voided were dropped into a netted device attached to the bottom of metabolism cage and collected periodically. The urine was collected in amber coloured bottle kept under the funnel of the cages. Sulphuric acid (25 per cent) at the rate of 20 ml were added in each bottle before the collection of urine. At 10 a.m. every day, faecal pellets and urine voided during the previous 24 hours were measured accurately, mixed thoroughly and separately. Representative samples of both faeces and urine at the rate of 20 per cent of the total voided quantity were taken and stored in a refrigerator. The samples collected from each animal, preserved during the entire collection period, were used for further chemical analysis.

3.3.4.2 Digestibility Coefficients.

Digestibility coefficients of nutrients were determined by conventional method.

3.3.4.3 Chemical Analysis

The feed samples and faeces collected during the metabolism trial were subjected to proximate analysis as per AOAC (1990), estimation of fibre fractions following the method given by Goering and VanSoet (1970), estimation of calcium using Atomic Absorption Spectrophotometer (Perkin Elmer-Model 2380) and inorganic phosphorus by Fiske and Subba Row (1925).

The urine samples were analysed for nitrogen (Kjeldahl method AOAC., 1990), calcium by Atomic Absorption Spectrophotometer (Perkin Elmer model 2380) and inorganic phosphorus by Fiske and Subba Row method (1925).

The results obtained from the chemical analysis were used for the calculation of digestibility coefficients of nutrients and balance of nitrogen, calcium and phosphorus, including percentage retention of each.

3.3.5 Carcass Characteristics

Four animals from each group were slaughtered at 8th, 16th and 24th week of experiment to study the following :

1. Dressing percentage
2. Chemical composition of muscle
3. Liver protein and liver fat
4. Fat constants viz., Iodine number and Saponification value of the abdominal fat.

After the final collection of faeces and urine, the animals of the respective groups were weighed accurately and slaughtered as described by Sandford and Woodgate (1957). Preslaughter weight and dressed weight were recorded to calculate the dressing percentage.

3.3.5.1 Chemical Analysis of Muscle, Liver and Fat.

The boneless meat of loin, hind limb and forelimb of each rabbit was taken, minced and mixed thoroughly and used for the analysis of proximate principles as per AOAC (1990). Liver collected from each animal were analysed for its protein and fat contents (AOAC, 1990).

Saponification value and iodine number of the abdominal fat were estimated as per the method specified in AOAC (1990).

3.4. Statistical Analysis

Statistical Analysis of the data were carried out using analysis of variance technique as given by Snedecor and Cochran (1967) Designs adopted are completely randomized design (CRD) and randomized block design (RBD).

RESULTS

RESULTS

An experiment with nine dietary treatments having different energy-protein combinations as outlined in the materials and methods, was conducted and tested in CRD and RBD designs. The experiment was conducted in two trials - one with pure bred SC for 168 days from weaning at 28 days of age and other with SC x NZW cross bred rabbit (CB rabbits) for 168 days from weaning at 28 days of age. The results obtained during the course of present investigation are detailed under the following heads.

4.1. Growth rate

The mean values on weekly body weights of SC and CB rabbits maintained on nine experimental rations are depicted in Fig. 1 and 2. Consolidated data on average daily gain in grams for the period of 0 to 168 days of experiment for different ration treatments are given in table 4 and represented in Fig. 3 and their statistical analysis in Appendix 25, table 1 and 2. Fig. 4 represent the growth curve plotting the ADG at 28 days intervals in SC and CB rabbits. Average daily gain in grams calculated at 56 days interval are shown in table 5 and 6 for SC and CB rabbits respectively and represented by Fig. 5. Mean weekly body weight of SC and CB rabbits are presented in Appendix 1 to 18.

Statistical analysis of the data on cumulative weight gain for 0 to 168 days of experiment indicates that both dietary energy and CP influence the average daily gain ($P<0.01$). Maximum growth rate (ADG g/day) has been recorded in animals maintained on ration B and D in both SC and CB rabbits. Considering the growth intensity during different periods, it can be noticed that maximum ADG (g/day) is observed during the initial period i.e., 0 to 56 days of experiment when compared to 56 to 112 days and 112 to 168 days of experiment.

4.2. Drymatter Consumption

The consolidated data for 0 to 168 days and 3 stages (0 to 56, 56 to 112 and 112 to 168 days) are given in table 4, 5 and 6 and graphically represented in Fig. 6 ,7, 8 and 9. Statistical analysis of data on average DMI (g/day) and per cent body weight for 0 to 168 days of experiment are given in Appendix-25, table 1 and 2 and it is found that dietary energy as well as crude protein levels significantly (P<0.01) influences the dry matter consumption of experimental animals. Week-wise mean daily feed consumption of rabbits fed different energy-protein combination upto 24th week of experiment as g/day and percentage of body weights are presented in Appendix 1 to 18.

4.3. Feed efficiency

Cumulative feed efficiency for 0 to 168 days of experiment calculated as feed gain ratio for different ration treatments in both SC and CB rabbits are set out in table 4 with statistical analysis in Appendix 25, table 1 and 2. There is significant influence (P<0.01) of dietary energy and protein on the feed efficiency of experimental animals and maximum efficiency is noticed in animals maintained on ration containing 2500 kcal DE and 20 per cent CP (Ration D). Feed efficiency of the experimental animals maintained on nine energy-protein combinations, recorded at weekly intervals during the experimental period of 24 weeks (168 days) are set out in Appendix 1 to 18, feed efficiency at 56 days intervals i.e. 0 to 56, 56 to 112 and 112 to 168 days of experiment are given in table 5 and 6 for SC and CB rabbits respectively and it is found that the efficiency of feed conversion is decreasing as the age advances and is maximum during 0 to 56 days of experiment. Graphical representation of feed/gain ratio of SC and CB rabbits during different periods of experiment are shown in Fig. 10 and 11.

4.4. Protein efficiency

Average cumulative protein efficiency for the experimental period of 168 days and protein efficiency at 56 days intervals are given in table 4, 5 and 6 and graphically represented in fig 12 and 13 and their statistical analysis are shown in Appendix-25, table 1 and 2. Results on protein efficiency reveals significant difference ($P<0.01$) due to variation in dietary energy and protein levels and the efficiency of protein utilization enhances as the CP levels in the feed decreases. Maximum protein efficiency is noticed in animals maintained on Ration C, i.e. ration containing 3000 kcal DE with 12 per cent CP, in SC and CB rabbits. Mean values on protein efficiency of experimental animals maintained on nine ration treatments, recorded at weekly intervals are shown in Appendix 1 to 9 for SC and 10 to 18 for CB rabbits. The protein efficiency is found decreasing as the age advances.

4.5 Cost of production

Cumulative cost of production of SC and CB rabbits evaluated as feed cost/kg live weight gain for the entire experimental period of 168 days are given in table 4 with statistical analysis in Appendix 25, table 1 and 2 and graphically presented in Fig. 14 and for 56 days interval in table 5 and 6 for SC and CB rabbits respectively and Fig.15. Mean values on cost per kg. gain at weekly intervals are set out in Appendix 1 to 18. Among the different energy protein combinations, the cumulative cost per kg. gain for the experimental period of 168 days is found least in rabbits maintained on ration D in both SC and CB rabbits.

4.6. Body measurements

Summarized data on total gain in body length, height and chest girth taking the initial and final values with respect to SC and CB rabbits maintained on nine experimental rations are given in table 7 and 8 respectively and their statistical analysis in Appendix 25 table 3 and 4. Mean values of body measurements of SC and CB rabbits viz., body length, body weight and chest girth recorded fortnightly are presented in Appendix 19 to 24. On the whole a linear increase is seen in all body measurements with increase in body weight. There is significant ($P<0.01$) influence of dietary energy and protein on body length, height and chest girth of experimental animals. A greater gain in body measurements is observed with increase in dietary energy and protein levels.

4.7. **Haematological values**

4.7.1. Haemoglobin

Mean values on haemoglobin concentration (g/100 ml) of SC and CB rabbits maintained on different ration treatments recorded at monthly intervals are presented in table 9 and their statistical analysis in Appendix 25. Table 5 and 6. The overall average haemoglobin concentration (g/100 ml) in animals maintained on different ration treatments ranges from 12.47 to 13.33 in the case of SC and 12.59 to 13.61 in the case of CB rabbits; statistical analysis reveals no significant influence of dietary energy and protein levels on haemoglobin concentration.

4.7.2. Serum protein

Mean values on serum protein concentration of SC and CB rabbits recorded at monthly intervals are shown in table 10 and their statistical analysis in Appendix - 25 table 5 and 6. Th overall mean values ranges from 6.11 to 6.32 in SC rabbits and 6.17 to 6.44 in CB rabbits respectively. Dietary energy as well as protein are not having significant influence on blood protein content.

4.7.3. Serum calcium

Mean values on serum calcium concentration of SC and CB rabbits recorded at monthly intervals are presented in table 11 and their statistical analysis shown in Appendix 25 table 5 and 6 reveals that there is no significant influence of dietary energy and protein levels on these parameter. The mean values ranges from 13.82 to 14.7 mg/100 ml in SC and 13.76 to 14.62 mg/100 ml in CB rabbits.

4.7.4. Serum Inorganic phosphorus

Inorganic phosphorus concentration in the blood serum of experimental animals were recorded at monthly intervals and the mean values are presented in table 12 for SC and CB rabbits with the statistical analysis in Appendix 25, table 5 and 6. Neither dietary protein nore the energy levels influences the parameter significantly.

4.7.5. Serum Magnesium

Mean values on serum magnesium concentration of SC and CB rabbits recorded at monthly intervals are given in table 13 and their statistical analysis in Appendix 25 table 5 and 6 and there is no significant difference between the dietary treatments as well as the period.

4.8. Metabolism trial data

4.8.1. Digestibility of nutrients

Digestibility coefficients of nutrients, estimated from the first, second and third metabolism trials are presented in table 14 to 19.

4.8.1.1. Dry matter

Average digestibility coefficient of dry matter in the nine experimental ration estimated from the three metabolism trials are presented in table 19.1 for SC and CB rabbits and their statistical analysis in Appendix 25, table 7 and 9. Graphical representation of the drymatter digestibility in rabbits given various ration treatments during the first, second and third metabolism trials are set out in Fig.16. Results on DM digestibility shows significant decrease ($P<0.01$) as the DE of the ration decreases.

4.8.1.2. Crude protein

Mean values on CP digestibility coefficients of the experimental rations during the three metabolism trials in SC and CB rabbits are given in table 19.2 with their statistical analysis in Appendix 25, table 7 and 9. Results on CP digestibility indicate significant variation ($P<0.01$) between the periods as well as ration treatments. There is an increase in CP digestibility on increasing the level of dietary CP as well as energy and also with an increase in age. Graphical representation of CP digestibility in SC and CB rabbits are given in Fig.17.

4.8.1.3. Crude fibre

Data on crude fibre digestibility in SC and CB rabbits, presented in table 19.3 with statistical analysis in Appendix 25, table 7 and 9 disclose a significantly lower rate of crude fibre digestibility as the DE content of feed decreases ($P<0.01$), but no significant difference in the rate of crude fibre digestibility could be noticed on increasing the level of CP in the ration. Results on crude fibre digestibility in SC and CB rabbits obtained from the three metabolism trials are also represented graphically in Fig 18.

4.8.1.4. Ether extract

Percentage digestibility of ether extract in the nine experimental rations estimated from three metabolism trials conducted during the 8th, 16th and 24th week of experiment are represented in table 19.4 and their statistical analysis in Appendix 25 table 7 and 9 and graphically represented in Fig. 19. Statistical analysis reveals that there is significant increase in ether extract digestibility as the level of DE in the ration increases.

4.8.1.5. Nitrogen free extract

Average values on digestibility coefficient of NFE in the experimental rations estimated during th 8th, 16th and 24th week of experiment are presented in table 19.5 with statistical analysis in Appendix 25 table 7 and 9 and graphical representation in Fig 20. Results on NFE digestibility indicate that DE level of experimental rations significantly influences the NFE digestibility ($P < 0.01$).

4.8.2. Digestibility of fibre fractions

4.8.2.1. Acid detergent fibre

Results on ADF digestibility of the experimental rations estimated in SC and CB rabbits during the 8th, 16th and 24th week of experiment are given in table 19.6 and their statistical analysis given in Appendix 25, table 8 and 10 indicate that both dietary DE and CP levels influence the ADF digestibility ($P < 0.01$). As between the periods it can be noticed that the ADF digestibility significantly ($P < 0.01$) enhances as the age of the animal advances, irrespective of the ration treatments.

4.8.2.2. Neutral detergent fibre.

Digestibility coefficient of NDF in the nine experimental rations estimated from the three metabolism trials conducted during three stages of the experiment are presented in table 19.7 and their statistical analysis in Appendix 25, table 8 and 10. Results on NDF digestibility indicate that both DE and CP significantly influence the NDF digestibility.

4.8.2.3. Hemicellulose

Percentage digestibility of hemicellulose in the experimental rations determined from the three metabolism trials conducted during the 8th, 16th and 24th week of experiment in both SC and CB rabbits are given in table 19.8 and their statistical analysis in appendix 25, table 8 and 10. The digestibility of hemicellulose is seen decreasing with decrease in dietary energy as well as crude protein levels. As between the periods there is an increasing trend in the hemicellulose digestibility as the age advances in both SC and CB rabbits.

4.8.2.4. Cellulose

Mean values on cellulose digestibility of nine experimental rations estimated from the three metabolism trials (8th, 16th and 24th week of experiment) in SC and CB rabbits are presented in table 19.9 with their statistical analysis in appendix 25 table 8 and 10. On statistical analysis of the data there is significant influence of digestible energy and crude protein levels on cellulose digestibility ($P<0.01$). As between the periods the digestibility of cellulose seems to be increased as the animal advances in age irrespective of the level of protein and energy in the ration ($P < 0.01$).

4.8.3. Nitrogen and Mineral balance

4.8.3.1. Nitrogen balance

Data on daily retention of nitrogen in SC and CB rabbits recorded from the metabolism trials conducted during the 8th, 16th and 24th week of experiment are set out in table 20 and 21 with their statistical analysis in Appendix 11 and 12. Graphical representation of the daily percentage retention of nitrogen during the three stage of experiment in SC and CB rabbits are given in Fig.21 statistical analysis of the result reveals that there is significant influence of dietary energy and protein and period of experiment (age of the animals) on nitrogen balance.

4.8.3.2. Calcium balance

Consolidated data on mean daily retention of calcium in SC and CB rabbits maintained on nine experimental rations studied during the 8th, 16th and 24th week of experiment are given in table 22 and 23, their statistical analysis in Appendix 25 table

11 and 12. Results on percentage retention of calcium during the three metabolism trails with respect to both SC and CB rabbits are graphically presented in Fig. 22.

4.8.3.3. Phosphorus balance

Mean values on daily intake, out go and retention of phosphorus in the experimental animals estimated from three metabolism trials conducted during the 8th, 16th and 24 th week of experiment are presented in table 24 and 25 for SC and CB rabbits respectively with their statistical analysis in Appendix 25 table 11 and 12. Graphical representation of the percentage retention of phosphorus in SC and CB rabbits during the three metabolism trials are given in Fig. 23. Statistical analysis reveals significant influence of dietary treatments and period on phosphorus retention in the experimental animals.

4.9. Carcass characteristics

4.9.1. Dressing percentage

Mean values on dressing percentage of SC and CB rabbits maintained under nine ration treatments during 8th, 16th and 24th week of experiment as arrived at from the pre- slaughter weight (g), dressed weight (g) are presented in table 26 and 27 respectively and their statistical analysis in Appendix 25 table 11 and 12 and graphically represented in Fig. 24. Significantly ($P<0.01$) better dressing percentage is noticed commensurate with an increase in dietary DE from 2000 to 3000 kcal and CP from 12 to 20 per cent during the 8th, 16th and 24th week of experiment. As between the periods dressing percentage is found to increase as the age advances along the increase in body weight.

4.9.2. Chemical composition of Muscle

4.9.2.1. Moisture

Mean values on moisture content of the muscle from SC and CB rabbits slaughtered during the three stages of experiment are presented in table 28 and 29 with their statistical analysis in Appendix 25 table 13 and 14. No significant influence of dietary protein or energy is noticed on muscle moisture content. As between the periods, there is significant decrease ($P < 0.01$) in moisture content during the 24th week of experiment irrespective of dietary treatments showing that age of the animal influences the moisture content in the muscle.

4.9.2.2. Dry matter

Data on dry matter content of the muscle from SC and CB rabbits slaughtered during the 8th, 16th and 24th week of experiment given in table 28 and 29 and their statistical analysis in Appendix 25 table 13 and 14 reveals no significant difference in animals maintained on different energy protein levels. As between the periods, the DM content in the muscle significantly ($P<0.01$) increase as the age of the animal advances, irrespective of the ration treatments.

4.9.2.3. Crude protein

Mean values on muscle crude protein content of SC and CB rabbits maintained under nine experimental rations and slaughtered during 8th, 16th and 24th week of experiment are set out in table 28 and 29 with statistical analysis in Appendix 25 table 13 and 14. As the age advances there is significant ($P<0.01$) decrease in CP content of muscle, on drymatter basis irrespective of dietary treatments. Dietary protein or energy does not seem to influence significantly the muscle CP content.

4.9.2.4. Ether extract

Data on muscle ether extract content of SC and CB rabbits during 8th, 16th and 24th week of experiment are set out in table 28 and 29. Statistical analysis presented in Appendix 25 table 14 and 15 reveals significant (P<0.01) decrease in muscle crude fat content when the dietary DE decreases. There is progressive increase in muscle fat content as the age of the animal advances.

4.9.2.5. Total Ash

Mean values on total ash content of muscle from SC and CB rabbits slaughtered during 8th, 16th and 24th week of experiment are shown in table 28 and 29 with their statistical analysis in Appendix 25, table 14 and 15. No significant difference can be noticed between the muscle values of animals maintained on varying levels of CP to the extend of 20, 16 and 12 per cent while dietary energy is found to influence significantly (P<0.01), the total ash content of muscle. As between the periods the muscle ash content show a significant decrease (P<0.01) with the age of the animal advances.

4.9.3. Liver protein

Average values of liver protein content on dry matter basis from SC and CB rabbits slaughtered during the 8th, 16th and 24th week of the experiment are given in table 30 and 31 and their statistical analysis in Appendix 25, table 16. Both dietary protein and energy are found to influence the liver protein content (P<0.01), while the difference between periods being not significant.

4.9.4. Liver fat

Mean values of ether extract content of liver on dry matter basis collected from SC and CB rabbits during the three stages (8th, 16th and 24th week) of experiment are presented in table 30 and 31. statistical analysis of the data presented in Appendix 25, table 16 reveals no significant difference between groups or the periods.

4.9.5. Fat constants

Appreciable quantities of abdominal fat for the estimation of iodine number and saponification value could be collected only from animals maintained on ration A,B,C,D,E and F and slaughtered during 16th and 24th week of experiment, since the same was not present in sufficient quantities in animals slaughtered at 8th week of experiment and animals maintained on rations G, H and I during the three stages of slaughter.

4.9.5.1 Iodine number

Mean values on iodine number of the adbominal fat collected from animals maintained on ration A,B,C,D,E and F and slaughtered during 16th and 24th week of experiment are presented in table 32 for SC and CB rabbits. On statistical analysis of the data (Table 17 Appendix 25) no significant difference could be noticed either between different dietary treatments or periods of experiments.

4.9.5.2. Saponification value.

Average values of saponification value of the abdominal fat collected from SC and CB rabbits maintained on Ration A,B,C,D,E and F and slaughtered during 16th and 24th week of experiment are presented in table 33 with their statistical analysis in table 17 Appendix 25. On statistical analysis of the data it can be noticed that dietary crude protein does not seem to influence the saponification value, while the DE content of the ration seems to influence the saponification value.

4.10. **Slaughter age**

Data showing the profit/loss over feed cost in SC and CB rabbits on slaughtering the rabbits at 8th, 16th and 24th week of experiment, are summarised in table 34 and 35. The results indicate that maximum profit is obtained, when the animals are slaughtered during the 8th week of experiment due to the lowered feed efficiency during the subsequent periods as the age advances. Ration E containing 2500 kcal with 16 per cent CP is found as the most cost effective one during the first stage of slaughter.

Maximum economy on slaughter derived out of the profit and loss statement of animals maintained on nine treatment combinations clearly support the animals maintained on ration D which converges the optimum DE and CP requirement for broiler rabbits as 2500 kcal/kg and 20 per cent respectively for profitable growth.

Table 4

Mean cumulative Average daily gain, Dry matter intake, Feed efficiency, Protein efficiency and cost per kg. live weight gain of Soviet Chinchilla and Cross bred rabbits for the experimental period of 168 days

Ration	A	B	C	D	E	F	G	H	I
DE. kcal/kg	3000			2500			2000		
CP. per cent	20	16	12	20	16	12	20	16	12
SOVIET CHINCHILLA RABBITS									
Average daily gain (g/day)	16.87[a] ±0.51	17.07[b] ±0.39	14.70[c] ±0.41	16.95[a, b] ±0.46	15.81[d] ±0.70	11.56[e] ±0.59	11.96[f] ±0.31	9.03[g] ±0.40	6.72[h] ±0.37
Dry matter intake (g/day)	160.87[a] ±1.32	159.75[b] ±1.60	160.49[a,b] ±1.52	157.21[c] ±1.17	156.21[d] ±1.76	140.22[e] ±1.38	138.80[f] ±1.40	120.95[g] ±1.23	110.31[h] ±1.95
Dry matter intake (Percentage of body weight)	7.43[b] ±0.31	7.56[a] ±0.24	8.17[c] ±0.35	7.65[a] ±0.28	7.78[d] ±0.16	8.47[e] ±0.13	8.33[f] ±0.20	9.26[g] ±0.24	10.23[h] ±0.17
Feed efficiency	9.54[b] ±0.38	9.36[a] ±0.12	10.92[c] ±0.20	9.27[a] ±0.23	9.88[d] ±0.16	12.13[e] ±0.19	11.60[f] ±0.25	13.39[g] ±0.28	16.42[h] ±0.36
Protein efficiency	0.52[a] ±0.03	0.66[b] ±0.04	0.75[c] ±0.02	0.53[d] ±0.04	0.62[e] ±0.03	0.67[f] ±0.05	0.42[g] ±0.06	0.46[h] ±0.03	0.49[i] ±0.07
Feed Cost/kg.wt.gain (Rs.)	51.71 ±0.26	48.39 ±0.21	55.15 ±0.43	43.85 ±0.28	44.66 ±0.32	52.04 ±0.56	46.28 ±0.20	48.61 ±0.25	53.86 ±0.55
CROSS BRED RABBITS									
Average daily gain (g/day)	17.05[a] ±0.40	17.31[b] ±0.31	15.46[c] ±0.26	17.17[a,b] ±0.65	16.68[e] ±0.38	13.07[f] ±0.29	11.52[g] ±0.45	9.94[h] ±0.41	7.30[i] ±0.57
Dry matter intake (g/day)	151.49[a] ±1.75	158.93[c] ±1.98	155.40[d] ±2.80	152.04[a] ±1.69	162.64[e] ±1.74	147.86[f] ±2.45	132.99[b] ±1.99	132.19[b] ±2.74	121.70[g] ±2.48
Dry matter intake (Percentage of body weight)	6.97[a] ±0.18	7.23[d] ±0.26	7.76[b] ±0.13	6.93[a] ±0.19	7.45[a] ±0.15	7.92[b,c] ±0.20	8.05[c] ±0.17	9.16[e] ±0.28	9.67[f] ±0.14
Feed efficiency	8.89[a] ±0.19	9.18[c] ±0.15	10.05[d] ±0.27	8.85[a] ±0.31	9.75[e] ±0.10	11.31[b] ±0.14	11.54[b] ±0.23	13.30[f] ±0.19	16.67[g] ±0.21
Protein efficiency	0.56[a] ±0.02	0.67[b] ±0.01	0.81[c] ±0.04	0.55[d] ±0.02	0.63[e] ±0.03	0.72[f] ±0.02	0.43[g] ±0.05	0.46[h] ±0.03	0.49[g] ±0.04
Cost/kg.wt.gain (Rs.)	48.18 ±0.52	47.46 ±0.22	50.75 ±0.58	41.86 ±0.77	43.79 ±0.39	48.52 ±0.46	46.04 ±0.37	48.28 ±0.50	54.68 ±0.75

Values bearing different superscripts in the same row differ significantly ($P<0.01$)

Table 5

Consolidated data on growth and nutrient utilization by Soviet Chinchilla rabbits during different periods of experiment

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg.	3000			2500			2000		
CP.per cent	20	16	12	20	16	12	20	16	12
Period	0 to 56 days of experiment								
Average daily gain (g/day)	23.99	22.95	21.96	22.35	22.17	20.23	18.16	13.39	8.88
Dry matter intake (g/day)	81.66	84.43	87.10	83.44	83.45	93.53	87.74	86.99	77.83
Dry matter intake (Percentage of body weight)	7.48	7.95	8.40	8.01	8.07	9.48	8.82	10.83	11.13
Feed efficiency	3.40	3.68	3.97	3.73	3.76	4.62	4.83	6.52	8.77
Protein efficiency	1.46	1.69	2.05	1.31	1.63	1.77	1.02	0.95	0.93
Cost / kg.gain (Rs.)	18.44	19.02	20.05	17.64	17.00	19.82	19.27	23.67	28.77
Period	56 to 112 days of experiment								
Average daily gain (g/day)	17.90	18.90	15.25	17.56	16.80	8.57	11.10	8.30	7.08
Dry matter intake (g/day)	184.71	186.03	188.05	182.44	184.84	157.46	152.51	134.31	120.80
Dry matter intake (Percentage of body weight)	7.74	7.94	8.62	8.14	8.34	8.39	8.44	9.18	10.51
Feed efficiency	10.32	9.84	12.33	10.39	11.00	18.37	13.74	16.18	17.06
Protein efficiency	0.48	0.63	0.66	0.47	0.56	0.45	0.36	0.38	0.48
Cost / kg.gain (Rs.)	55.93	50.87	62.27	49.14	49.72	78.81	54.82	58.73	55.96
Period	112 to 168 days of experiment								
Average daily gain (g/day)	8.75	9.70	6.88	10.94	8.46	5.88	6.61	5.40	4.20
Dry matter intake (g/day)	216.25	208.79	206.33	205.76	200.34	169.68	176.16	141.56	132.30
Dry matter intake (Percentage of body weight)	7.07	6.79	7.50	6.79	6.94	7.55	7.73	7.76	9.06
Feed efficiency	24.71	21.52	29.99	18.81	23.68	28.86	26.65	26.22	31.50
Protein efficiency	0.20	0.29	0.27	0.26	0.26	0.28	0.18	0.23	0.26
Cost/kg.gain (Rs.)	133.93	111.26	151.45	88.97	107.03	123.81	106.33	95.18	103.32

Table 6

Consolidated data on growth and nutrient utilization by Cross bred Rabbits during different periods of experiment

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg.	3000			2500			2000		
CP.per cent	20	16	12	20	16	12	20	16	12
Period	0 to 56 days of experiment								
Average daily gain (g/day)	22.96	23.65	18.41	24.09	22.81	19.93	16.24	12.05	8.65
Dry matter intake (g/day)	77.00	84.23	72.04	85.84	81.43	81.60	77.28	76.75	67.87
Dry matter intake (Percentage of body weight)	7.30	7.85	7.57	7.66	7.54	7.99	8.23	9.22	9.19
Feed efficiency	3.35	3.56	3.91	3.56	3.57	4.09	4.76	6.37	7.85
Protein efficiency	1.48	1.74	2.08	1.37	1.72	2.00	1.03	0.97	1.04
Cost / kg.gain (Rs.)	18.16	18.41	19.71	16.84	16.10	17.55	18.99	23.12	25.75
Period	56 to 112 days of experiment								
Average daily gain (g/day)	20.96	20.83	19.14	20.20	20.19	13.90	11.84	12.00	8.10
Dry matter intake (g/day)	187.34	194.27	176.99	186.52	203.65	193.46	156.12	163.05	141.17
Dry matter intake (Percentage of body weight)	7.47	7.69	8.15	7.44	8.36	9.18	8.60	10.50	11.42
Feed efficiency	8.94	9.33	9.25	9.23	10.09	13.92	13.19	13.59	17.43
Protein efficiency	0.55	0.66	0.88	0.53	0.61	0.59	0.37	0.45	0.47
Cost / kg.gain (Rs.)	48.45	48.24	46.62	43.66	45.51	59.72	52.63	49.33	57.17
Period	112 to 168 days of experiment								
Average daily gain (g/day)	7.21	7.44	8.84	7.22	7.05	5.38	6.48	5.78	5.15
Dry matter intake (g/day)	190.14	198.28	217.18	183.76	202.83	168.53	165.56	156.77	156.06
Dry matter intake (Percentage of body weight)	6.14	6.16	7.55	5.69	6.44	6.59	7.32	7.75	9.75
Feed efficiency	26.37	26.65	24.57	25.45	28.77	31.33	25.55	27.12	30.30
Protein efficiency	0.19	0.23	0.33	0.19	0.21	0.26	0.19	0.23	0.27
Cost / kg.gain (Rs.)	142.93	137.78	123.83	120.38	129.75	134.41	101.94	98.45	99.38

Table 7

Summarised data on body measurements of Soviet Chinchilla rabbits as influenced by experimental diets showing initial and final values

Body Length (cm)

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg	**3000**	**3000**	**3000**	**2500**	**2500**	**2500**	**2000**	**2000**	**2000**
CP per cent	**20**	**16**	**12**	**20**	**16**	**12**	**20**	**16**	**12**
Initial length (cm)	20.40	21.10	21.05	21.20	21.15	20.10	20.40	20.05	20.10
S.E.	± 0.39	± 0.4	± 0.36	± 0.33	± 0.52	± 0.64	± 0.48	± 0.25	± 0.3
Final length	36.55	36.60	34.80	37.10	36.40	33.25	33.10	29.20	27.15
S.E.	± 0.58	± 0.72	± 0.69	± 0.49	± 0.29	± 0.82	± 0.92	± 0.8	± 0.5
Total gain (cm)	16.15^{a}	15.50^{a}	13.75^{b}	15.90^{a}	15.25^{a}	13.15^{b}	12.70^{b}	9.15^{c}	7.05^{d}
S.E.	± 0.56	± 0.26	± 0.39	± 0.15	± 0.48	± 0.19	± 0.20	± 0.64	± 0.1

Body Height (cm)

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg	**3000**	**3000**	**3000**	**2500**	**2500**	**2500**	**2000**	**2000**	**2000**
CP per cent	**20**	**16**	**12**	**20**	**16**	**12**	**20**	**16**	**12**
Initial height (cm)	15.05	15.10	15.20	15.20	15.10	15.20	15.20	15.25	15.20
S.E.	± 0.32	± 0.29	± 0.23	± 0.40	± 0.29	± 0.25	±0.42	±0.45	±0.27
Final height (cm)	26.20	26.60	25.20	26.40	25.50	23.20	23.10	21.50	20.60
S.E.	± 0.33	± 0.60	± 0.56	± 0.32	± 0.25	± 0.45	±0.44	±0.45	±0.55
Total gain (cm)	11.15^{a}	11.50^{a}	10.00^{a}	11.20^{a}	10.40^{a}	8.00^{b}	7.90^{b}	6.25^{c}	5.40^{c}
S.E.	± 0.59	± 0.82	± 0.68	± 0.07	± 0.22	± 0.34	± 0.09	± 0.21	± 0.47

Chest Girth (cm)

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg	**3000**	**3000**	**3000**	**2500**	**2500**	**2500**	**2000**	**2000**	**2000**
CP per cent	**20**	**16**	**12**	**20**	**16**	**12**	**20**	**16**	**12**
Initial chest girth (cm)	16.15	16.05	16.05	16.20	15.25	16.05	15.50	16.20	16.15
S.E.	± 0.43	± 0.32	± 0.48	± 0.31	± 0.43	± 0.47	± 0.46	± 0.23	± 0.43
Final chest girth (cm)	33.40	33.80	31.85	33.80	32.90	28.10	27.10	24.60	23.20
S.E.	± 0.40	± 0.60	± 0.45	± 0.37	± 0.14	± 0.46	± 0.53	± 0.27	± 0.16
Total gain (cm)	17.25^{a}	17.75^{a}	15.80^{b}	17.60^{a}	17.65^{a}	12.05^{c}	11.60^{d}	8.40^{e}	7.05^{f}
S.E.	± 0.10	± 0.38	± 0.07	± 0.21	± 0.34	± 0.11	± 0.67	± 0.14	± 0.40

Values bearing different superscripts in the same row differ significantly ($P<0.01$)

Table 8

Summarised data on body measurements of Cross bred rabbits as influenced by experimental diets showing initial and final values

Body Length (cm)

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP per cent	20	16	12	20	16	12	20	16	12
Initial length (cm)	21.10	21.00	21.20	21.00	21.20	21.00	20.30	21.10	21.20
S.E.	± 0.53	± 0.52	± 0.87	± 0.87	± 0.64	± 0.50	± 0.45	± 0.55	± 0.71
Final length (cm)	37.20	37.25	35.00	37.15	36.20	35.10	33.25	32.20	29.30
(S.E.	± 0.5	± 0.66	± 0.79	± 0.68	± 0.63	± 0.55	± 0.61	± 0.71	± 0.58
Total gain (cm)	16.10^{a}	16.25^{a}	13.80^{b}	16.15^{a}	15.00^{c}	14.10^{b}	12.95^{d}	11.10^{e}	8.10^{f}
S.E.	± 0.35	± 0.38	± 0.17	± 0.38	± 0.54	± 0.16	± 0.20	± 0.23	± 0.43

Body Height (cm)

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP per cent	20	16	12	20	16	12	20	16	12
Initial height (cm)	15.10	15.05	15.10	15.10	15.05	15.10	15.05	15.15	15.25
S.E.	± 0.29	± 0.28	± 0.32	± 0.38	± 0.32	± 0.31	± 0.39	± 0.40	± 0.28
Final height (cm)	26.40	26.70	25.50	26.65	26.20	23.95	23.30	22.10	21.10
S.E.	± 0.30	± 0.33	± 0.50	± 0.40	± 0.33	± 0.29	± 0.25	± 0.31	± 0.36
Total gain (cm)	11.30^{a}	11.65^{a}	10.40^{c}	11.55^{a}	11.15^{a}	8.85^{b}	8.25^{b}	6.95^{d}	5.85^{e}
S.E.	± 0.12	± 0.10	± 0.13	± 0.31	± 0.30	± 0.14	± 0.16	± 0.04	± 0.05

Chest Girth (cm)

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP per cent	20	16	12	20	16	12	20	16	12
Initial chest girth (cm)	16.20	16.20	16.25	16.35	16.10	16.10	16.05	16.30	16.25
S.E.	± 0.35	± 0.39	± 0.43	± 0.46	± 0.29	± 0.51	± 0.30	± 0.29	± 0.37
Final chest girth (cm)	34.10	34.50	32.10	34.40	34.05	28.60	27.05	25.70	24.10
S.E.	± 0.38	± 0.46	± 0.42	± 0.47	± 0.32	± 0.49	± 0.48	± 0.33	± 0.30
Total gain (cm)	17.90^{a}	18.30^{a}	15.85^{d}	18.05^{a}	17.95^{a}	12.50^{b}	11.00^{b}	9.40^{c}	7.85^{c}
S.E.	± 0.40	± 0.09	± 0.55	± 0.49	± 0.48	± 0.82	± 0.29	± 0.42	± 0.31

Values bearing different superscripts in the same row differ significantly ($P < 0.01$)

Table 9

Mean Haemoglobin values (g%) of Soviet Chinchilla and Cross bred rabbits at monthly intervals, as influenced by experimental diets

Ration	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
DE.kcal/kg.	**3000**	**3000**	**3000**	**2500**	**2500**	**2500**	**2000**	**2000**	**2000**
CP per cent	**20**	**16**	**12**	**20**	**16**	**12**	**20**	**16**	**12**
					SOVIET CHINCHILLA				
MONTH									
1	13.45 ±0.49	13.60 ±1.13	12.99 ±1.02	13.14 ±0.84	13.22 ±0.72	13.08 ±1.04	13.11 ±0.89	12.71 ±0.79	12.50 ±0.95
2	13.14 ±0.74	13.39 ±1.11	13.19 ±0.72	13.21 ±0.88	13.11 ±1.21	12.94 ±0.94	13.04 ±0.92	12.80 ±0.89	12.74 ±0.73
3	13.11 ±0.74	13.07 ±0.78	13.20 ±1.24	12.91 ±0.79	12.87 ±1.13	12.41 ±1.09	12.91 ±0.94	12.65 ±0.74	12.38 ±0.76
4	13.41 ±0.42	13.37 ±0.85	12.99 ±1.01	13.20 ±1.04	13.10 ±1.27	12.69 ±0.98	13.05 ±0.52	12.52 ±0.78	12.27 ±0.72
5	13.39 ±0.81	13.42 ±1.03	13.07 ±1.05	12.94 ±0.44	13.09 ±0.94	12.87 ±0.87	12.91 ±0.92	12.40 ±0.57	12.35 ±0.70
6	13.48 ±1.25	13.37 ±0.57	13.10 ±0.65	13.05 ±0.52	12.81 ±1.21	12.59 ±0.62	12.87 ±0.90	12.51 ±0.61	12.60 ±1.01
Average SE	**13.33 ±0.07**	**13.37 ±0.09**	**13.09 ±0.05**	**13.08 ±0.06**	**13.03 ±0.08**	**12.76 ±0.12**	**12.98 ±0.04**	**12.60 ±0.07**	**12.47 ±0.09**
					CROSS BRED				
MONTH									
1	13.81 ±0.13	13.63 ±0.38	13.70 ±0.35	13.58 ±0.27	13.69 ±0.07	13.61 ±0.34	13.10 ±0.70	13.25 ±0.22	13.19 ±0.30
2	13.67 ±0.85	13.45 ±0.92	12.98 ±0.30	13.01 ±0.51	13.14 ±0.56	13.26 ±0.15	12.98 ±0.45	13.00 ±0.89	12.83 ±0.70
3	13.85 ±0.53	13.71 ±0.47	13.41 ±0.76	13.20 ±0.30	13.31 ±0.69	13.14 ±1.06	13.10 ±0.96	13.21 ±0.28	13.15 ±0.94
4	13.91 ±0.68	14.09 ±0.93	13.57 ±0.95	13.28 ±0.41	13.19 ±0.13	13.16 ±0.12	13.17 ±0.70	12.99 ±0.94	12.87 ±0.44
5	13.50 ±0.42	13.77 ±0.40	13.26 ±0.60	13.24 ±0.22	13.21 ±0.14	12.70 ±0.81	13.05 ±0.45	12.75 ±0.60	12.83 ±0.88
6	13.61 ±0.69	13.43 ±0.87	12.90 ±0.65	13.15 ±0.70	13.09 ±0.14	12.94 ±0.69	12.65 ±0.89	12.80 ±0.54	12.59 ±0.60
Average SE	**13.73 ±0.07**	**13.68 ±0.11**	**13.30 ±0.15**	**13.24 ±0.09**	**13.27 ±0.10**	**13.14 ±0.14**	**13.01 ±0.09**	**13.00 ±0.10**	**12.91 ±0.11**

Non significant between groups as well as periods

Table 10

Mean serum protein values (g%) of Soviet Chinchilla and Cross bred rabbits at monthly intervals as influenced by experimental diets

Ration	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
DE.kcal/kg.	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP per cent	20	16	12	20	16	12	20	16	12
SOVIET CHINCHILLA									
MONTH									
1	6.34 ±0.53	6.20 ±0.62	6.48 ±0.69	6.34 ±0.64	6.19 ±0.36	6.02 ±0.33	6.16 ±0.61	6.06 ±0.86	6.11 ±0.50
2	6.31 ±0.61	6.25 ±0.49	6.16 ±0.49	6.32 ±0.51	6.22 ±0.38	6.22 ±0.16	6.11 ±0.78	6.19 ±0.56	6.13 ±0.70
3	6.31 ±0.34	6.27 ±0.61	6.11 ±0.51	6.31 ±0.50	6.20 ±0.36	6.03 ±0.51	6.08 ±0.75	6.26 ±0.77	6.18 ±0.43
4	6.33 ±0.62	6.29 ±0.60	6.04 ±0.31	6.30 ±0.38	6.21 ±0.41	6.07 ±0.50	6.13 ±0.81	6.09 ±0.88	6.08 ±0.39
5	6.32 ±0.35	6.25 ±0.51	6.07 ±0.37	6.29 ±0.51	6.18 ±0.49	6.10 ±0.77	6.10 ±0.71	6.33 ±0.53	6.07 ±0.74
6	6.31 ±0.34	6.24 ±0.35	6.12 ±0.34	6.30 ±0.41	6.20 ±0.52	6.08 ±0.71	6.22 ±0.37	6.10 ±0.39	6.11 ±0.43
Average *SE*	**6.32 ±0.01**	**6.25 ±0.01**	**6.16 ±0.06**	**6.31 ±0.01**	**6.20 ±0.01**	**6.19 ±0.13**	**6.13 ±0.02**	**6.17 ±0.05**	**6.11 ±0.02**
CROSS BRED									
MONTH									
1	6.41 ±0.58	6.38 ±0.29	6.34 ±0.35	6.50 ±0.34	6.40 ±0.36	6.29 ±0.58	6.30 ±0.41	6.25 ±0.44	6.18 ±0.66
2	6.39 ±0.27	6.51 ±0.65	6.38 ±0.32	6.47 ±0.27	6.35 ±0.50	6.30 ±0.53	6.29 ±0.50	6.31 ±0.29	6.20 ±0.41
3	6.35 ±0.44	6.49 ±0.56	6.29 ±0.29	6.50 ±0.39	6.32 ±0.27	6.33 ±0.24	6.31 ±0.46	6.28 ±0.44	6.16 ±0.43
4	6.43 ±0.29	6.42 ±0.38	6.31 ±0.35	6.35 ±0.27	6.40 ±0.38	6.25 ±0.32	6.26 ±0.31	6.28 ±0.44	6.14 ±0.40
5	6.38 ±0.31	6.40 ±0.24	6.28 ±0.30	6.41 ±0.60	6.35 ±0.24	6.30 ±0.45	6.32 ±0.40	6.29 ±0.44	6.18 ±0.46
6	6.43 ±0.25	6.36 ±0.26	6.30 ±0.24	6.42 ±0.31	6.40 ±0.33	6.29 ±0.48	6.34 ±0.25	6.25 ±0.43	6.16 ±0.43
Average *SE*	**6.40 ±0.01**	**6.43 ±0.03**	**6.32 ±0.02**	**6.44 ±0.02**	**6.37 ±0.01**	**6.29 ±0.01**	**6.30 ±0.01**	**6.28 ±0.01**	**6.17 ±0.01**

Table 11

Mean Serum calcium values (mg%) of Soviet Chinchilla and Cross bred rabbits at monthly intervals as influenced by experimental diets

Ration	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*
DE.kcal/kg.	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP per cent	20	16	12	20	16	12	20	16	12
SOVIET CHINCHILLA									
MONTH									
1	14.50 ±0.64	14.47 ±0.68	14.10 ±0.89	13.95 ±1.03	14.20 ±1.00	14.21 ±1.10	13.67 ±0.79	14.13 ±0.69	13.50 ±0.72
2	14.20 ±0.99	15.01 ±0.39	14.83 ±0.72	13.62 ±0.80	14.67 ±0.63	14.10 ±0.58	14.19 ±0.61	13.80 ±0.78	14.00 ±1.04
3	14.43 ±0.69	14.39 ±0.48	14.46 ±0.55	13.98 ±0.58	13.89 ±0.87	15.01 ±0.66	14.60 ±0.66	14.18 ±0.73	14.10 ±0.71
4	14.98 ±0.63	14.62 ±1.10	15.09 ±0.69	15.10 ±0.20	14.70 ±0.46	15.02 ±0.16	13.50 ±0.37	13.87 ±0.47	13.80 ±0.58
5	14.81 ±0.88	14.83 ±0.59	14.92 ±0.66	14.75 ±0.84	14.79 ±0.74	14.26 ±0.90	14.23 ±0.58	13.92 ±0.97	13.47 ±0.57
6	14.99 ±0.75	14.38 ±0.73	14.82 ±0.70	14.26 ±0.98	15.05 ±0.81	14.54 ±0.61	13.81 ±0.75	13.74 ±0.78	14.03 ±0.80
Average SE	**14.65 ±0.16**	**14.62 ±0.10**	**14.70 ±0.15**	**14.28 ±0.23**	**14.55 ±0.17**	**14.52 ±0.16**	**14.00 ±0.19**	**13.94 ±0.08**	**13.82 ±0.13**
CROSS BRED									
MONTH									
1	14.18 ±0.52	14.23 ±0.26	14.11 ±0.10	14.26 ±0.27	14.30 ±0.30	14.00 ±0.33	13.49 ±0.24	13.88 ±0.24	13.61 ±0.34
2	14.40 ±0.27	14.62 ±0.39	14.30 ±0.31	14.32 ±0.25	14.16 ±0.29	13.87 ±0.32	14.00 ±0.44	13.29 ±0.25	13.37 ±0.24
3	14.68 ±0.35	14.31 ±0.20	14.27 ±0.42	14.35 ±0.20	14.29 ±0.28	13.94 ±0.30	13.85 ±0.33	13.46 ±0.22	13.51 ±0.30
4	14.72 ±0.32	14.51 ±0.18	14.70 ±0.23	14.68 ±0.29	14.73 ±0.16	14.40 ±0.56	14.21 ±0.60	14.30 ±0.41	13.99 ±0.20
5	14.85 ±0.09	14.67 ±0.29	14.80 ±0.34	14.71 ±0.27	14.69 ±0.30	14.50 ±0.35	14.38 ±0.20	14.07 ±0.26	14.12 ±0.17
6	14.87 ±0.45	14.59 ±0.24	14.90 ±0.33	14.60 ±0.24	14.48 ±0.28	14.39 ±0.27	14.24 ±0.50	14.10 ±0.39	13.97 ±0.38
Average SE	**14.62 ±0.12**	**14.49 ±0.08**	**14.51 ±0.15**	**14.49 ±0.09**	**14.44 ±0.10**	**14.18 ±0.13**	**14.03 ±0.15**	**13.85 ±0.18**	**13.76 ±0.14**

Table 12

Mean Serum inorganic phosphorus values (mg%) of Soviet Chinchilla and Cross bred rabbits at monthly intervals as influenced by experimental diets

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg.	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP per cent	20	16	12	20	16	12	20	16	12
SOVIET CHINCHILLA									
MONTH									
1	4.63 ±0.25	4.50 ±0.24	4.47 ±0.32	4.69 ±0.10	4.48 ±0.29	4.41 ±0.35	4.50 ±0.26	4.35 ±0.31	4.38 ±0.30
2	4.57 ±0.20	4.53 ±0.28	4.50 ±0.27	4.80 ±0.25	4.46 ±0.22	4.45 ±0.14	4.41 ±0.16	4.46 ±0.14	4. 42 ±0.17
3	4.49 ±0.22	4.36 ±0.29	4.48 ±0.25	4.75 ±0.14	4.62 ±0.08	4.40 ±0.11	4.48 ±0.21	4.40 ±0.13	4.51 ±0.29
4	4.54 ±0.26	4.49 ±0.36	4.51 ±0.22	4.66 ±0.07	4.65 ±0.09	4.49 ±0.24	4.52 ±0.23	4.38 ±0.33	4.47 ±0.04
5	4.44 ±0.31	4.50 ±0.29	4.47 ±0.24	4.69 ±0.08	4.72 ±0.05	4.48 ±0.16	4.49 ±0.22	4.34 ±0.21	4.32 ±0.30
6	4.47 ±0.26	4.43 ±0.37	4.51 ±0.32	4.70 ±0.05	4.73 ±0.05	4.47 ±0.30	4.42 ±0.34	4.40 ±0.17	4.51 ±0.22
Average SE	**4.52 ±0.03**	**4.42 ±0.03**	**4.49 ±0.01**	**4.72 ±0.02**	**4.61 ±0.12**	**4.45 ±0.02**	**4.47 ±0.02**	**4.39 ±0.02**	**4.44 ±0.03**
CROSS BRED									
MONTH									
1	4.83 ±0.22	4.80 ±0.24	4.49 ±0.20	4.75 ±0.18	4.65 ±0.21	4.43 ±0.31	4.61 ±0.15	4.39 ±0.24	4.40 ±0.14
2	4.75 ±0.24	4.69 ±0.35	4.54 ±0.32	4.68 ±0.20	4.71 ±0.13	4.50 ±0.22	4.48 ±0.18	4.40 ±0.36	4.35 ±0.12
3	4.80 ±0.24	4.76 ±0.27	4.61 ±0.20	4.55 ±0.22	4.51 ±0.26	4.63 ±0.30	4.41 ±0.26	4.50 ±0.19	4.43 ±0.17
4	4.54 ±0.31	4.61 ±0.30	4.70 ±0.32	4.48 ±0.33	4.50 ±0.30	4.49 ±0.31	4.40 ±0.22	4.35 ±0.20	4.31 ±0.12
5	4.75 ±0.48	4.59 ±0.23	4.63 ±0.33	4.71 ±0.43	4.64 ±0.41	4.52 ±0.15	4.45 ±0.10	4.50 ±0.42	4.48 ±0.11
6	4.61 ±0.30	4.48 ±0.18	4.51 ±0.26	4.63 ±0.32	4.44 ±0.23	4.40 ±0.12	4.60 ±0.23	4.40 ±0.28	4.35 ±0.13
Average SE	**4.71 ±0.05**	**4.68 ±0.04**	**4.58 ±0.03**	**4.63 ±0.05**	**4.58 ±0.04**	**4.50 ±0.04**	**4.49 ±0.03**	**4.42 ±0.03**	**4.39 ±0.03**

Table 13

Mean Serum magnesium values (mg%) of Soviet Chinchilla and Cross bred (SC x NZW) rabbits at monthly intervals as influenced by experimental diets

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg.	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP per cent	20	16	12	20	16	12	20	16	12
SOVIET CHINCHILLA									
MONTH									
1	3.22 ±0.01	3.20 ±0.04	3.20 ±0.05	3.18 ±0.06	3.21 ±0.01	3.26 ±0.02	3.20 ±0.02	3.23 ±0.06	3.19 ±0.12
2	3.24 ±0.02	3.18 ±0.09	3.24 ±0.02	3.23 ±0.01	3.19 ±0.07	3.20 ±0.03	3.21 ±0.02	3.20 ±0.01	3.22 ±0.01
3	3.21 ±0.04	3.18 ±0.01	3.22 ±0.03	3.25 ±0.02	3.15 ±0.11	3.08 ±0.09	3.19 ±0.05	3.24 ±0.02	3.20 ±0.05
4	3.23 ±0.02	3.19 ±0.02	3.23 ±0.03	3.24 ±0.02	3.21 ±0.02	3.22 ±0.05	3.23 ±0.02	3.20 ±0.07	3.24 ±0.01
5	3.20 ±0.02	3.22 ±0.01	3.25 ±0.02	3.20 ±0.02	3.18 ±0.01	3.17 ±0.08	3.19 ±0.09	3.22 ±0.01	3.26 ±0.01
6	3.18 ±0.08	3.20 ±0.04	3.21 ±0.03	3.22 ±0.03	3.23 ±0.02	3.21 ±0.01	3.21 ±0.02	3.23 ±0.03	3.22 ±0.03
Average SE	**3.21 ±0.01**	**3.20 ±0.01**	**3.23 ±0.01**	**3.22 ±0.01**	**3.20 ±0.01**	**3.19 ±0.03**	**3.21 ±0.01**	**3.22 ±0.01**	**3.22 ±0.01**
CROSS BRED (SC x NZW)									
MONTH									
1	3.30 ±0.14	3.28 ±0.18	3.21 ±0.08	3.31 ±0.10	3.25 ±0.10	3.27 ±0.13	3.08 ±0.05	3.10 ±0.05	3.05 ±0.12
2	3.26 ±0.05	3.21 ±0.04	3.27 ±0.06	3.25 ±0.13	3.30 ±0.03	3.24 ±0.09	3.17 ±0.05	3.22 ±0.06	3.29 ±0.09
3	3.24 ±0.10	3.26 ±0.05	3.21 ±0.05	3.24 ±008	3.29 ±0.13	3.20 ±0.08	3.28 ±0.10	3.20 ±0.60	3.18 ±0.10
4	3.27 ±0.09	3.24 ±0.04	3.30 ±0.13	3.29 ±0.07	3.30 ±0.60	3.21 ±0.11	3.23 ±0.03	3.18 ±0.06	3.20 ±0.08
5	3.22 ±0.10	3.20 ±0.06	3.21 ±0.08	3.24 ±0.09	3.20 ±0.07	3.26 ±0.06	3.24 ±0.09	3.20 ±0.08	3.25 ±0.03
6	3.30 ±0.08	3.23 ±0.03	3.25 ±0.10	3.28 ±0.08	3.24 ±0.04	3.21 ±0.06	3.20 ±0.10	3.27 ±0.03	3.26 ±0.06
Average SE	**3.27 ±0.02**	**3.24 ±0.02**	**3.24 ±0.02**	**3.27 ±0.01**	**3.26 ±0.02**	**3.23 ±0.01**	**3.20 ±0.03**	**3.20 ±0.02**	**3.21 ±0.04**

Table 14

Digestibility coefficients of nutrients in the nine experimental rations obtained from the first Metabolism trial (8th week of experiment) in Soviet Chinchilla rabbits

Nutrients	Rations	A	B	C	D	E	F	G	H	I
	DE.kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
	CP Per cent	20	16	12	20	16	12	20	16	12
Dry matter		71.30[a] ±2.17	70.71[a] ±1.76	70.16[a] ±2.21	60.51[b] ±2.15	58.07[b,c] ±1.67	57.85[b,d,c] ±2.26	55.08[c,d,e] ±2.07	54.10[d,e] ±2.71	51.56[e] ±2.32
Crude Protein		72.67[g] ±2.70	69.69[a] ±2.61	60.05[b] ±2.07	69.91[a] ±2.77	63.40[c] ±1.18	57.04[d] ±1.94	62.55[b,c] ±1.05	52.10[e] ±2.01	46.20[f] ±2.00
Crude Fibre		46.85[d] ±1.93	46.71[a] ±1.99	46.37[b] ±2.03	42.29[a] ±1.79	41.83[c] ±2.11	42.06[e] ±1.46	38.11[b,c] ±3.02	36.24[f] ±2.83	34.89[g] ±1.49
Ether Extract		75.81[a] ±1.69	76.19[a] ±2.26	75.35[a] ±1.68	67.07[b] ±2.46	68.23[b] ±2.43	66.91[b] ±2.27	50.04[c] 2.28	47.90[c] ±2.73	48.01[c] ±2.52
Nitrogen Free Extract		78.42[a] ±1.15	77.15[a] ±2.82	76.24[a] ±2.36	67.23[b] ±2.76	66.17[b] ±2.37	65.90[b] ±2.02	57.04[c] ±2.93	54.61[c] ±2.32	53.12[c] ±1.93
Acid Detergent Fibre		33.79[a] ±1.92	32.42[a,b] ±2.03	32.10[a,c] ±1.69	32.57[a,d] ±2.25	31.42[a,d] ±2.41	29.82[b,c,d,e] ±1.98	27.75[e] ±2.16	23.29[f] ±2.04	22.46[f] ±1.82
Neutral Detergent Fibre		51.66[a] ±2.15	50.77[a] ±1.98	49.97[a] ±2.10	49.36[a] ±1.86	44.72[b] ±2.57	42.27[b,c] ±1.79	40.12[c] ±3.01	36.91[d] ±1.87	34.15[e] ±2.11
Cellulose		38.00[b] ±1.54	33.75[f] ±1.97	29.24[a,d] ±2.17	28.98[a,d] ±2.02	28.83[a] ±1.01	27.39[a,e] ±1.59	25.99[c,d,e] ±2.11	23.16[c] ±1.50	21.60[h] ±1.93
Hemicellulose		71.23[a] ±1.66	70.56[a] ±2.32	66.96[b] ±2.16	66.44[b] ±1.45	63.50[e] ±1.98	60.27[c] ±2.05	57.77[c,d] ±1.60	55.81[d] ±1.51	51.92[f] ±1.63

Values bearing different superscripts in the same row differ significantly (P<0.01)

Table 15

Digestibility coefficients of nutrients in the nine experimental rations obtained from the second metabolism trial (16th week of experiment) in Soviet Chinchilla rabbits

Nutrients	Rations	A	B	C	D	E	F	G	H	I
	DE.kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
	CP Per cent	20	16	12	20	16	12	20	16	12
Dry matter		72.83[a] ±1.87	72.14[a] ±2.25	71.96[a] ±1.75	65.22[e] ±1.82	59.03[b] ±1.76	59.42[b] ±1.85	56.65[b,c] ±1.80	55.23[c,d] ±2.93	52.41[d] ±1.70
Crude protein		77.67[e] ±2.30	74.43[a] ±1.29	64.14[b] ±1.61	72.89[a] ±1.06	67.91[c] ±2.30	60.82[d] ±1.62	66.14[b,c] ±1.78	58.73[d] ±0.98	47.85[f] ±2.52
Crude fibre		47.12[a] ±2.16	47.05[a] ±2.68	47.37[a] ±2.91	43.71[b] ±2.03	42.90[b] ±2.71	43.15[b] ±1.86	38.67[c] ±2.20	37.19[c] ±1.94	35.48[c] ±1.70
Ether extract		78.64[a] ±2.81	78.12[a] ±2.10	77.35[a] ±2.49	68.70[b] ±2.17	69.07[b] ±2.01	68.13[b] ±2.61	50.62[c] ±2.45	48.83[c] ±2.16	48.56[c] ±2.18
Nitrogen free extract		78.46[a] ±2.16	78.10[a] ±2.34	77.50[a] ±2.16	67.85[b] ±2.91	66.91[b] ±2.1	66.14[b] ±2.76	57.30[c] ±2.06	54.93[c] ±1.94	53.87[c] ±2.41
Acid detergent fibre		39.85[g] ±1.44	34.40[a] ±1.64	29.85[b] ±1.78	32.81[a,c] ±1.89	31.75[a,b,d] ±2.19	30.37[b,c,e] ±2.57	29.40[b,f] ±1.99	29.10[d,e,f] ±1.95	25.05[h] ±1.26
Neutral detergent fibre		55.32[f] ±1.47	51.73[a] ±1.30	49.58[a] ±1.59	46.56[b] ±1.37	43.70[b,c] ±1.43	42.72[c,d] ±1.52	41.17[c,e] ±1.41	40.31[d,e] ±1.66	36.45[g] ±1.43
Cellulose		40.41[d] ±1.26	34.95[a] ±1.83	30.20[b] ±0.32	35.24[a] ±0.38	31.12[b] ±0.43	30.19[b] ±0.17	26.90[c] ±0.51	24.89[c] ±0.60	24.35[c] ±1.83
Hemicellulose		71.70[a] ±1.33	70.99[a] ±2.19	68.34[e] ±2.05	63.61[f] ±1.91	60.55[b] ±2.06	60.60[b] ±1.93	57.99[b,c] ±2.30	55.91[c,d] ±2.12	53.79[d] ±1.20

Values bearing different superscripts in the same row differ significantly ($P < 0.01$)

Table 16

Digestibility coefficients of nutrients in the nine experimental rations obtained from the third metabolism trial (24th week of experiment) in Soviet Chinchilla rabbits

Nutrients	Rations	A	B	C	D	E	F	G	H	I
	DE.kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
	CP Per cent	20	16	12	20	16	12	20	16	12
Dry matter		76.29^{a} ±1.29	75.16^{a} ±1.70	74.80^{a} ±1.95	67.98^{d} ±2.68	62.51^{b} ±1.54	60.79^{b} ±2.18	56.94^{c} ±2.11	55.60^{c} ±2.03	51.86^{e} ±1.91
Crude protein		79.45^{d} ±2.96	75.32^{a} ±1.90	68.08^{b} ±2.84	73.15^{a} ±1.24	68.52^{b} ±2.70	63.67^{c} ±1.30	67.83^{b} ±2.66	62.08^{c} ±1.38	47.98^{e} ±2.94
Crude fibre		48.14^{a} ±2.97	47.83^{a} ±3.26	47.56^{a} ±2.97	44.53^{b} ±1.44	44.29^{b} ±1.66	43.85^{b} ±3.02	39.15^{c} ±2.89	37.83^{c} ±3.16	36.78^{c} ±3.10
Ether extract		79.08^{a} ±2.64	78.93^{a} ±2.16	78.61^{a} ±2.72	69.18^{b} ±3.37	69.42^{b} ±2.73	68.94^{b} ±2.91	51.05^{c} ±1.41	50.90^{c} ±3.62	49.71^{c} ±2.79
Nitrogen free extract		79.85^{a} ±3.06	79.41^{a} ±3.02	78.16^{a} ±2.67	68.42^{b} ±2.5	68.17^{b} ±3.11	66.83^{b} ±2.05	58.78^{c} ±3.37	55.14^{c} ±1.98	54.62^{c} ±2.05
Acid detergent fibre		41.49^{a} ±1.75	41.27^{a} ±1.91	$34.01^{b,c,d}$ ±1.10	36.06^{b} ±1.81	35.82^{b} ±1.79	$31.09^{d,e}$ ±1.67	34.70^{b} ±1.92	$31.19^{c,e}$ ±2.06	28.08^{f} ±1.66
Neutral detergent fibre		52.52^{a} ±2.16	54.46^{a} ±1.74	50.84^{a} ±1.70	46.58^{b} ±1.44	$43.98^{b,c}$ ±1.51	$41.46^{c,d}$ ±1.85	$39.46^{d,e}$ ±1.04	37.34^{e} ±1.31	35.13^{f} ±1.99
Cellulose		40.88^{d} ±1.78	35.76^{a} ±1.85	34.52^{a} ±1.41	36.98^{a} ±1.88	33.77^{a} ±1.26	29.71^{b} ±1.57	$27.39^{b,c}$ ±1.73	$27.44^{b,c}$ ±1.47	25.02^{c} ±2.02
Hemicellulose		72.31^{a} ±2.07	$71.28^{a,e}$ ±1.21	68.73^{e} ±2.15	63.94^{f} ±1.27	$61.70^{b,f}$ ±1.86	61.29^{b} ±1.55	58.49^{c} ±1.67	$56.88^{c,d}$ ±1.25	54.37^{d} ±1.53

Values bearing different superscripts in the same row differ significantly ($P < 0.01$)

Table 17

Digestibility coefficients of nutrients in the nine experimental rations obtained from the first metabolism trial (8th week of experiment) in Cross bred rabbits

Nutrients	Rations	A	B	C	D	E	F	G	H	I
	DE.kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
	CP Per cent	20	16	12	20	16	12	20	16	12
Dry matter		72.38^{a} ±1.20	72.24^{a} ±1.05	71.40^{a} ±1.30	65.68^{e} ±1.51	61.96^{b} ±1.22	61.58^{b} ±1.34	57.26^{c} ±1.51	$55.61^{c,d}$ ±1.09	53.52^{d} ±1.17
Crude protein		72.90^{a} ±0.69	70.86^{a} ±0.83	60.22^{b} ±0.91	71.89^{a} ±1.01	63.85^{c} ±1.15	58.83^{d} ±1.00	66.41^{c} ±1.20	$60.73^{b,c}$ ±1.04	51.84^{e} ±1.13
Crude fibre		49.92^{a} ±1.49	49.78^{a} ±1.35	49.11^{a} ±1.28	46.44^{b} ±1.43	45.29^{b} ±1.37	45.08^{b} ±1.23	42.19^{c} ±1.19	40.94^{c} ±1.14	40.11^{c} ±1.31
Ether extract		78.95^{a} ±1.63	79.15^{a} ±1.45	77.38^{a} ±1.21	68.91^{b} ±1.55	69.86^{b} ±1.30	67.22^{b} ±1.40	50.86^{c} ±1.08	50.73^{c} ±1.31	49.67^{c} ±1.25
Nitrogen free extract		79.10^{a} ±1.39	81.30^{a} ±1.40	80.07^{a} ±0.61	69.44^{b} ±1.03	69.87^{b} ±1.10	$66.48^{b,c}$ ±1.22	64.98^{c} ±1.37	64.10^{c} ±1.11	63.36^{c} ±1.24
Acid detergent fibre		34.13^{a} ± 2.15	$33.49^{a,b}$ ± 1.95	$32.62^{a,c}$ ± 1.83	$33.48^{a,d}$ ± 2.11	$32.06^{a,e}$ ± 1.45	$30.09^{b,c,d,e,f}$ ± 1.73	27.81^{f} ± 2.13	24.11^{g} ± 1.90	23.26^{g} ± 1.81
Neutral detergent fibre		53.18^{a} ±1.61	52.11^{a} ±1.54	51.84^{a} ±1.06	49.53^{c} ±1.62	46.90^{d} ±1.56	44.45^{e} ±1.74	41.17^{f} ±1.92	38.70^{b} ±1.25	36.42^{b} ±0.93
Cellulose		38.10^{e} ±2.03	34.09^{f} ±1.65	30.15^{a} ±1.39	$29.14^{a,c}$ ±1.78	$28.76^{a,c}$ ±1.61	$27.94^{a,c}$ ±1.43	$26.33^{c,b,d}$ ±2.10	23.28^{d} ±1.95	22.00^{b} ±1.84
Hemicellulose		73.34^{a} ±0.68	$72.83^{a,b}$ ±1.00	$70.18^{b,c}$ ±0.32	$69.41^{c,e}$ ±0.93	$67.82^{c,d}$ ±1.53	$65.24^{d,e}$ ±1.36	60.28^{f} ±1.64	$58.92^{f,g}$ ±1.37	56.41^{g} ±1.20

Values bearing different superscripts in the same row differ significantly

Table 18

Digestibility coefficients of nutrients in the nine experimental rations obtained from the second metabolism trial (16th week of experiment) in Cross bred rabbits

Nutrients	Rations	A	B	C	D	E	F	G	H	I
	DE.kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
	CP Per cent	20	16	12	20	16	12	20	16	12
Dry matter		73.44[a] ±1.08	73.40[a] ±1.60	72.50[a] ±0.98	66.93[e] ±1.15	62.36[b] ±1.08	61.84[b] ±1.17	58.38[c] ±1.28	56.11[c,d] ±1.30	54.14[d] ±1.25
Crude protein		79.48[a] ±1.06	76.72[a,b] ±1.25	64.39[c] ±1.33	74.46[b] ±1.21	68.84[d] ±1.04	65.93[c,d] ±1.53	69.30[d] ±1.41	64.62[c] ±1.26	52.23[e] ±1.40
Crude fibre		49.15[a] ±1.33	50.73[a] ±1.35	50.30[a] ±1.26	48.09[a] ±1.32	47.96[a] ±1.56	47.68[a] ±1.71	42.85[b] ±1.28	40.28[b,c] ±1.14	39.03[c] ±1.31
Ether extract		79.51[a] ±1.49	80.90[a] ±1.72	80.31[a] ±1.59	69.19[b] ±1.20	70.63[b] ±1.33	69.16[b] ±1.45	51.29[c] ±1.35	51.03[c] ±1.29	49.94[c] ±1.86
Nitrogen free extract		79.28[a] ±1.54	79.18[a] ±1.60	80.20[a] ±1.39	69.11[b] ±1.47	68.88[b] ±1.25	67.53[b,c] ±1.80	65.21[b,c] ±1.36	64.53[c] ±1.42	63.49[c] ±1.38
Acid detergent fibre		39.96[f] ± 1.76	34.78[a] ± 1.57	33.71[a,b] ± 2.01	34.12[a,c] ± 1.80	33.54[a] ± 1.93	30.93[b,c,d] ± 1.79	29.55[b,e] ± 1.64	29.25[d,e] ± 1.87	25.38[g] ± 2.05
Neutral detergent fibre		56.46[f] ±1.74	52.86[b] ±1.35	52.31[b,c] ±0.91	50.14[c,d] ±1.32	47.92[d] ±1.18	45.34[g] ±1.89	43.03[e] ±1.50	41.88[e] ±1.63	38.04[h] ±1.77
Cellulose		40.51[e] ±1.63	35.28[b] ±1.55	31.77[a] ±1.80	32.46[b,a] ±1.46	31.48[a] ±1.76	36.62[a,c] ±1.11	27.41[c,d] ±1.26	24.73[d] ±1.81	24.91[d] ±1.44
Hemicellulose		73.95[a] ±1.45	73.00[a,b] ±1.00	70.52[b,c] ±1.57	70.01[c] ±1.81	68.17[c,d] ±1.31	66.21[d] ±1.18	62.31[f] ±1.98	59.43[e] ±1.40	57.29[e] ±1.45

Values bearing different superscripts in the same row differ significantly ($P<0.01$)

Table 19

Digestibility coefficients of nutrients in the nine experimental rations obtained from the third metabolism trial (24th week of experiment) in Cross bred rabbits

Nutrients / Rations	A	B	C	D	E	F	G	H	I
DE.kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP per cent	20	16	12	20	16	12	20	16	12
Dry matter	74.73^{a} ±0.96	74.01^{a} ±1.05	73.19^{a} ±0.95	68.25^{e} ±1.16	64.81^{b} ±1.23	62.92^{b} ±1.05	$58.98^{c,d}$ ±1.29	56.73^{c} ±1.08	55.45^{d} ±1.21
Crude protein	80.51^{a} ±1.03	$77.30^{a,b}$ ±1.10	68.60^{c} ±0.99	74.95^{b} ±1.12	69.66^{c} ±0.95	$66.68^{c,d}$ ±1.06	69.64^{c} ±1.22	65.16^{d} ±1.30	52.89^{e} ±1.01
Crude fibre	50.13^{a} ±1.20	51.87^{a} ±1.49	51.78^{a} ±1.29	49.34^{a} ±1.02	48.94^{a} ±1.40	48.56^{a} ±1.21	42.92^{b} ±1.23	41.30^{b} ±1.42	40.45^{b} ±1.32
Ether extract	80.48^{a} ±1.48	80.14^{a} ±1.40	79.86^{a} ±1.14	70.10^{b} ±1.74	70.82^{b} ±1.96	70.54^{b} ±1.09	51.63^{c} ±1.36	51.34^{c} ±1.03	50.08^{c} ±1.30
Nitrogen free extract	80.77^{a} ±1.63	79.89^{a} ±1.39	79.75^{a} ±1.66	69.54^{b} ±1.29	$68.68^{b,c}$ ±1.42	$67.61^{b,d}$ ±1.28	$65.55^{c,d}$ ±1.46	$64.89^{c,d}$ ±2.05	63.65^{d} ±1.69
Acid detergent fibre	41.78^{a} ±2.05	41.49^{a} ±1.83	35.34^{b} ±1.15	36.28^{b} ±0.98	36.01^{b} ±1.10	31.25^{c} ±1.23	$34.83^{b,c}$ ±1.43	31.25^{c} ±2.00	28.35^{c} ±1.39
Neutral detergent fibre	60.73^{a} ±1.94	58.86^{a} ±1.61	56.31^{d} ±1.83	51.61^{b} ±1.51	49.76^{b} ±1.42	46.00^{c} ±1.79	47.08^{c} ±0.85	43.39^{e} ±1.03	40.58^{f} ±1.43
Cellulose	41.89^{e} ±1.05	36.10^{a} ±1.77	34.87^{a} ±1.28	37.06^{a} ±1.45	$34.11^{a,b}$ ±1.15	$30.89^{b,c}$ ±1.86	$28.16^{c,d}$ ±1.74	$27.68^{c,d}$ ±1.66	25.47^{d} ±1.49
Hemicellulose	75.91^{a} ±1.76	$73.44^{a,b}$ ±2.06	$72.25^{b,c}$ ±1.60	$70.62^{c,d}$ ±1.45	$69.20^{d,e}$ ±1.42	$67.32^{e,f}$ ±1.59	64.60^{f} ±1.70	60.29^{g} ±1.59	59.19^{h} ±1.63

Values bearing different superscripts in the same row differ significantly ($P<0.01$)

Table 19.1

Sumarized data on digestibility coefficient of Dry matter in the nine experimental rations obtained from the metabolism trials conducted during 8th, 16th and 24th week of experiment in Soviet Chinchilla and Cross bred rabbits

Ration	DE kcal/kg	CP %	8th week	16th week	24th week	Overall Means
SOVIET CHINCHILLA						
A	3000	20	71.30 ± 2.17	72.83 ± 1.87	76.29 ± 1.29	73.47 ± 1.48
B	3000	16	70.71 ± 1.76	72.14 ± 2.25	75.16 ± 1.70	72.67 ± 1.31
C	3000	12	70.16 ± 2.21	71.96 ± 1.75	74.80 ± 1.95	72.31 ± 1.35
D	2500	20	60.51 ± 2.15	65.22 ± 1.82	67.98 ± 2.68	64.57 ± 2.18
E	2500	16	58.07 ± 1.67	59.03 ± 1.76	62.51 ± 1.54	59.87 ± 1.37
F	2500	12	57.85 ± 2.26	59.42 ± 1.85	60.79 ± 2.18	59.35 ± 0.85
G	2000	20	55.08 ± 2.07	56.65 ± 1.80	56.94 ± 2.11	56.22 ± 0.58
H	2000	16	54.10 ± 2.71	55.20 ± 2.93	55.60 ± 2.03	54.97 ± 0.62
I	2000	12	51.56 ± 2.32	52.41 ± 1.70	51.86 ± 1.91	51.94 ± 0.25
Overall means			**61.04 ± 2.42**	**62.76 ± 2.50**	**64.66 ± 2.91**	**62.82 ± 2.60**
CROSS BRED						
A	3000	20	72.38 ± 1.20	73.44 ± 1.08	74.73 ± 0.96	73.52 ± 0.68
B	3000	16	72.24 ± 1.05	73.40 ± 1.60	74.01 ± 1.05	73.22 ± 0.52
C	3000	12	71.40 ± 1.30	72.50 ± 0.98	73.19 ± 0.95	72.36 ± 0.43
D	2500	20	65.68 ± 1.51	66.93 ± 1.15	68.25 ± 1.16	66.95 ± 0.74
E	2500	16	61.96 ± 1.22	62.36 ± 1.08	64.81 ± 1.23	66.95 ± 0.61
F	2500	12	61.58 ± 1.34	61.84 ± 1.17	62.92 ± 1.05	62.11 ± 0.34
G	2000	20	57.26 ± 1.51	58.38 ± 1.28	58.98 ± 1.29	58.21 ± 0.57
H	2000	16	55.61 ± 1.09	56.11 ± 1.30	56.73 ± 1.08	56.15 ± 0.26
I	2000	12	53.52 ± 1.17	54.11 ± 1.25	55.45 ± 1.21	54.36 ± 0.47
Overall means			**63.51 ± 2.30**	**64.34 ± 2.37**	**65.45 ± 2.36**	**64.43 ± 2.35**

SC : Between groups ($P<0.01$)
Between periods ($P<0.01$)

CB : Between groups ($P<0.01$)
Between periods - NS

Table 19.2

Sumarized data on digestibility coefficient of Crude protein in the nine experimental rations obtained from the metabolism trials conducted during 8th, 16th and 24th week of experiment in Soviet Chinchilla and Cross bred rabbits

Ration	DE kcal/kg	CP %	8th week	16th week	24th week	Overall Means
SOVIET CHINCHILLA						
A	3000	20	72.67 ± 2.70	77.67 ± 2.30	79.45 ± 2.96	76.60 ± 1.66
B	3000	16	69.69 ± 2.61	74.43 ± 1.29	75.32 ± 1.90	73.15 ± 1.42
C	3000	12	60.05 ± 2.07	64.14 ± 1.61	68.08 ± 2.84	64.09 ± 1.90
D	2500	20	69.91 ± 2.77	72.89 ± 1.06	73.15 ± 1.24	71.98 ± 0.85
E	2500	16	63.40 ± 1.18	67.91 ± 2.30	68.52 ± 2.70	66.61 ± 1.32
F	2500	12	57.04 ± 1.94	60.82 ± 1.62	63.67 ± 1.30	60.51 ± 0.91
G	2000	20	62.55 ± 1.05	66.14 ± 1.78	67.83 ± 2.66	65.51 ± 1.27
H	2000	16	52.10 ± 2.01	58.73 ± 0.98	62.08 ± 1.38	57.64 ± 1.39
I	2000	12	46.20 ± 2.00	47.85 ± 2.52	47.98 ± 2.94	47.34 ± 0.47
Overall means			**61.51 ± 2.75**	**65.62 ± 2.87**	**67.34 ± 2.86**	**64.82 ± 2.81**
CROSS BRED						
A	3000	20	72.90 ± 0.69	79.48 ± 1.06	80.51 ± 1.03	77.63 ± 1.95
B	3000	16	70.86 ± 0.83	76.72 ± 1.25	77.30 ± 1.10	74.96 ± 1.68
C	3000	12	60.22 ± 0.91	64.39 ± 1.33	68.60 ± 0.99	64.40 ± 1.97
D	2500	20	71.89 ± 1.01	74.46 ± 1.21	74.95 ± 1.12	73.77 ± 0.78
E	2500	16	63.85 ± 1.15	68.84 ± 1.04	69.66 ± 0.95	67.45 ± 1.48
F	2500	12	58.83 ± 1.00	65.93 ± 1.53	66.68 ± 1.06	63.81 ± 2.04
G	2000	20	66.41 ± 1.21	69.30 ± 1.41	69.64 ± 1.22	68.45 ± 0.83
H	2000	16	60.73 ± 1.04	64.62 ± 1.26	65.16 ± 1.30	63.50 ± 1.14
I	2000	12	51.84 ± 1.13	52.23 ± 1.40	52.89 ± 1.01	52.32 ± 0.25
Overall means			**64.17 ± 2.20**	**68.44 ± 2.26**	**69.49 ± 2.52**	**67.37 ± 2.28**

SC : Between groups (P<0.01)
Between periods (P<0.01)

CB : Between groups (P<0.01)
Between periods (P<0.01)

Table 19.3

Sumarized data on digestibility coefficient of Crude fibre in the nine experimental rations obtained from the metabolism trials conducted during 8th, 16th and 24th week of experiment in Soviet Chinchilla and Cross bred rabbits

Ration	DE kcal/kg	CP %	8th week	16th week	24th week	Overall Means
SOVIET CHINCHILLA						
A	3000	20	46.85 ± 1.93	47.12 ± 2.16	48.14 ± 2.97	47.37 ± 0.39
B	3000	16	46.71 ± 1.99	47.05 ± 2.68	47.83 ± 3.26	47.20 ± 0.33
C	3000	12	46.37 ± 2.03	47.37 ± 2.91	47.56 ± 2.97	47.10 ± 0.37
D	2500	20	42.29 ± 1.79	43.71 ± 2.03	44.53 ± 1.44	43.51 ± 0.66
E	2500	16	41.83 ± 2.11	42.90 ± 2.71	44.29 ± 1.66	43.01 ± 0.71
F	2500	12	42.06 ± 1.46	43.15 ± 1.86	43.85 ± 3.02	43.02 ± 0.52
G	2000	20	38.11 ± 3.02	38.67 ± 2.20	39.15 ± 2.89	38.64 ± 0.30
H	2000	16	36.24 ± 2.83	37.19 ± 1.94	37.83 ± 3.16	37.09 ± 0.46
I	2000	12	34.89 ± 1.49	35.48 ± 1.70	36.78 ± 3.10	35.72 ± 0.56
Overall means			**41.71 ± 1.42**	**42.52 ± 1.40**	**43.33 ± 1.38**	**42.52 ± 1.40**
CROSS BRED						
A	3000	20	49.92 ± 1.49	49.15 ± 1.33	50.13 ± 1.20	49.73 ± 0.30
B	3000	16	49.78 ± 1.35	50.73 ± 1.35	51.87 ± 1.49	50.79 ± 0.60
C	3000	12	49.11 ± 1.28	50.30 ± 1.26	51.78 ± 1.29	50.40 ± 0.77
D	2500	20	46.44 ± 1.43	48.09 ± 1.32	49.34 ± 1.02	47.96 ± 0.84
E	2500	16	45.29 ± 1.37	47.96 ± 1.56	48.94 ± 1.40	47.40 ± 1.09
F	2500	12	45.08 ± 1.23	47.68 ± 1.71	48.56 ± 1.21	47.11 ± 1.05
G	2000	20	42.19 ± 1.19	42.85 ± 1.28	42.92 ± 1.23	42.65 ± 0.23
H	2000	16	40.94 ± 1.14	40.28 ± 1.14	41.30 ± 1.42	40.84 ± 0.30
I	2000	12	40.11 ± 1.31	39.03 ± 1.31	40.45 ± 1.32	39.86 ± 0.43
Overall means			**45.43 ± 1.18**	**46.23 ± 1.37**	**47.25 ± 1.40**	**46.30 ± 1.31**

SC : Between groups (P<0.01)
Between periods - NS

CB : Between groups (P<0.01)
Between periods - NS

Table 19.4

Sumarized data on digestibility coefficient of Ether extract in the nine experimental rations obtained from the metabolism trials conducted during 8th, 16th and 24th week of experiment in Soviet Chinchilla and Cross bred rabbits

Ration	DE kcal/kg	CP %	8th week	16th week	24th week	Overall Means
SOVIET CHINCHILLA						
A	3000	20	75.81 ± 1.69	78.64 ± 2.81	79.08 ± 2.64	77.84 ± 1.03
B	3000	16	76.19 ± 2.26	78.12 ± 2.10	78.93 ± 2.16	77.75 ± 0.81
C	3000	12	75.35 ± 1.68	77.30 ± 2.49	78.61 ± 2.72	77.09 ± 0.95
D	2500	20	67.07 ± 2.46	68.70 ± 2.17	69.18 ± 3.37	68.32 ± 1.11
E	2500	16	68.23 ± 2.43	69.07 ± 2.01	69.42 ± 2.73	68.91 ± 0.35
F	2500	12	66.91 ± 2.27	68.13 ± 2.61	68.94 ± 2.91	67.99 ± 0.48
G	2000	20	50.04 ± 2.28	50.62 ± 2.45	51.05 ± 1.41	50.57 ± 0.29
H	2000	16	47.90 ± 2.73	48.83 ± 2.16	50.90 ± 3.62	49.21 ± 0.72
I	2000	12	48.01 ± 2.52	48.56 ± 2.18	49.71 ± 2.79	48.76 ± 0.50
Overall means			**63.95 ± 1.26**	**65.33 ± 3.99**	**66.20 ± 3.91**	**65.16 ± 3.89**
CROSS BRED						
A	3000	20	78.95 ± 1.63	79.51 ± 1.49	80.48 ± 1.48	79.65 ± 0.45
B	3000	16	79.15 ± 1.45	80.90 ± 1.72	80.14 ± 1.40	80.06 ± 0.51
C	3000	12	77.38 ± 1.21	80.31 ± 1.59	79.86 ± 1.14	79.18 ± 0.91
D	2500	20	68.91 ± 1.55	69.19 ± 1.20	70.10 ± 1.74	69.40 ± 0.36
E	2500	16	69.86 ± 1.30	70.63 ± 1.33	70.82 ± 1.96	70.44 ± 0.29
F	2500	12	67.22 ± 1.40	69.16 ± 1.45	70.54 ± 1.09	68.97 ± 0.96
G	2000	20	50.86 ± 1.08	51.29 ± 1.35	51.63 ± 1.36	51.26 ± 0.22
H	2000	16	50.73 ± 1.31	51.03 ± 1.29	51.34 ± 1.03	51.03 ± 0.18
I	2000	12	49.67 ± 1.25	49.94 ± 1.86	50.08 ± 1.30	49.90 ± 0.12
Overall means			**65.86 ± 3.89**	**66.88 ± 4.07**	**67.22 ± 4.00**	**66.65 ± 3.99**

SC : Between groups (P<0.01)
Between periods - NS

CB : Between groups (P<0.01)
Between periods - NS

Table 19.5

Sumarized data on digestibility coefficient of Nitrogen free-extract in the nine experimental rations obtained from the metabolism trials conducted during 8th, 16th and 24th week of experiment in Soviet Chinchilla and Cross bred rabbits

Ration	DE kcal/kg	CP %	8th week	16th week	24th week	Overall Means
SOVIET CHINCHILLA						
A	3000	20	78.40 ± 1.15	78.46 ± 2.16	79.85 ± 3.06	78.90 ± 0.47
B	3000	16	77.15 ± 2.82	78.10 ± 2.34	79.41 ± 3.02	78.22 ± 0.66
C	3000	12	76.24 ± 2.36	77.50 ± 2.16	78.16 ± 2.67	77.30 ± 0.56
D	2500	20	67.23 ± 2.76	67.85 ± 2.91	68.42 ± 2.50	67.42 ± 0.38
E	2500	16	66.17 ± 2.37	66.91 ± 2.1	68.17 ± 3.11	67.08 ± 0.58
F	2500	12	65.90 ± 2.02	66.14 ± 2.76	66.83 ± 2.05	66.29 ± 0.28
G	2000	20	57.04 ± 2.93	57.30 ± 2.06	58.78 ± 3.37	57.71 ± 0.54
H	2000	16	54.61 ± 2.32	54.93 ± 1.94	55.14 ± 1.98	54.82 ± 0.15
I	2000	12	53.12 ± 1.93	53.87 ± 2.41	54.62 ± 2.05	53.87 ± 0.43
Overall means			**66.21 ± 3.06**	**66.78 ± 3.10**	**67.71 ± 3.15**	**66.85 ± 3.10**
CROSS BRED						
A	3000	20	79.10 ± 1.39	79.28 ± 1.54	80.77 ± 1.63	79.72 ± 0.53
B	3000	16	81.30 ± 1.40	79.18 ± 1.60	79.89 ± 1.39	80.12 ± 0.62
C	3000	12	80.07 ± 0.61	80.20 ± 1.39	79.75 ± 1.66	80.01 ± 0.13
D	2500	20	69.44 ± 1.03	69.11 ± 1.47	69.54 ± 1.29	69.36 ± 0.11
E	2500	16	69.87 ± 1.10	68.88 ± 1.25	68.70 ± 1.42	69.15 ± 0.36
F	2500	12	66.48 ± 1.22	67.53 ± 1.80	67.61 ± 1.28	67.21 ± 0.30
G	2000	20	64.98 ± 1.37	65.21 ± 1.36	65.55 ± 1.46	65.25 ± 0.17
H	2000	16	64.11 ± 1.11	64.53 ± 1.42	64.89 ± 2.05	64.51 ± 0.58
I	2000	12	63.36 ± 1.24	63.49 ± 1.38	63.65 ± 2.05	63.50 ± 0.08
Overall means			**70.97 ± 2.28**	**70.82 ± 2.14**	**71.15 ± 2.20**	**70.98 ± 2.20**

SC : Between groups (P<0.01)
Between periods - NS

CB : Between groups (P<0.01)
Between periods - NS

Table 19.6

Sumarized data on digestibility coefficient of Acid detergent fibre in the nine experimental rations obtained from the metabolism trials conducted during 8th, 16th and 24th week of experiment in Soviet Chinchilla and Cross bred rabbits

Ration	DE kcal/kg	CP %	8th week	16th week	24th week	Overall Means
SOVIET CHINCHILLA						
A	3000	20	33.79 ± 1.92	33.85 ± 1.44	41.49 ± 1.75	36.38 ± 0.58
B	3000	16	32.42 ± 2.03	34.40 ± 1.64	41.27 ± 1.91	36.03 ± 2.68
C	3000	12	32.10 ± 1.69	29.85 ± 1.78	34.01 ± 1.10	31.99 ± 1.70
D	2500	20	32.57 ± 2.25	32.81 ± 1.89	36.06 ± 1.81	33.81 ± 1.13
E	2500	16	31.42 ± 2.41	31.75 ± 2.19	35.82 ± 1.79	33.00 ± 1.42
F	2500	12	29.82 ± 1.98	30.37 ± 2.57	31.09 ± 1.67	30.43 ± 0.37
G	2000	20	27.75 ± 2.16	29.40 ± 1.99	34.70 ± 1.92	30.62 ± 1.71
H	2000	16	23.29 ± 2.04	29.10 ± 1.95	31.19 ± 2.06	27.86 ± 2.37
I	2000	12	22.46 ± 1.82	25.05 ± 1.26	28.08 ± 1.66	25.20 ± 1.63
Overall means			**29.51 ± 1.31**	**30.73 ± 0.90**	**34.86 ± 1.50**	**31.70 ± 1.15**
CROSS BRED						
A	3000	20	34.13 ± 2.05	39.96 ± 3.20	41.78 ± 2.05	38.62 ± 2.31
B	3000	16	33.49 ± 1.93	34.78 ± 2.61	41.49 ± 1.83	36.59 ± 2.48
C	3000	12	32.62 ± 3.10	33.71 ± 1.98	35.34 ± 1.15	33.89 ± 0.79
D	2500	20	33.48 ± 2.57	34.12 ± 2.15	36.28 ± 0.98	34.63 ± 0.85
E	2500	16	32.06 ± 1.87	33.54 ± 3.01	36.01 ± 1.10	33.87 ± 1.15
F	2500	12	30.09 ± 2.61	30.93 ± 2.35	31.25 ± 1.23	30.76 ± 0.35
G	2000	20	27.81 ± 1.95	29.55 ± 3.09	34.83 ± 1.43	30.73 ± 2.11
H	2000	16	24.11 ± 3.11	29.25 ± 1.95	31.25 ± 2.00	28.20 ± 2.13
I	2000	12	23.26 ± 2.46	25.38 ± 2.11	28.35 ± 1.39	25.66 ± 1.48
Overall means			**30.12 ± 1.30**	**32.36 ± 1.31**	**35.18 ± 1.42**	**32.55 ± 1.29**

SC : Between groups ($P<0.01$)
Between periods ($P<0.01$)

CB : Between groups ($P<0.01$)
Between periods ($P<0.01$)

Table 19.7

Sumarized data on digestibility coefficient of Neutral detergent fibre in the nine experimental rations obtained from the metabolism trials conducted during 8th, 16th and 24th week of experiment in Soviet Chinchilla and Cross bred rabbits

Ration	DE kcal/kg	CP %	8th week	16th week	24th week	Overall Means
SOVIET CHINCHILLA						
A	3000	20	51.66 ± 2.15	55.32 ± 1.47	52.52 ± 2.16	53.17 ± 1.11
B	3000	16	50.77 ± 1.98	51.73 ± 1.30	54.46 ± 1.74	52.32 ± 0.90
C	3000	12	49.97 ± 2.10	49.58 ± 1.59	50.84 ± 1.70	50.13 ± 0.37
D	2500	20	49.36 ± 1.86	46.56 ± 1.37	46.58 ± 1.44	47.50 ± 0.93
E	2500	16	44.72 ± 2.57	43.70 ± 1.43	43.98 ± 1.57	44.13 ± 0.30
F	2500	12	42.26 ± 1.79	42.72 ± 1.52	41.46 ± 1.85	42.15 ± 0.37
G	2000	20	40.12 ± 3.01	41.17 ± 1.41	39.46 ± 1.04	40.25 ± 0.41
H	2000	16	36.91 ± 1.87	40.31 ± 1.66	37.34 ± 1.31	38.19 ± 1.07
I	2000	12	34.15 ± 2.11	36.45 ± 1.43	35.13 ± 1.99	35.24 ± 0.67
Overall means			**44.43 ± 2.10**	**45.28 ± 1.43**	**44.64 ± 1.61**	**44.79 ± 1.70**
CROSS BRED						
A	3000	20	53.18 ± 1.61	56.46 ± 1.74	60.73 ± 1.94	56.79 ± 2.19
B	3000	16	52.11 ± 1.54	52.86 ± 1.35	58.86 ± 1.61	54.61 ± 2.14
C	3000	12	51.84 ± 1.06	52.31 ± 0.91	56.34 ± 1.83	53.49 ± 1.42
D	2500	20	49.53 ± 1.62	50.14 ± 1.32	51.61 ± 1.51	50.43 ± 0.62
E	2500	16	46.90 ± 1.56	47.92 ± 1.18	49.76 ± 1.42	48.19 ± 0.84
F	2500	12	44.45 ± 1.74	45.34 ± 1.89	46.00 ± 1.79	45.26 ± 0.45
G	2000	20	41.17 ± 1.92	43.03 ± 1.50	47.08 ± 0.85	43.76 ± 1.75
H	2000	16	38.70 ± 1.25	41.88 ± 1.63	43.39 ± 1.03	41.32 ± 1.38
I	2000	12	36.42 ± 0.93	38.04 ± 1.77	40.58 ± 1.43	38.45 ± 1.21
Overall means			**46.03 ± 1.43**	**47.55 ± 1.46**	**50.48 ± 1.50**	**48.03 ± 1.41**

SC : Between groups ($P<0.01$)
Between periods - NS

CB : Between groups ($P<0.01$)
Between periods ($P<0.01$)

Table 19.8

Sumarized data on digestibility coefficient of Hemicellulose in the nine experimental rations obtained from the metabolism trials conducted during 8th, 16th and 24th week of experiment in Soviet Chinchilla and Cross bred rabbits

Ration	DE kcal/kg	CP %	8th week	16th week	24th week	Overall Means
SOVIET CHINCHILLA						
A	3000	20	71.23 ± 1.66	71.70 ± 1.30	72.31 ± 2.07	71.74 ± 0.70
B	3000	16	70.56 ± 2.32	70.99 ± 2.19	71.28 ± 1.21	70.94 ± 0.21
C	3000	12	66.96 ± 2.16	68.34 ± 2.05	68.73 ± 2.15	68.01 ± 0.54
D	2500	20	66.44 ± 1.45	63.61 ± 1.91	63.94 ± 1.27	64.66 ± 0.89
E	2500	16	63.50 ± 1.98	60.55 ± 2.06	61.70 ± 1.86	61.92 ± 0.85
F	2500	12	60.27 ± 2.05	60.60 ± 1.93	61.29 ± 1.55	60.72 ± 0.30
G	2000	20	57.77 ± 1.60	57.99 ± 2.30	58.49 ± 1.67	58.09 ± 0.21
H	2000	16	55.81 ± 1.51	55.91 ± 2.12	56.88 ± 1.25	57.43 ± 0.82
I	2000	12	51.92 ± 1.63	53.79 ± 1.20	54.37 ± 1.53	53.36 ± 0.74
Overall means			62.72 ± 2.11	62.61 ± 2.05	63.22 ± 2.00	62.99 ± 1.99
CROSS BRED						
A	3000	20	73.34 ± 0.68	73.95 ± 1.45	75.91 ± 1.76	74.40 ± 0.78
B	3000	16	72.83 ± 1.00	73.00 ± 1.00	73.44 ± 2.06	73.09 ± 0.18
C	3000	12	70.18 ± 0.32	70.52 ± 1.57	72.25 ± 1.60	70.98 ± 0.47
D	2500	20	69.41 ± 0.93	70.01 ± 1.81	70.62 ± 1.45	70.01 ± 0.35
E	2500	16	67.82 ± 1.53	68.17 ± 1.31	69.20 ± 1.42	68.40 ± 0.41
F	2500	12	65.24 ± 1.36	66.21 ± 1.18	67.32 ± 1.59	66.26 ± 0.60
G	2000	20	60.28 ± 1.64	62.31 ± 1.98	64.60 ± 1.70	62.40 ± 1.25
H	2000	16	58.92 ± 1.37	59.43 ± 1.40	60.29 ± 1.59	59.55 ± 0.40
I	2000	12	56.41 ± 1.20	57.29 ± 1.45	59.19 ± 1.63	57.63 ± 0.67
Overall means			66.05 ± 1.95	66.77 ± 1.86	68.09 ± 1.93	66.97 ± 1.87

SC : Between groups (P<0.01)
Between periods -NS

CB : Between groups (P<0.01)
Between periods (P<0.01)

Table 19.9

Sumarized data on digestibility coefficient of Cellulose in the nine experimental rations obtained from the metabolism trials conducted during 8th, 16th and 24th week of experiment in Soviet Chinchilla and Cross bred rabbits

Ration	DE kcal/kg	CP %	8th week	16th week	24th week	Overall Means
SOVIET CHINCHILLA						
A	3000	20	38.00 ± 1.54	40.41 ± 1.26	40.88 ± 1.78	39.78 ± 0.90
B	3000	16	33.75 ± 1.97	34.95 ± 1.83	35.76 ± 1.85	34.82 ± 0.58
C	3000	12	29.24 ± 2.17	30.20 ± 0.32	34.52 ± 1.41	31.32 ± 1.63
D	2500	20	28.98 ± 2.02	35.24 ± 0.38	36.98 ± 1.88	33.73 ± 2.43
E	2500	16	28.83 ± 1.01	31.12 ± 0.43	33.77 ± 1.26	31.24 ± 1.43
F	2500	12	27.39 ± 1.59	30.19 ± 0.17	29.71 ± 1.57	29.10 ± 0.87
G	2000	20	25.99 ± 2.11	26.90 ± 0.51	27.39 ± 1.73	26.76 ± 0.33
H	2000	16	23.16 ± 1.50	24.89 ± 0.60	27.44 ± 1.47	25.16 ± 1.24
I	2000	12	21.60 ± 1.93	24.35 ± 1.83	25.02 ± 2.02	23.66 ± 1.05
Overall means			**28.55 ± 1.58**	**30.92 ± 1.66**	**32.39 ± 1.65**	**30.62 ± 1.70**
CROSS BRED						
A	3000	20	38.10 ± 2.03	40.51 ± 1.63	41.89 ± 1.05	40.17 ± 1.10
B	3000	16	34.09 ± 1.65	35.28 ± 1.55	36.10 ± 1.77	35.16 ± 0.58
C	3000	12	30.15 ± 1.39	31.77 ± 1.88	34.87 ± 1.28	32.26 ± 1.39
D	2500	20	29.14 ± 1.78	32.46 ± 1.46	37.06 ± 1.45	32.89 ± 2.30
E	2500	16	28.76 ± 1.61	31.48 ± 1.76	34.11 ± 1.15	31.45 ± 1.55
F	2500	12	27.94 ± 1.43	36.62 ± 1.11	30.89 ± 1.86	31.82 ± 2.60
G	2000	20	26.33 ± 2.10	27.41 ± 1.26	28.16 ± 1.74	27.30 ± 0.53
H	2000	16	23.28 ± 1.95	24.73 ± 1.81	27.68 ± 1.66	25.23 ± 0.58
I	2000	12	22.00 ± 1.84	24.91 ± 1.44	25.47 ± 1.49	24.13 ± 1.08
Overall means			**28.87 ± 1.57**	**31.69 ± 1.68**	**32.91 ± 1.76**	**31.16 ± 1.58**

SC : Between groups ($P<0.01$)
Between periods ($P<0.01$)

CB : Between groups ($P<0.01$)
Between periods ($P<0.01$)

Table 20

Consolidated data on Nitrogen balance during the first, second and third metabolism trial conducted during the 8th, 16th and 24th week of experiment in Soviet Chinchilla rabbits

Period of experiment	Ration	Dry matter intake (g/day)	Nitrogen intake (g/day)	Nitrogen excretion (g/day)			Nitrogen retention	
				Urine	Feces	Total excretion (g/day)	(g/day)	% of Intake
A 8th Week	A	138.90 ± 1.10	4.48 ± 0.05	1.00 ± 0.03	1.22 ± 0.01	2.22 ± 0.03	2.26 ± 0.03	50.43 ± 0.58^{b}
	B	143.90 ± 1.68	3.72 ± 0.02	0.95 ± 0.04	1.13 ± 0.02	2.08 ± 0.03	1.64 ± 0.02	44.09 ± 0.55^{a}
	C	144.10 ± 1.54	2.83 ± 0.04	0.47 ± 0.03	1.19 ± 0.05	1.66 ± 0.04	1.17 ± 0.06	41.31 ± 0.84^{c}
	D	138.20 ± 1.46	4.52 ± 0.04	1.11 ± 0.02	1.36 ± 0.03	2.47 ± 0.01	2.05 ± 0.04	45.35 ± 0.53^{d}
	E	139.70 ± 1.19	3.64 ± 0.05	0.71 ± 0.03	1.33 ± 0.02	2.04 ± 0.03	1.60 ± 0.03	43.93 ± 0.18^{i}
	F	134.90 ± 1.63	2.64 ± 0.04	0.55 ± 0.03	1.13 ± 0.02	1.68 ± 0.04	0.96 ± 0.06	36.36 ± 0.47^{e}
	G	107.80 ± 1.41	3.51 ± 0.05	1.21 ± 0.02	1.31 ± 0.03	2.52 ± 0.01	0.99 ± 0.02	28.23 ± 0.58^{f}
	H	113.30 ± 1.63	2.95 ± 0.06	0.91 ± 0.03	1.41 ± 0.02	2.32 ± 0.02	0.63 ± 0.02	21.37 ± 0.14^{g}
	I	110.30 ± 1.98	2.17 ± 0.05	0.55 ± 0.03	1.17 ± 0.04	1.72 ± 0.04	0.45 ± 0.02	20.73 ± 0.89^{g}
B 16th Week	A	207.60 ± 2.05	6.70 ± 0.06	2.17 ± 0.02	1.50 ± 0.03	3.67 ± 0.04	3.03 ± 0.06	45.22 ± 0.62
	B	199.30 ± 1.73	5.15 ± 0.05	1.76 ± 0.06	1.32 ± 0.04	3.08 ± 0.05	2.07 ± 0.02	40.19 ± 0.28^{a}
	C	204.80 ± 1.81	4.03 ± 0.06	1.08 ± 0.05	1.44 ± 0.03	2.52 ± 0.04	1.51 ± 0.04	37.47 ± 0.67^{b}
	D	198.40 ± 2.15	6.49 ± 0.07	2.08 ± 0.03	1.76 ± 0.04	3.84 ± 0.03	2.65 ± 0.06	40.83 ± 0.98^{a}
	E	203.30 ± 2.01	5.29 ± 0.05	1.56 ± 0.03	1.70 ± 0.05	3.26 ± 0.06	2.03 ± 0.03	38.37 ± 0.19^{b}
	F	172.50 ± 1.95	3.38 ± 0.05	0.89 ± 0.02	1.32 ± 0.03	2.21 ± 0.04	1.17 ± 0.03	34.62 ± 0.76^{d}
	G	166.70 ± 1.68	5.43 ± 0.05	2.10 ± 0.03	1.84 ± 0.03	3.94 ± 0.04	1.49 ± 0.02	27.44 ± 0.33^{e}
	H	140.30 ± 1.84	3.65 ± 0.04	1.33 ± 0.02	1.51 ± 0.04	2.84 ± 0.03	0.81 ± 0.01	22.19 ± 0.14^{f}
	I	134.50 ± 1.77	2.65 ± 0.06	0.76 ± 0.03	1.38 ± 0.02	1.07 ± 0.02	0.51 ± 0.04	19.25 ± 0.68^{g}
C 24th Week	A	219.40 ± 1.85	7.08 ± 0.04	2.65 ± 0.02	1.45 ± 0.03	4.10 ± 0.05	2.98 ± 0.04	42.09 ± 0.83^{b}
	B	214.90 ± 1.91	5.55 ± 0.06	2.04 ± 0.03	1.37 ± 0.02	3.41 ± 0.03	2.14 ± 0.05	38.58 ± 0.04^{c}
	C	197.90 ± 2.03	3.89 ± 0.07	1.28 ± 0.02	1.24 ± 0.04	2.52 ± 0.03	1.37 ± 0.03	35.22 ± 0.22^{a}
	D	210.30 ± 2.05	6.87 ± 0.06	2.45 ± 0.03	1.85 ± 0.04	4.30 ± 0.04	2.57 ± 0.01	37.41 ± 0.18^{d}
	E	206.80 ± 1.97	5.38 ± 0.04	1.79 ± 0.02	1.69 ± 0.03	3.48 ± 0.04	1.90 ± 0.03	35.31 ± 0.50^{a}
	F	169.20 ± 2.13	3.31 ± 0.05	1.04 ± 0.03	1.20 ± 0.04	2.24 ± 0.02	1.07 ± 0.03	32.33 ± 0.56^{e}
	G	182.60 ± 1.38	5.95 ± 0.04	2.77 ± 0.02	1.91 ± 0.04	4.68 ± 0.03	1.27 ± 0.02	21.35 ± 0.43^{f}
	H	142.90 ± 1.81	3.72 ± 0.03	1.58 ± 0.02	1.41 ± 0.03	2.99 ± 0.04	0.73 ± 0.03	19.62 ± 0.25^{g}
		136.00 ± 1.29	2.68 ± 0.03	0.87 ± 0.05	1.39 ± 0.02	2.26 ± 0.03	0.42 ± 0.04	15.67 ± 0.57^{h}

Values bearing different superscripts in the same column within the period differ significantly ($P<0.01$)
ABC significantly different between periods ($P<0.01$)

Table 21

Consolidated data on Nitrogen balance from the first, second and third metabolism trial conducted during the 8th, 16th and 24th week of experiment in Cross bred rabbits

Period of experiment	Ration	Dry matter intake (g/day)	Nitrogen intake (g/day)	Nitrogen outgo (g/day)			Nitrogen retention	
				Urine	Feces	Total outgo (g/day)	(g/day)	% of intake
8th Week^{A}	A	131.55 ± 1.43	4.25 ± 0.05	0.95 ± 0.05	1.15 ± 0.04	2.10 ± 0.02	2.15 ± 0.06	50.62 ± 0.93^{b}
	B	138.00 ± 1.75	3.56 ± 0.03	0.94 ± 0.02	1.04 ± 0.02	1.98 ± 0.01	1.58 ± 0.03	44.38 ± 0.60^{a}
	C	119.84 ± 1.70	2.36 ± 0.04	0.44 ± 0.02	0.94 ± 0.01	1.38 ± 0.01	0.98 ± 0.02	41.56 ± 0.76^{c}
	D	144.18 ± 1.64	4.71 ± 0.02	1.22 ± 0.03	1.32 ± 0.04	2.54 ± 0.05	2.17 ± 0.07	46.08 ± 1.36^{a}
	E	138.25 ± 1.97	3.60 ± 0.10	0.71 ± 0.02	1.30 ± 0.08	2.01 ± 0.06	1.59 ± 0.03	44.20 ± 1.52^{d}
	F	128.26 ± 2.29	2.51 ± 0.03	0.55 ± 0.03	1.03 ± 0.01	1.58 ± 0.04	0.93 ± 0.03	37.03 ± 1.08^{e}
	G	126.48 ± 1.73	4.12 ± 0.05	1.53 ± 0.04	1.38 ± 0.02	2.91 ± 0.03	1.21 ± 0.01	29.37 ± 0.31^{f}
	H	118.46 ± 1.28	3.08 ± 0.03	1.18 ± 0.11	1.21 ± 0.09	2.39 ± 0.05	0.69 ± 0.04	22.39 ± 1.18^{g}
	I	105.97 ± 1.78	2.09 ± 0.04	0.65 ± 0.05	1.00 ± 0.02	1.65 ± 0.03	0.44 ± 0.04	21.03 ± 1.54^{h}
16th Week^{B}	A	210.21 ± 1.80	6.78 ± 0.06	2.27 ± 0.07	1.39 ± 0.04	3.66 ± 0.04	3.12 ± 0.03	46.03 ± 0.53^{b}
	B	217.18 ± 1.93	5.61 ± 0.05	1.99 ± 0.06	1.31 ± 0.05	3.30 ± 0.02	2.31 ± 0.52	41.22 ± 0.34^{a}
	C	202.67 ± 1.11	3.99 ± 0.02	1.07 ± 0.03	1.42 ± 0.02	2.49 ± 0.03	1.50 ± 0.03	37.69 ± 0.62^{c}
	D	200.11 ± 1.75	6.54 ± 0.04	2.18 ± 0.04	1.67 ± 0.03	3.85 ± 0.03	2.69 ± 0.05	41.11 ± 0.63^{a}
	E	224.63 ± 1.36	5.85 ± 0.03	1.75 ± 0.05	1.82 ± 0.02	3.57 ± 0.05	2.28 ± 0.02	39.03 ± 0.51^{e}
	F	210.49 ± 1.86	4.12 ± 0.06	1.29 ± 0.06	1.40 ± 0.07	2.69 ± 0.03	1.43 ± 0.04	34.72 ± 0.90^{f}
	G	175.00 ± 1.93	5.70 ± 0.07	2.35 ± 0.04	1.75 ± 0.03	4.10 ± 0.02	1.60 ± 0.02	28.08 ± 0.30^{g}
	H	176.55 ± 1.01	4.59 ± 0.03	1.93 ± 0.05	1.62 ± 0.03	3.55 ± 0.04	1.04 ± 0.02	22.66 ± 0.55^{h}
	I	149.18 ± 1.08	2.94 ± 0.02	0.95 ± 0.06	1.40 ± 0.05	2.35 ± 0.03	0.59 ± 0.02	20.07 ± 0.66^{d}
24th Week^{C}	A	187.50 ± 1.84	6.05 ± 0.06	2.31 ± 0.09	1.18 ± 0.07	3.49 ± 0.04	2.56 ± 0.05	42.29 ± 0.79^{a}
	B	199.68 ± 1.09	5.16 ± 0.03	1.98 ± 0.10	1.17 ± 0.05	3.15 ± 0.03	2.01 ± 0.01	38.96 ± 0.29^{b}
	C	231.13 ± 1.03	4.54 ± 0.02	1.47 ± 0.04	1.43 ± 0.04	2.90 ± 0.04	1.64 ± 0.03	36.11 ± 0.74^{c}
	D	172.13 ± 1.54	5.63 ± 0.05	2.09 ± 0.07	1.41 ± 0.05	3.52 ± 0.03	2.11 ± 0.04	37.47 ± 0.67^{h}
	E	202.61 ± 1.77	5.27 ± 0.04	1.78 ± 0.02	1.61 ± 0.03	3.38 ± 0.02	1.89 ± 0.01	35.88 ± 0.26^{d}
	F	152.13 ± 1.78	2.98 ± 0.05	1.01 ± 0.03	0.99 ± 0.02	2.00 ± 0.03	0.98 ± 0.02	32.92 ± 0.87^{e}
	G	162.78 ± 1.69	5.30 ± 0.04	2.52 ± 0.05	1.61 ± 0.05	4.13 ± 0.01	1.17 ± 0.03	22.06 ± 0.45^{f}
	H	155.64 ± 1.46	4.05 ± 0.06	1.83 ± 0.07	1.41 ± 0.08	3.24 ± 0.03	0.81 ± 0.02	20.00 ± 0.50^{g}
	I	160.19 ± 1.91	3.16 ± 0.05	1.16 ± 0.07	1.49 ± 0.05	2.65 ± 0.03	0.51 ± 0.02	16.17 ± 0.61^{i}

Values bearing different superscripts in the same column within the period differ significantly ($P<0.01$)
ABC significantly different between periods.

Table 22

Consolidated data on calcium balance from the first, second and third metabolism trial conducted during the 8th, 16th and 24th week of experiment in Soviet Chinchilla rabbits

Period of experiment	Ration	Dry matter intake (g/day)	Calcium intake (g/day)	Calcium Excretion (g/day)			Calcium Retention	
				Urine	Feces	Total excretion (g/day)	(g/day)	% of Intake
A 8th Week	A	138.90 ± 1.10	1.04 ± 0.03	0.404 ± 0.02	0.505 ± 0.02	0.909 ± 0.02	0.57 ± 0.05	54.82 ± 0.10^{a}
	B	143.90 ± 1.68	1.19 ± 0.02	0,088 ± 0.03	0.462 ± 0.05	0.550 ± 0.04	0.64 ± 0.06	53.78 ± 0.20$^{a, b}$
	C	144.1 ± 1.54	1.28 ± 0.03	0.112 ± 0.04	0.502 ± 0.06	0.614 ± 0.05	0.67 ± 0.01	52.34 ± 0.40^{b}
	D	138.2 ± 1.46	1.59 ± 0.04	0.108 ± 0.05	0.612 ± 0.02	0.72 ± 0.04	0.87 ± 0.04	54.72 ± 0.30^{a}
	E	139.70 ± 1.19	1.45 ± 0.05	0.156 ± 0.02	0.566 ± 0.03	0.722 ± 0.05	0.73 ± 0.03	50.35 ± 0.49^{c}
	F	134.90 ± 1.63	1.34 ± 0.06	0.170 ± 0.05	0.502 ± 0.02	0.672 ± 0.04	0.66 ± 0.06	49.25 ± 0.50^{c}
	G	107.80 ± 1.41	0.93 ± 0.04	0.076 ± 0.02	0.418 ± 0.05	0.494 ± 0.03	0.43 ± 0.07	46.26 ± 0.43^{d}
	H	113.3 ± 1.63	1.03 ± 0.05	0.042 ± 0.03	0.522 ± 0.06	0.564 ± 0.07	0.47 ± 0.05	45.63 ± 0.57^{d}
	I	110.3 ± 1.98	1.00 ± 0.03	0.046 ± 0.04	0.518 ± 0.03	0.564 ± 0.04	0.44 ± 0.08	44.00 ± 0.74^{e}
B 16th Week	A	207.60 ± 2.05	1.56 ± 0.04	0.140 ± 0.06	0.596 ± 0.04	0.736 ± 0.08	0.82 ± 0.06	52.53 ± 0.69^{a}
	B	199.30 ± 1.73	1.65 ± 0.05	0.160 ± 0.02	0.638 ± 0.03	0.798 ± 0.04	0.86 ± 0.07	52.13 ± 0.78^{a}
	C	204.80 ± 1.81	1.82 ± 0.03	0.218 ± 0.02	0.714 ± 0.04	0.932 ± 0.03	0.89 ± 0.06	48.90 ± 0.29^{b}
	D	198.40 ± 2.15	2.28 ± 0.06	0.234 ± 0.03	0.878 ± 0.05	1.112 ± 0.05	1.17 ± 0.04	51.27 ± 0.45$^{a, c}$
	E	203.30 ± 2.01	2.11 ± 0.04	0.250 ± 0.05	0.812 ± 0.03	1.062 ± 0.04	1.05 ± 0.07	49.77 ± 0.60$^{b, c}$
	F	172.50 ± 1.95	1.71 ± 0.06	0.28 ± 0.03	0.666 ± 0.02	0.946 ± 0.05	0.76 ± 0.04	44.45 ± 0.38^{d}
	G	166.70 ± 1.68	1.43 ± 0.04	0.132 ± 0.03	0.722 ± 0.05	0.854 ± 0.06	0.58 ± 0.07	40.56 ± 0.61^{e}
	H	140.30 ± 1.84	1.28 ± 0.02	0.120 ± 0.04	0.65 ± 0.03	0.77 ± 0.04	0.51 ± 0.05	39.85 ± 0.40^{e}
	I	134.50 ± 1.77	1.22 ± 0.05	0.18 ± 0.03	0.634 ± 0.04	0.814 ± 0.07	0.41 ± 0.04	33.62 ± 0.73^{f}
C 24th Week	A	219.40 ± 1.85	1.65 ± 0.05	0.39 ± 0.02	0.632 ± 0.06	1.022 ± 0.05	0.63 ± 0.03 a	38.18 ± 0.29^{a}
	B	214.90 ± 1.91	1.78 ± 0.04	0.418 ± 0.03	0.708 ± 0.05	1.126 ± 0.04	0.66 ± 0.06 b	37.07 ± 0.33$^{a, b}$
	C	197.90 ± 2.03	1.76 ± 0.06	0.434 ± 0.04	0.70 ± 0.03	1.134 ± 0.08	0.63 ± 0.03 c	35.80 ± 0.71$^{b, c}$
	D	210.30 ± 2.05	2.42 ± 0.03	0.430 ± 0.05	1.116 ± 0.04	1.546 ± 0.06	0.87 ± 0.07	35.96 ± 0.38$^{b, c}$
	E	206.80 ± 1.97	2.15 ± 0.05	0.438 ± 0.04	0.948 ± 0.06	1.386 ± 0.07	0.76 ± 0.04	35.35 ± 0.90$^{c, d}$
	F	169.20 ± 2.13	1.674 ± 0.04	0.442 ± 0.05	0.662 ± 0.03	1.104 ± 0.05	0.57 ± 0.05	34.15 ± 0.67$^{d, e}$
	G	182.60 ± 1.38	1.57 ± 0.06	0.238 ± 0.07	0.800 ± 0.03	1.038 ± 0.06	0.53 ± 0.05	33.76 ± 0.46^{e}
	H	142.90 ± 1.81	1.30 ± 0.05	0.232 ± 0.03	0.658 ± 0.07	0.89 ± 0.05	0.41 ± 0.06	31.54 ± 0.52^{f}
	I	137.60 ± 1.29	1.25 ± 0.07	0.232 ± 0.05	0.636 ± 0.06	0.87 ± 0.03	0.38 ± 0.07	30.40 ± 0.60^{f}

Values bearing different superscripts in the same column within the period differ significantly ($P<0.01$)
ABC significantly different between periods

Table 23

Consolidated data on Calcium balance of Cross Bred rabbits from the first, second and third metabolism trial conducted during the 8th, 16th and 24th week of experiment

Period of Experiment	Ration	Dry matter intake (g/day)	Calcium intake (g/day)	Calcium Excretion (g/day)			Calcium Retention	
				Urine	Feces	Total excretion (g/day)	(g/day)	% retention
A 8th Week	A	131.55 ± 1.43	0.99 ± 0.04	0.14 ± 0.03	0.30 ± 0.02	0.44 ± 0.04	0.55 ± 0.05	55.85 ± 0.67^{a}
	B	138.00 ± 1.75	1.15 ± 0.05	0.18 ± 0.02	0.35 ± 0.03	0.53 ± 0.06	0.62 ± 0.07	54.16 ± 0.73^{b}
	C	119.84 ± 1.70	1.07 ± 0.03	0.18 ± 0.04	0.32 ± 0.03	0.50 ± 0.05	0.57 ± 0.04	53.41 ± 0.55^{c}
	D	144.18 ± 1.64	1.66 ± 0.04	0.25 ± 0.03	0.50 ± 0.02	0.75 ± 0.04	0.91 ± 0.06	54.91 ± 0.69^{d}
	E	138.25 ± 1.97	1.44 ± 0.05	0.28 ± 0.06	0.43 ± 0.03	0.71 ± 0.07	0.73 ± 0.05	50.70 ± 0.42^{e}
	F	128.26 ± 2.29	1.27 ± 0.07	0.07 ± 0.03	0.57 ± 0.04	0.64 ± 0.05	0.63 ± 0.08	49.66 ± 0.91^{f}
	G	126.48 ± 1.73	1.09 ± 0.04	0.08 ± 0.06	0.50 ± 0.02	0.58 ± 0.07	0.51 ± 0.03	47.01 ± 0.63^{g}
	H	118.46 ± 1.28	1.08 ± 0.02	0.08 ± 0.04	0.51 ± 0.03	0.59 ± 0.04	0.49 ± 0.06	45.49 ± 0.54^{h}
	I	105.97 ± 1.78	0.96 ± 0.03	0.17 ± 0.02	0.36 ± 0.04	0.53 ± 0.05	0.43 ± 0.07	44.61 ± 0.71^{i}
B 16thWeek	A	210.21 ± 1.80	1.58 ± 0.05	0.08 ± 0.05	0.66 ± 0.03	0.74 ± 0.04	0.84 ± 0.06	53.34 ± 0.85^{a}
	B	217.18 ± 1.93	1.80 ± 0.06	0.06 ± 0.04	0.79 ± 0.02	0.85 ± 0.05	0.95 ± 0.08	52.71 ± 0.97^{a}
	C	202.67 ± 1.11	1.80 ± 0.04	0.25 ± 0.06	0.65 ± 0.03	0.90 ± 0.04	0.90 ± 0.06	49.93 ± 0.62^{c}
	D	200.11 ± 1.75	2.30 ± 0.06	0.30 ± 0.03	0.81 ± 0.05	1.11 ± 0.05	1.19 ± 0.07	51.69 ± 0.83^{d}
	E	224.63 ± 1.36	2.34 ± 0.03	0.09 ± 0.04	1.08 ± 0.07	1.17 ± 0.04	1.17 ± 0.02	50.17 ± 0.29^{c}
	F	210.49 ± 1.86	2.08 ± 0.05	0.25 ± 0.06	0.89 ± 0.04	1.14 ± 0.03	0.94 ± 0.04	45.14 ± 0.38^{f}
	G	175.00 ± 1.93	1.51 ± 0.02	0.41 ± 0.04	0.48 ± 0.05	0.89 ± 0.06	0.62 ± 0.05	41.27 ± 0.45^{g}
	H	176.55 ± 1.01	1.61 ± 0.05	0.43 ± 0.03	0.53 ± 0.04	0.96 ± 0.04	0.65 ± 0.06	40.50 ± 0.53^{h}
	I	149.18 ± 1.08	1.36 ± 0.03	0.27 ± 0.04	0.63 ± 0.02	0.90 ± 0.05	0.46 ± 0.04	33.89 ± 0.68^{i}
C 24th Week	A	187.50 ± 1.84	1.41 ± 0.07	0.24 ± 0.02	0.62 ± 0.03	0.86 ± 0.03	0.55 ± 0.05	39.15 ± 0.31^{b}
	B	199.68 ± 1.09	1.66 ± 0.03	0.33 ± 0.04	0.71± 0.05	1.04 ± 0.04	0.62 ± 0.06	37.41 ± 0.47^{c}
	C	231.13 ± 1.03	2.06 ± 0.05	0.45 ± 0.07	0.87 ± 0.02	1.32 ± 0.03	0.74 ± 0.07	35.92 ± 0.35^{a}
	D	172.13 ± 1.54	1.98 ± 0.04	0.41 ± 0.03	0.85 ± 0.04	1.26 ± 0.05	0.72 ± 0.04	36.36 ± 0.26^{a}
	E	202.61 ± 1.77	2.11 ± 0.04	0.48 ± 0.04	0.87 ± 0.03	1.35 ± 0.06	0.76 ± 0.04	36.06 ± 0.58^{a}
	F	152.13 ± 1.78	1.51 ± 0.05	0.35 ± 0.06	0.63 ± 0.02	0.98 ± 0.04	0.53 ± 0.03	35.10 ± 0.73^{d}
	G	162.78 ± 1.69	1.40 ± 0.04	0.36 ± 0.03	0.56 ± 0.07	0.92 ± 0.05	0.48 ± 0.06	34.29 ± 0.51^{e}
	H	155.64 ± 1.46	1.42 ± 0.03	0.42 ± 0.06	0.55 ± 0.03	0.97 ± 0.04	0.45 ± 0.05	31.75 ± 0.43^{f}
	I	160.19 ± 1.91	1.46 ± 0.06	0.46 ± 0.04	0.55 ± 0.05	1.01 ± 0.04	0.45 ± 0.07	30.88 ± 0.64^{g}

Values bearing different superscripts in the same column within the period differ significantly ($P < 0.01$)

ABC significantly different between periods ($P < 0.01$)

Table 24

Consolidated data on Phosphorus balance of Soviet Chinchilla rabbits from the first, second and third metabolism trial conducted during the 8th, 16th and 24th week of experiment

Period of Experiment	Ration	Dry matter intake (g/day)	Phosphorus intake (g/day)	Phosphorus Excretion (g/day)			Phosphorus Retention	
				Urine	Feces	Total excretion (g/day)	(g/day)	% of Intake
A 8th Week	A	138.9 ± 1.10	0.96 ± 0.04	0.03 ± 0.03	0.34 ± 0.05	0.37 ± 0.02	0.59 ± 0.01	61.47 ± 0.71 [a]
	B	143.9 ± 1.68	1.01 ± 0.03	0.04 ± 0.04	0.38 ± 0.02	0.42 ± 0.03	0.59 ± 0.05	58.42 ± 0.63 [a, b]
	C	144.10 ± 1.54	0.88 ± 0.04	0.04 ± 0.02	0.34 ± 0.03	0.38 ± 0.04	0.50 ± 0.06	56.85 ± 0.49 [b, c]
	D	138.20 ± 1.46	1.12 ± 0.05	0.04 ± 0.03	0.41 ± 0.06	0.45 ± 0.02	0.67 ± 0.03	59.82 ± 0.54 [a, c]
	E	139.70 ± 1.19	1.12 ± 0.03	0.06 ± 0.04	0.40 ± 0.02	0.46 ± 0.03	0.66 ± 0.04	58.93 ± 0.49 [a, c]
	F	134.90 ± 1.63	1.01 ± 0.03	0.05 ± 0.02	0.37 ± 0.03	0.42 ± 0.04	0.59 ± 0.06	58.42 ± 0.55 [b, c]
	G	107.8 ± 1.41	0.68 ± 0.04	0.15 ± 0.03	0.33 ± 0.05	0.47 ± 0.06	0.21 ± 0.03	30.88 ± 0.29 [d]
	H	113.30 ± 1.63	0.73 ± 0.05	0.16 ± 0.02	0.36 ± 0.03	0.52 ± 0.04	0.21 ± 0.05	28.81 ± 0.48 [d]
	I	110.30 ± 1.98	0.73 ± 0.06	0.18 ± 0.05	0.35 ± 0.03	0.53 ± 0.02	0.20 ± 0.03	27.41 ± 0.91 [d]
B 16th Week	A	207.60 ± 2.05	1.43 ± 0.03	0.10 ± 0.02	0.53 ± 0.04	0.63 ± 0.05	0.80 ± 0.02	55.94 ± 0.67 [a]
	B	199.30 ± 1.73	1.40 ± 0.02	0.10 ± 0.01	0.53 ± 0.03	0.63 ± 0.04	0.77 ± 0.03	55.00 ± 0.54 [a]
	C	204.80 ± 1.81	1.25 ± 0.09	0.11 ± 0.03	0.47 ± 0.05	0.58 ± 0.06	0.67 ± 0.07	53.60 ± 0.73 [a, b]
	D	198.40 ± 2.15	1.61 ± 0.07	0.12 ± 0.04	0.68 ± 0.02	0.80 ± 0.05	0.81 ± 0.86	50.31 ± 0.66 [b]
	E	203.30 ± 2.01	1.63 ± 0.04	0.14 ± 0.03	0.68 ± 0.07	0.82 ± 0.04	0.81 ± 0.02	49.70 ± 0.82 [b]
	F	172.50 ± 1.95	1.29 ± 0.03	0.16 ± 0.05	0.49 ± 0.03	0.64 ± 0.05	0.64 ± 0.06	49.61 ± 0.75 [b]
	G	166.70 ± 1.68	1.05 ± 0.02	0.18 ± 0.03	0.54 ± 0.04	0.72 ± 0.06	0.33 ± 0.05	31.43 ± 0.62 [c]
	H	140.30 ± 1.84	0.90 ± 0.04	0.19 ± 0.05	0.43 ± 0.06	0.62 ± 0.02	0.28 ± 0.07	31.11 ± 0.98 [c]
	I	134.50 ± 1.77	0.89 ± 0.05	0.23 ± 0.04	0.40 ± 0.03	0.63 ± 0.06	0.26 ± 0.02	29.21 ± 0.78 [c]
C 24th Week	A	219.40 ± 1.85	1.51 ± 0.04	0.28 ± 0.05	0.59 ± 0.02	0.87 ± 0.07	0.64 ± 0.03	42.39 ± 0.61 [a]
	B	214.90 ± 1.91	1.50 ± 0.05	0.31 ± 0.06	0.56 ± 0.04	0.87 ± 0.03	0.63 ± 0.04	42.00 ± 0.60 [a]
	C	197.90 ± 2.03	1.20 ± 0.04	0.32 ± 0.02	0.38 ± 0.05	0.70 ± 0.04	0.50 ± 0.83	41.67 ± 0.57 [a, b]
	D	210.30 ± 2.05	1.70 ± 0.03	0.34 ± 0.04	0.68 ± 0.03	1.02 ± 0.07	0.68 ± 0.05	40.00 ± 0.68 [a, c]
	E	206.80 ± 1.97	1.65 ± 0.05	0.35 ± 0.05	0.66 ± 0.06	1.01 ± 0.04	0.64 ± 0.06	38.79 ± 0.79 [a, c]
	F	169.20 ± 2.13	1.27 ± 0.06	0.36 ± 0.03	0.44 ± 0.07	0.80 ± 0.05	0.47 ± 0.03	37.01 ± 0.81 [b, c]
	G	182.60 ± 1.38	1.15 ± 0.02	0.33 ± 0.04	0.49 ± 0.05	0.82 ± 0.03	0.33 ± 0.04	28.70 ± 0.48 [d]
	H	142.90 ± 1.81	0.91 ± 0.04	0.25 ± 0.03	0.41 ± 0.04	0.66 ± 0.07	0.26 ± 0.05	28.57 ± 0.51 [d]
	I	137.60 ± 1.29	0.90 ± 0.05	0.26 ± 0.04	0.39 ± 0.05	0.65 ± 0.04	0.25 ± 0.06	27.78 ± 0.49 [d]

Values bearing different superscripts in the same column within the period differ significantly ($P<0.01$)

ABC significantly different between periods ($P<0.01$)

Table 25

Consolidated data on Phosphorus balance of Cross Bred rabbits from the first, second and third metabolism trial conducted during the 8th, 16th and 24th week of experiment

Period of Experiment	Ration	Dry matter intake (g/day)	Phosphorus intake (g/day)	Phosphorus excretion (g/day)			Phosphorus Retention	
				Urine	Feces	Total excretion (g/day)	(g/day)	% of Intake
A 8th Week	A	131.55 ± 1.43	0.91 ± 0.04	0.07 ± 0.06	0.27 ± 0.02	0.34 ± 0.05	0.57 ± 0.03	62.72 ± 0.75^{b}
	B	138.00 ± 1.75	0.97 ± 0.05	0.09 ± 0.03	0.31 ± 0.02	0.40 ± 0.04	0.57 ± 0.04	59.18 ± 0.69^{a}
	C	119.84 ± 1.70	0.73 ± 0.03	0.10 ± 0.04	0.21 ± 0.03	0.31 ± 0.05	0.42 ± 0.02	57.36 ± 0.60^{c}
	D	144.18 ± 1.64	1.17 ± 0.04	0.06 ± 0.05	0.41 ± 0.03	0.47 ± 0.04	0.70 ± 0.05	59.96 ± 0.51^{a}
	E	138.25 ± 1.97	1.10 ± 0.06	0.05 ± 0.03	0.40 ± 0.04	0.45 ± 0.05	0.65 ± 0.02	59.05 ± 0.48^{a} d
	F	128.26 ± 2.29	0.96 ± 0.07	0.11 ± 0.04	0.32 ± 0.03	0.43 ± 0.05	0.53 ± 0.03	55.27 ± 0.51^{d}
	G	126.48 ± 1.73	0.80 ± 0.04	0.27 ± 0.05	0.28 ± 0.03	0.55 ± 0.04	0.25 ± 0.07	31.36 ± 0.77^{e}
	H	118.46 ± 1.28	0.76 ± 0.02	0.28 ± 0.04	0.26 ± 0.04	0.54 ± 0.05	0.22 ± 0.03	29.04 ± 0.59^{f}
	I	105.97 ± 1.78	0.70 ± 0.04	0.26 ± 0.03	0.25 ± 0.05	0.51 ± 0.06	0.19 ± 0.04	27.26 ± 0.70^{g}
B 16th Week	A	207.60 ± 2.05	1.43 ± 0.03	0.10 ± 0.02	0.53 ± 0.04	0.63 ± 0.05	0.80 ± 0.02	55.94 ± 0.67^{a}
	B	199.30 ± 1.73	1.40 ± 0.02	0.10 ± 0.01	0.53 ± 0.03	0.63 ± 0.04	0.77 ± 0.03	55.00 ± 0.54^{a}
	C	204.80 ± 1.81	1.25 ± 0.09	0.11 ± 0.03	0.47 ± 0.05	0.58 ± 0.06	0.67 ± 0.07	$53.60 \pm 0.73^{a, b}$
	D	198.40 ± 2.15	1.61 ± 0.07	0.12 ± 0.04	0.68 ± 0.02	0.80 ± 0.05	0.81 ± 0.86	50.31 ± 0.66^{b}
	E	203.30 ± 2.01	1.63 ± 0.04	0.14 ± 0.03	0.68 ± 0.07	0.82 ± 0.04	0.81 ± 0.02	49.70 ± 0.82^{b}
	F	172.50 ± 1.95	1.29 ± 0.03	0.16 ± 0.05	0.49 ± 0.03	0.64 ± 0.05	0.64 ± 0.06	49.61 ± 0.75^{b}
	G	166.70 ± 1.68	1.05 ± 0.02	0.18 ± 0.03	0.54 ± 0.04	0.72 ± 0.06	0.33 ± 0.05	31.43 ± 0.62^{c}
	H	140.30 ± 1.84	0.90 ± 0.04	0.19 ± 0.05	0.43 ± 0.06	0.62 ± 0.02	0.28 ± 0.07	31.11 ± 0.98^{c}
	I	134.50 ± 1.77	0.89 ± 0.05	0.23 ± 0.04	0.40 ± 0.03	0.63 ± 0.06	0.26 ± 0.02	29.21 ± 0.78^{c}
C 24th Week	A	219.40 ± 1.85	1.51 ± 0.04	0.28 ± 0.05	0.59 ± 0.02	0.87 ± 0.07	0.64 ± 0.03	42.39 ± 0.61^{a}
	B	214.90 ± 1.91	1.50 ± 0.05	0.31 ± 0.06	0.56 ± 0.04	0.87 ± 0.03	0.63 ± 0.04	42.00 ± 0.60^{a}
	C	197.90 ± 2.03	1.20 ± 0.04	0.32 ± 0.02	0.38 ± 0.05	0.70 ± 0.04	0.50 ± 0.83	$41.67 \pm 0.57^{a, b}$
	D	210.30 ± 2.05	1.70 ± 0.03	0.34 ± 0.04	0.68 ± 0.03	1.02 ± 0.07	0.68 ± 0.05	$40.00 \pm 0.68^{a, c}$
	E	206.80 ± 1.97	1.65 ± 0.05	0.35 ± 0.05	0.66 ± 0.06	1.01 ± 0.04	0.64 ± 0.06	$38.79 \pm 0.79^{a, c}$
	F	169.20 ± 2.13	1.27 ± 0.06	0.36 ± 0.03	0.44 ± 0.07	0.80 ± 0.05	0.47 ± 0.03	$37.01 \pm 0.81^{b, c}$
	G	182.60 ± 1.38	1.15 ± 0.02	0.33 ± 0.04	0.49 ± 0.05	0.82 ± 0.03	0.33 ± 0.04	28.70 ± 0.48^{d}
	H	142.90 ± 1.81	0.91 ± 0.04	0.25 ± 0.03	0.41 ± 0.04	0.66 ± 0.07	0.26 ± 0.05	28.57 ± 0.51^{d}
	I	137.60 ± 1.29	0.90 ± 0.05	0.26 ± 0.04	0.39 ± 0.05	0.65 ± 0.04	0.25 ± 0.06	27.78 ± 0.49^{d}

Values bearing different superscripts in the same column within the period differ significantly ($P < 0.01$)
ABC significantly different between periods ($P < 0.01$)

Table 26

Mean dressing percentage of Soviet Chinchilla rabbits maintained on different dietary regimes and slaughtered during 8th, 16th and 24th week of experiment

Ration	A	B	C	D	E	F	G	H	I
DE. kcal/kg		3000			2500			2000	
CP. per cent	20	16	12	20	16	12	20	16	12
8th week of experiment A									
Pre-slaughter weight (g)	1806.25 ± 2.17	1752.50 ± 1.32	1690.19 ± 0.09	1716.13 ± 1.92	1698.50 ± 1.44	1589.25 ± 1.75	1465.25 ± 1.93	1202.50 ± 2.10	955.50 ± 0.65
Dressed weight (g)	870.00 ± 2.50	834.00 ± 1.68	799.00 ± 4.33	814.00 ± 1.68	803.00 ± 2.86	745.00 ± 2.48	660.00 ± 4.49	530.00 ± 1.58	412.00 ± 1.22
Dressing percentage	a 48.17 ± 0.15	b 47.59 ± 0.08	b 47.27 ± 0.23	b 47.43 ± 0.06	b 47.30 ± 0.53	c 46.88 ± 0.39	d 45.04 ± 0.56	e 44.07 ± 0.33	f 43.12 ± 0.34
16th week of experiment B									
Pre-slaughter weight (g)	2805.00 ± 2.48	2790.00 ± 2.27	2541.50 ± 1.85	2694.50 ± 1.85	2642.00 ± 1.96	2070.25 ± 2.29	2088.25 ± 1.71	1669.50 ± 1.85	1350.00 ± 1.08
Dressed weight (g)	1594.00 ± 2.80	1582.00 ± 2.48	1387.00 ± 0.18	1486.00 ± 1.87	1398.00 ± 2.29	1040.00 ± 1.58	1042.00 ± 1.68	810.00 ± 1.96	629.00 ± 1.58
Dressing percentage	a 56.81 ± 0.14	a 56.70 ± 0.13	b 54.57 ± 0.18	c 55.15 ± 0.06	b 52.92 ± 0.12	d 50.24 ± 0.09	e 49.89 ± 0.07	f 48.52 ± 0.11	g 46.59 ± 0.13
24th week of experiment C									
Pre-slaughter weight (g)	3299.70 ± 4.62	3336.50 ± 3.07	2930.00 ± 1.84	3310.50 ± 2.85	3115.00 ± 2.52	2400.00 ± 4.85	2460.30 ± 3.71	1974.00 ± 3.16	1587.70 ± 3.12
Dressed weight (g)	1935.00 ± 2.38	1959.00 ± 1.68	1676.00 ± 0.10	1942.00 ± 1.22	1819.00 ± 0.91	1331.00 ± 1.68	1375.00 ± 1.58	990.00 ± 4.56	747.00 ± 2.20
Dressing percentage	a 58.64 ± 0.13	a 58.71 ± 0.10	c 57.20 ± 0.15	a 58.66 ± 0.17	a 58.40 ± 0.12	d 55.46 ± 0.16	e 55.89 ± 0.10	f 50.15 ± 0.31	g 47.05 ± 0.15

Values bearing different superscripts in the same row differ significantly (P<0.01)
A, B, C significantly different between periods (P<0.01)

Table 27

Mean dressing percentage of Cross bred rabbits maintained at different dietary regimes and slaughtered at 8th, 16th and 24th week of experiment

Ration	A	B	C	D	E	F	G	H	I
DE. kcal/kg	3000			2500			2000		
CP. per cent	20	16	12	20	16	12	20	16	12
8th week of experiment [A]									
Pre-slaughter weight (g)	1783.75 ± 1.75	1830.00 ± 4.69	1537.50 ± 3.12	1860.25 ± 2.39	1782.75 ± 1.93	1622.00 ± 2.16	1421.50 ± 1.94	1184.50 ± 3.66	990.75 ± 2.72
Dressed weight (g)	860.75 ± 1.84	882.50 ± 2,10	727.75 ± 2.39	900.50 ± 5.91	860.00 ± 4.30	766.75 ± 2.29	642.75 ± 2.06	530.75 ± 2.56	436.50 ± 2.33
Dressing percentage	48.26[a] ± 0.19	48.22[a] ± 0.12	47.34[c] ± 0.17	48.41[a] ± 0.28	48.24[a] ± 0.20	47.27[c] ± 0.14	45.22[b] ± 0.09	44.81[d] ± 0.20	44.06[e] ± 0.26
16th week of experiment [B]									
Pre-slaughter weight (g)	2968.50 ± 1.85	2997.00 ± 4.06	2610.50 ± 1.94	2940.50 ± 2.33	2913.25 ± 3.50	2401.50 ± 4.03	2078.00 ± 5.09	1838.00 ± 5.48	1450.75 ± 6.01
Dressed weight (g)	1722.00 ± 1.55	1743.00 ± 2.50	1433.75 ± 1.75	1705.00 ± 3.17	1669.68 ± 3.25	1242.75 ± 2.84	1037.00 ± 9.09	896.25 ± 6.67	682.25 ± 5.31
Dressing percentage	58.01[a] ± 0.02	58.16[a] ± 0.04	54.92[c] ± 0.03	57.99[a] ± 0.10	57.31[a, d] ± 0.08	51.75[d] ± 0.16	49.89[e] ± 0.40	48.77[f] ± 0.49	47.02[g] ± 0.42
24th week of experiment [C]									
Pre-slaughter weight (g)	3372.30 ± 5.55	3415.50 ± 3.53	3106.90 ± 3.91	3397.00 ± 4.31	3309.60 ± 6.00	2705.00 ± 3.50	2443.70 ± 3.15	2180.40 ± 2.11	1735.00 ± 3.72
Dressed weight (g)	1980.00 ± 6.47	2023.00 ± 4.82	1793.00 ± 6.77	2010.00 ± 5.10	1923.50 ± 4.80	1549.75 ± 5.16	1367.50 ± 4.53	1135.00 ± 7.02	854.25 ± 5.68
Dressing percentage	58.72[a] ± 0.22	59.23[a] ± 0.13	57.71[b] ± 0.20	59.17[a] ± 0.29	58.12[a] ± 0.51	57.28[c] ± 0.19	55.96[d] ± 0.20	52.05[e] ± 0.68	49.24[f] ± 0.34

Values bearing different superscripts in the same row differ significantly (P<0.01)
A, B, C significantly different between periods (P<0.01)

Table 28

Mean per cent chemical composition of meat from Soviet Chinchilla rabbits maintained on different dietary regimes and slaughtered during the 8th, 16th and 24th week of experiment

				Crude Protein		Ether extract		Total Ash	
Period	Ration	Moisture	Dry matter	Fresh basis	Dry matter basis	Fresh basis	Dry matter basis	Fresh basis	Dry matter basis
A 8th week	A	71.60 ± 0.97	28.40	20.23 ± 0.41	71.23 ± 0.98	6.43 ± 0.28^{a}	22.64 ± 0.61^{a}	1.36 ± 0.8^{a}	4.78 ± 0.17^{a}
	B	71.70 ± 0.73	28.29	20.18 ± 0.37	71.33 ± 0.84	6.38 ± 0.35^{a}	22.55 ± 0.73^{a}	1.35 ± 0.05^{a}	4.77 ± 0.19^{a}
	C	71.82 ± 0.75	28.18	20.07 ± 0.50	71.22 ± 1.03	6.24 ± 0.41^{a}	22.14 ± 0.88^{a}	1.30 ± 0.06^{a}	4.62 ± 0.20^{a}
	D	72.10 ± 0.31	27.90	19.94 ± 0.36	71.47 ± 0.97	5.64 ± 0.38^{b}	21.22 ± 0.79^{d}	1.35 ± 0.03^{a}	4.83 ± 0.11^{a}
	E	72.41 ± 0.73	27.59	19.80 ± 0.68	71.77 ± 1.25	5.37 ± 0.44^{b}	19.46 ± 0.98^{b}	1.31 ± 0.07^{a}	4.75 ± 0.15^{a}
	F	72.80 ± 0.25	27.20	19.49 ± 0.27	71.65 ± 0.86	5.16 ± 0.25^{b}	18.97 ± 0.75^{b}	1.16 ± 0.05^{b}	4.27 ± 0.13^{c}
	G	72.93 ± 0.46	27.07	19.29 ± 0.39	71.25 ± 0.91	4.70 ± 0.51^{c}	17.36 ± 1.05^{e}	1.47 ± 0.06^{b}	5.43 ± 0.19^{b}
	H	73.41 ± 0.74	26.59	19.05 ± 0.41	71.65 ± 1.02	4.39 ± 0.63^{c}	16.51 ± 0.97^{c}	1.45 ± 0.07^{b}	5.44 ± 0.28^{b}
	I	73.50 ± 0.62	26.50	18.96 ± 0.52	71.55 ± 1.31	4.31 ± 0.67^{c}	16.26 ± 1.21^{c}	1.37 ± 0.04$^{a, b}$	5.16 ± 0.16^{b}
B 16th week	A	69.63 ± 0.87	30.37	21.46 ± 0.34	70.66 ± 1.10	7.15 ± 0.48^{a}	23.54 ± 1.07^{a}	1.49 ± 0.06$^{a, c}$	4.91 ± 0.20^{a}
	B	69.18 ± 0.93	30.82	21.68 ± 0.48	70.34 ± 1.52	7.28 ± 0.61^{a}	23.62 ± 1.11^{a}	1.54 ± 0.08^{a}	5.01 ± 0.15^{a}
	C	69.35 ± 0.85	30.65	21.49 ± 0.51	70.11 ± 1.26	7.05 ± 0.57^{a}	23.0 ± 1.00$^{a, b}$	1.57 ± 0.07^{a}	5.13 ± 0.22$^{a, b}$
	D	70.10 ± 1.03	29.90	20.88 ± 0.28	69.83 ± 0.79	6.93 ± 0.29^{a}	23.18 ± 0.85$^{a, b}$	1.40 ± 0.05^{c}	4.69 ± 0.25^{a,d}
	E	69.98 ± 1.09	30.02	21.02 ± 0.60	70.03 ± 0.88	6.75 ± 0.45$^{a, b}$	22.49 ± 0.76^{b}	1.50 ± 0.06^{a}	4.99 ± 0.23^{a}
	F	70.14 ± 1.55	29.86	20.88 ± 0.72	69.93 ± 1.35	6.38 ± 0.34^{b}	21.37 ± 0.69^{d}	1.56 ± 0.07^{a}	5.24 ± 0.28$^{a, e}$
	G	70.25 ± 1.04	29.75	20.69 ± 0.56	69.55 ± 1.60	5.89 ± 0.68^{c}	19.80 ± 1.51^{e}	1.61 ± 0.06^{d}	5.40 ± 0.19$^{f, b, d, e}$
	H	70.69 ± 1.42	29.31	20.27 ± 0.35	69.16 ± 1.40	5.41 ± 0.39^{d}	18.46 ± 1.04^{c}	1.52 ± 0.07^{a}	5.17 ± 0.15$^{a, f}$
	I	70.83 ± 1.26	29.17	20.21 ± 0.47	69.28 ± 1.05	5.50 ± 0.47$^{c, d}$	18.85 ± 0.75^{c}	1.58 ± 0.08^{a}	5.43 ± 0.21$^{d, e, f}$
C 24th week	A	65.83 ± 1.08	34.17	23.85 ± 0.73	69.80 ± 1.16	8.63 ± 0.53^{a}	25.26 ± 1.70^{c}	1.53 ± 0.07^{a}	4.47 ± 0.17^{a}
	B	66.15 ± 0.89	33.85	23.55 ± 0.80	69.57 ± 1.50	8.12 ± 0.31^{a}	24.00 ± 0.88^{a}	1.47 ± 0.06$^{a, b}$	4.35 ± 0.22$^{a, b}$
	C	66.26 ± 1.46	33.74	23.51 ± 0.61	69.68 ± 1.31	8.10 ± 0.72^{a}	24.00 ± 1.35^{a}	1.40 ± 0.05$^{b, c}$	4.15 ± 0.24$^{b, c}$
	D	66.51 ± 1.52	33.49	23.31 ± 0.50	69.60 ± 1.08	8.19 ± 0.55^{a}	24.46 ± 1.28^{a}	1.56 ± 0.04^{a}	4.66 ± 0.18^{a}
	E	66 55 ± 1.13	33.45	23.25 ± 0.63	69.51 ± 01.05	7.98 ± 0.81$^{a, b}$	23.86 ± 1.56^{a}	1.34 ± 0.07^{c}	4.00 ± 0.20^{c}
	F	66.71 ± 0.93	33.29	23.10 ± 0.78	69.39 ± 1.25	7.56 ± 0.91^{b}	22.71 ± 1.63^{d}	1.52 ± 0.04^{a}	4.57 ± 0.15$^{a, b}$
	G	67.02 ± 1.24	32.98	22.80 ± 0.49	69.10 ± 0.83	6.78 ± 0.40^{c}	20.56 ± 1.50^{d}	1.71 ± 0.08^{d}	5.36 ± 0.22^{d}
	H	67.10 ± 1.15	32.90	22.74 ± 0.28	69.14 ± 0.76	6.60 ± 0.48^{c}	20.07 ± 1.21^{b}	1.67 ± 0.06^{d}	5.07 ± 0.15^{d}
	I	67.15 ± 1.09	32.85	22.68 ± 0.36	69.05 ± 0.98	6.49 ± 0.39^{c}	19.76 ± 1.30^{b}	1.68 ± 0.07^{d}	5.11 ± 0.21^{d}

Values bearing different superscripts in the same column within the period differ significantly ($P < 0.01$)
ABC differ significantly between periods ($P < 0.01$)

Table 29

Mean per cent chemical composition of meat from Cross bred rabbits maintained on different dietary regimes and slaughtered during the 8th, 16th and 24th week of experiment

Period	Ration	Moisture	Dry matter	Crude Protein		Ether extract		Total Ash	
				Fresh basis	Dry matter basis	Fresh basis	Dry matter basis	Fresh basis	Dry matter basis
A 8th Week	A	71.50 ± 1.14	28.50	20.17 ± 0.51	71.09 ± 1.68	6.47 ± 0.16^{a}	22.81 ± 0.76^{a}	1.40 ± 0.12	4.88 ± 0.29$^{a, b}$
	B	71.63 ± 1.02	28.37	20.32 ± 0.38	71.34 ± 1.20	6.38 ± 0.25^{a}	22.42 ± 0.69^{a}	1.36 ± 0.05	4.83 ± 0.17$^{a, b}$
	C	71.80 ± 1.18	28.21	20.15 ± 0.44	71.25 ± 1.05	6.24 ± 0.40$^{a, b}$	20.05 ± 0.63^{a}	1.30 ± 0.02	4.64 ± 0.20^{a}
	D	71.99 ± 01.0	28.01	20.04 ± 0.39	71.51 ± 1.13	5.56 ± 0.28$^{b, c}$	19.92 ± 0.49^{b}	1.29 ± 0.11	4.61 ± 0.12^{a}
	E	72.28 ± 0.05	27.72	19.81 ± 0.27	71.43 ± 0.98	5.50 ± 0.28^{c}	19.48 ± 0.37^{b}	1.33 ± 0.10	4.76 ± 0.21^{a}
	F	72.76 ± 1.19	27.24	19.48 ± 0.23	71.70 ± 0.90	5.02 ± 0.44$^{c, d}$	18.44 ± 0.48^{e}	1.28 ± 0.18	4.62 ± 0.49^{a}
	G	72.86 ± 1.00	27.14	19.29 ± 0.54	71.30 ± 1.76	4.67 ± 0.14$^{d, h}$	17.24 ± 0.50^{c}	1.40 ± 0.07	5.16 ± 0.07$^{b, c}$
	H	73.30 ± 1.20	26.72	19.10 ± 0.93	71.69 ± 1.15	4.49 ± 0.28$^{d, h}$	16.48 ± 0.61$^{c, d}$	1.39 ± 0.08	5.21 ± 0.15^{c}
	I	73.28 ± 0.86	26.70	19.13 ± 0.90	71.48 ± 1.27	4.30 ± 0.17^{h}	16.06 ± 0.39^{d}	1.40 ± 0.09	5.20 ± 0.17^{c}
B 16th Week	A	69.45 ± 0.92	30.55	21.45 ± 0.75	70.34 ± 1.25	7.17 ± 0.23^{a}	23.40 ± 0.72^{a}	1.50 ± 0.05	4.90 ± 0.09^{a}
	B	69.01 ± 0.85	30.99	21.66 ± 0.66	70.02 ± 1.45	7.32 ± 0.41^{a}	23.56 ± 0.93^{a}	1.49 ± 0.07	4.81 ± 0.06^{a}
	C	69.31 ± 1.04	30.69	21.49 ± 0.98	70.15 ± 1.07	7.01 ± 0.43^{a}	22.78 ± 1.05$^{a, b}$	1.52 ± 0.04	4.99 ± 0.15^{a}
	D	70.05 ± 1.18	29.95	20.94 ± 0.77	69.82 ± 1.96	6.89 ± 0.36$^{a, b}$	23.00 ± 0.85$^{a, b}$	1.48 ± 0.10	4.97 ± 0.08$^{a, b}$
	E	69.93 ± 1.12	30.07	21.15 ± 0.61	70.10 ± 1.57	6.70 ± 0.47$^{a, b}$	22.21 ± 1.12^{b}	1.53 ± 0.17	5.02 ± 0.21$^{a, b}$
	F	70.10 ± 0.86	29.90	21.05 ± 0.50	70.02 ± 1.29	6.22 ± 0.26$^{b, c}$	20.84 ± 0.90^{e}	1.50 ± 0.15	5.03 ± 0.17$^{a, b}$
	G	70.16 ± 1.09	29.84	20.71 ± 0.52	69.64 ± 1.20	5.85 ± 0.50$^{c, d}$	19.53 ± 1.03^{c}	1.57 ± 0.11	5.23 ± 0.12^{b}
	H	70.57 ± 1,10	29.43	20.36 ± 0.47	69.11 ± 1.46	5.37 ± 0.61^{d}	18.28 ± 1.14^{d}	1.51 ± 0.04	5.13 ± 0.15^{a}
	I	70.72 ± 1.03	29.28	20.30 ± 0.60	69.30 ± 1.61	5.51 ± 0.63^{d}	18.72 ± 0.89$^{c, d}$	1.49 ± 0.08	5.09 ± 0.17^{a}
C 24th Week	A	65.78 ± 1.02	34.22	23.87 ± 0.39	69.78 ± 0.78	8.49 ± 0.59^{a}	24.81 ± 1.70^{a}	1.51 ± 0.12	4.41 ± 0.20^{a}
	B	66.00 ± 0.90	34.00	23.43 ± 0.25	68.91 ± 0.64	8.22 ± 0.40^{a}	24.11 ± 0.86$^{a, b}$	1.48 ± 0.04	4.35 ± 0.10^{a}
	C	66.13 ± 1.18	33.87	23.62 ± 0.17	69.74 ± 0.52	8.04 ± 0.54$^{a, b}$	23.80 ± 1.15^{b}	1.49 ± 0.03	4.43 ± 0.17^{a}
	D	66.29 ± 1.06	33.71	23.40 ± 0.38	69.45 ± 1.07	8.12 ± 0.39$^{a, b}$	24.09 ± 1.20$^{a, b}$	1.41 ± 0.04	4.21 ± 0.13^{a}
	E	65.39 ± 1.00	34.01	23.65 ± 0.19	69.55 ± 0.45	7.63 ± 0.42$^{a, b}$	22.42 ± 0.95^{c}	1.43 ± 0.04	4.19 ± 0.09^{a}
	F	66.68 ± 1.05	33.32	23.16 ± 0.23	69.48 ± 0.62	7.48 ± 0.65^{b}	22.51 ± 1.31^{c}	1.42 ± 0.08	4.26 ± 0.12^{a}
	G	67.00 ± 1.07	33.00	22.78 ± 0.45	69.15 ± 1.14	6.71 ± 0.30^{c}	20.33 ± 0.79^{d}	1.60 ± 0.07	4.85 ± 0.20^{b}
	H	67.08 ± 1.10	32.92	22.65 ± 0.29	68.80 ± 0.97	6.52 ± 0.34^{c}	19.78 ± 1.25^{d}	1.58 ± 0.04	4.79 ± 0.13^{b}
	I	67.10 ± 0.98	32.90	22.72 ± 0.30	69.09 ± 0.75	6.46 ± 0.27^{c}	19.60 ± 0.91^{d}	1.59 ± 0.06	4.83 ± 0.04^{b}

Values bearing different superscripts in the same column within the period differ significantly ($P<0.01$)

ABC differ significantly between periods ($P<0.01$)

Table 30

Mean per cent liver protein and liver fat of Soviet Chinchilla rabbits on dry matter basis at 8th, 16th and 24th week of experiment

Ration	A	B	C	D	E	F	G	H	I
DE. kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP. per cent	20	16	12	20	16	12	20	16	12
8th week of experiment									
Crude protein per cent (DMB)	71.93[a] ± 1.12	71.80[a] ± 0.94	61.70[b] ± 1.55	70.54[c] ± 2.06	68.43[c] ± 1.75	61.50[b] ± 1.96	69.49[a, c] ± 2.05	68.55[c] ± 1.77	61.77[b] ± 1.86
Ether extract per cent (DMB)	16.41 ± 0.79	16.48 ± 0.68	16.90 ± 0.50	15.35 ± 0.77	15.40 ± 0.80	15.62 ± 0.83	15.13 ± 0.52	15.24 ± 0.76	15.30 ± 1.08
16th week of experiment									
Crude protein per cent (DMB)	70.53[a] ± 1.79	69.90[a] ± 1.40	61.58[c] ± 1.42	71.66[a] ± 1.66	67.62[d] ± 1.89	62.53[b] ± 1.26	69.56[a] ± 1.28	65.90[e] ± 2.15	61.58[b] ± 2.03
Ether extract per cent (DMB)	16.59 ± 0.85	16.80 ± 0.93	16.90 ± 0.92	15.42 ± 0.75	15.65 ± 0.88	15.83 ± 0.61	15.15 ± 0.95	15.29 ± 0.90	15.33 ± 1.11
24th week of experiment									
Crude protein per cent (DMB)	70.77[a] ± 2.04	69.43[a] ± 2.03	61.62[b] ± 1.46	71.95[a] ± 1.56	67.06[d] ± 1.45	63.74[c] ± 1.06	69.83[a] ± 1.12	64.54[c] ± 1.75	61.62[b] ± 1.27
Ether extract per cent (DMB)	16.50 ± 1.29	16.71 ± 0.78	16.78 ± 0.67	15.60 ± 1.01	15.74 ± 0.93	15.97 ± 1.25	15.21 ± 0.87	15.35 ± 1.31	15.49 ± 1.50

Values bearing different superscripts in the same row differ significantly (P<0.01)

Table 31

Mean per cent liver protein and liver fat content of Cross bred rabbits on dry matter basis at 8th, 16th and 24th week of experiment

Ration	A	B	C	D	E	F	G	H	I
DE. kcal/kg	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP. per cent	20	16	12	20	16	12	20	16	12
8th week of experiment									
	a	a	b	a, c	c	b	a, c	c	b
Crude protein per cent	71.98	71.78	61.51	70.61	68.59	61.62	69.67	68.63	61.84
(DMB)	± 1.27	± 1.22	± 1.24	± 1.55	± 1.30	± 0.63	± 0.98	± 1.11	± 1.83
Ether extract per cent	16.52	16.49	16.97	15.42	15.51	15.74	15.28	15.37	15.29
(DMB)	± 1.36	± 1.12	± 1.01	± 1.21	± 1.04	± 1.14	± 1.37	± 0.88	± 0.93
16th week of experiment									
	a	a, b	c	a, b	b, d	c	a, b	d	c
Crude protein per cent	71.53	70.86	62.19	71.03	68.12	62.30	70.05	67.19	61.63
(DMB)	± 1.20	± 1.37	± 0.82	± 1.19	± 0.68	± 1.20	± 1.36	± 1.21	± 1.17
Ether extract per cent	16.58	16.83	17.01	15.60	15.70	15.87	15.32	15.41	15.38
(DMB)	± 0.66	± 1.98	± 1.20	± 1.41	± 1.17	± 1.89	± 1.16	± 1.27	± 0.60
24th week of experiment									
	a	a	b	a, c	c, d	b, c	a	d	b
Crude protein per cent	71.56	71.09	62.13	71.44	67.99	63.80	70.12	66.93	61.70
(DMB)	± 1.03	± 0.89	± 0.85	± 1.11	± 0.94	± 1.74	± 0.99	± 0.95	± 1.29
Ether extract per cent	16.61	16.75	17.04	15.90	15.85	15.91	15.56	15.44	15.40
(DMB)	± 0.87	±1.31	± 0.98	± 1.37	± 1.58	± 1.16	± 1.52	± 0.84	± 1.08

Values bearing different superscripts in the same row differ significantly (P<0.01)

Table 32

Mean iodine number of abdominal fat from Soviet Chinchilla and Cross bred rabbits at 16th and 24th week of experiment

Breed	Ration	A	B	C	D	E	F
	DE.kcal/kg.	3000	3000	3000	2500	2500	2500
	CP.per cent	20	16	12	20	16	12
Soviet Chinchilla	16th Week	66.61 ± 4.31	63.30 ± 5.96	66.29 ± 4.40	69.43 ± 4.75	71.76 ± 3.78	74.70 ± 4.83
	24th Week	67.70 ± 4.04	66.27 ± 4.95	68.07 ± 4.14	71.11 ± 5.04	73.74 ± 4.86	73.66 ± 5.39
	Mean SE.	67.16 ± 0.27	64.79 ± 0.74	67.18 ± 0.45	70.27 ± 0.42	72.75 ± 0.50	74.18 ± 0.26
Cross bred	16th Week	67.08 ± 4.53	64.23 ± 4.22	67.19 ± 4.93	70.28 ± 4.77	72.26 ± 4.26	75.03 ± 3.38
	24th Week	68.15 ± 4.41	67.31 ± 4.30	68.25 ± 4.02	71.30 ± 5.10	73.91 ± 5.06	75.14 ± 4.16
	Mean SE.	67.62 ± 0.27	65.77 ± 1.09	67.72 ± 0.27	70.79 ± 0.17	73.09 ± 0.41	75.08 ± 0.02

Table 33

Mean saponification value of abdominal fat from Soviet Chinchilla and Cross bred rabbits at 16th and 24th week of experiment

Breed	Ration	A	B	C	D	E	F
	DE.kcal/kg.	3000	3000	3000	2500	2500	2500
	CP.per cent	20	16	12	20	16	12
Soviet Chinchilla	16th Week	162.80 ± 4.58	162.41 ± 4.88	161.66 ± 5.80	154.08 ± 3.93	159.57 ± 5.10	152.88 ± 5.29
	24th Week	169..82[a] ± 4.81	172.32[a] ± 3.85	163.37[a, b] ± 4.22	152.19[c] ± 4.70	152.83[c] ± 5.48	155.10[b, c] ± 5.32
	Mean SE.	166.31 ± 1.76	167.37 ± 2.48	162.52 ± 0.43	153.14 ± 0.47	156.20 ± 1.69	153.99 ± 0.56
Cross bred	16th Week	160.49[a] ± 4.76	161.30[a] ± 5.40	162.00[a] ± 4.93	154.13[a, b] ± 3.64	159.08[a, b] ± 4.84	151.63[b] ± 5.57
	24th Week	168.73[a] ± 5.32	171.04[a] ± 4.58	165.42[a] ± 4.83	151.95[b] ± 4.88	152.11[b] ± 4.71	154.38[b] ± 5.38
	Mean SE.	164.61 ± 2.06	166.17 ± 2.44	163.71 ± 0.86	153.04 ± 0.55	155.60 ± 1.74	153.01 ± 0.69

Values bearing different superscripts in the same row differ significantly P<0.05 (SC) and P<0.01(CB)

Table 35

Data showing Profit / Loss on slaughter of Cross bred rabbits at 8th, 16th and 24th week of experiment

Ration	A	B	C	D	E	F	G	H	I
DE.kcal/kg.	3000	3000	3000	2500	2500	2500	2000	2000	2000
CP.per cent	20	16	12	20	16	12	20	16	12
Period / Week	0 - 56 days (8th week) of Experiment								
Parameters									
Body weight (g)	1794.50	1832.80	1540.25	1861.25	1784.30	1625.60	1418.24	1185.00	993.00
Dressing percentage	48.26	48.22	47.33	48.41	48.24	47.27	45.22	44.81	44.06
Dressed weight (kg)	0.866	0.884	0.729	0.901	0.861	0.768	0.641	0.531	0.438
Meat cost (Rs.)	43.30	44.19	36.45	45.05	43.04	38.42	32.07	26.55	21.88
Dry matter intake (kg)	4.312	4.717	4.034	4.807	4.560	4.570	4.328	4.298	3.801
Feed Cost (Rs.)	23.37	24.39	20.37	22.74	20.61	19.61	17.27	15.60	12.47
Net Profit (Rs.)	19.93	19.80	16.08	22.31	22.43	18.81	14.80	10.95	9.41
Period / Week	0 - 112 days (16th week) of Experiment								
Body weight (g)	2968.50	2999.00	2612.00	2992.50	2914.75	2404.00	2081.13	1857.00	1446.63
Dressing percentage	58.01	58.16	54.92	57.99	57.31	51.75	49.89	48.77	47.02
Dressed weight (kg)	1.722	1.744	1.434	1.735	1.670	1.244	1.038	0.906	0.680
Meat cost (Rs.)	86.10	87.20	71.73	86.77	83.52	62.20	51.91	45.28	34.00
Dry matter intake (kg)	14.803	15.596	13.890	15.252	15.964	15.403	13.070	13.429	11.706
Feed Cost (Rs.)	80.23	80.63	70.14	72.14	72.16	66.08	52.15	48.75	38.40
Net Profit (Rs.)	5.87	6.57	1.59	14.63	11.36	-3.88	-0.24	-3.47	-4.4
Period / Week	0 - 168 days (24th week) of Experiment								
Body weight (g)	3372.25	3415.50	3107.00	3397.00	3309.60	2705.00	2443.75	2180.50	1735.00
Dressing percentage	58.72	59.23	57.71	59.17	58.12	57.28	55.96	52.05	49.24
Dressed weight (kg)	1.980	2.023	1.793	2.010	1.923	1.549	1.367	1.135	0.854
Meat cost (Rs.)	99.00	101.15	89.65	100.50	96.18	77.47	63.38	56.75	42.72
Dry matter intake (kg)	25.450	26.700	26.107	25.542	27.323	24.840	22.342	22.208	20.446
Feed Cost (Rs.)	137.94	138.04	131.84	120.81	1223.50	106.56	89.14	80.62	67.06
Net Profit (Rs.)	-38.94	-36.39	-42.19	-20.81	-27.32	-29.09	-20.76	-23.87	-24.34

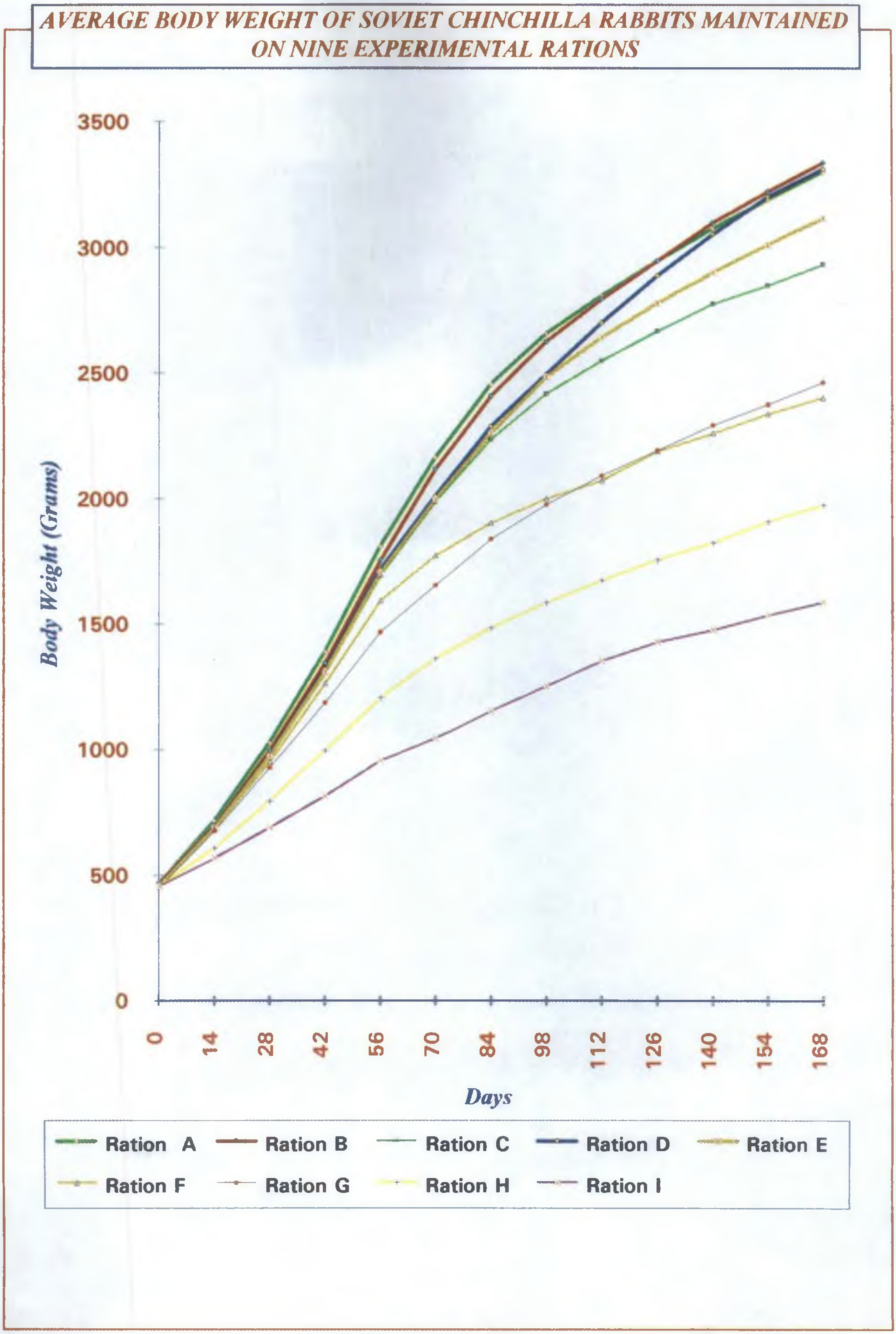
DISCUSSION

DISCUSSION

The results obtained during the course of the experimental programme are discussed under separate heads to explain the objectives visualized viz., (a) Energy-protein requirement for optimum growth and (b) optimum age for economic slaughter in broiler rabbits.

5.1. Growth Rate

It can be seen from the table (4,5 and 6) represented by Fig.1 - 5 and Appendix 1 - 18 with their statistical analysis in Appendix 25.1 and 25.2 that, both SC purebred and SC x NZW crossbred (CB) rabbits maintained on rations A, B, C, D, E, F, G, H and I containing varying levels of CP and DE exhibit an appreciable increase in body weight during the period upto 168 days of experimentation (Fig. 1 and 2) and the ADG recorded for the SC and CB rabbits maintained on rations A, B, C, D, E, F, G, H and I being 16.87 and 17.05; 17.07 and 17.31; 14.7 and 15.46; 16.95 and 17.17; 15.81 and 16.68; 11.56 and 13.07; 11.96 and 11.52; 9.03 and 9.94 and 6.72 and 7.30 g/day respectively, the effect is more pronounced in animals maintained on rations B and D both in the case of SC and CB rabbits respectively (Fig.3). It is to be noted that the highest rate of gain was achieved in animals maintained on rations containing comparatively higher DE and CP (Rations A,B,D, and E) while lowest rate of gain was noticed in animals maintained on low energy low protein diet (Ration I). On further scrutiny of data it can be seen that, as between the groups maintained on rations A, B and C containing 3000 kcal DE and groups maintained on rations D, E and F containing 2500 kcal DE but with varying levels of CP to the extent of 20, 16 and 12 per cent in each respectively, an appreciably better growth response was observed in animals maintained on ration containing 3000 kcal DE with 16 per cent CP (Ration B) and ration containing 2500 kcal DE with 20 per cent CP (Ration D) in both SC and CB rabbits and on statistical analysis, no significant difference could be noticed in animals maintained on rations D and B tending to suggest that, for maximum growth response a ration containing 2500 kcal DE (Ration D) would be sufficient, since further increase in DE (Rations B and A) have not evinced any better


AVERAGE BODY WEIGHT OF SOVIET CHINCHILLA RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS
Body Weight (Grams)
3500
3000
2500
2000
1500
1000
500
0
0
14
28
42
56
70
84
98
112
126
140
154
168
Days
Ration A
Ration B
Ration C
Ration D
Ration E
Ration F
Ration G
Ration H
Ration I

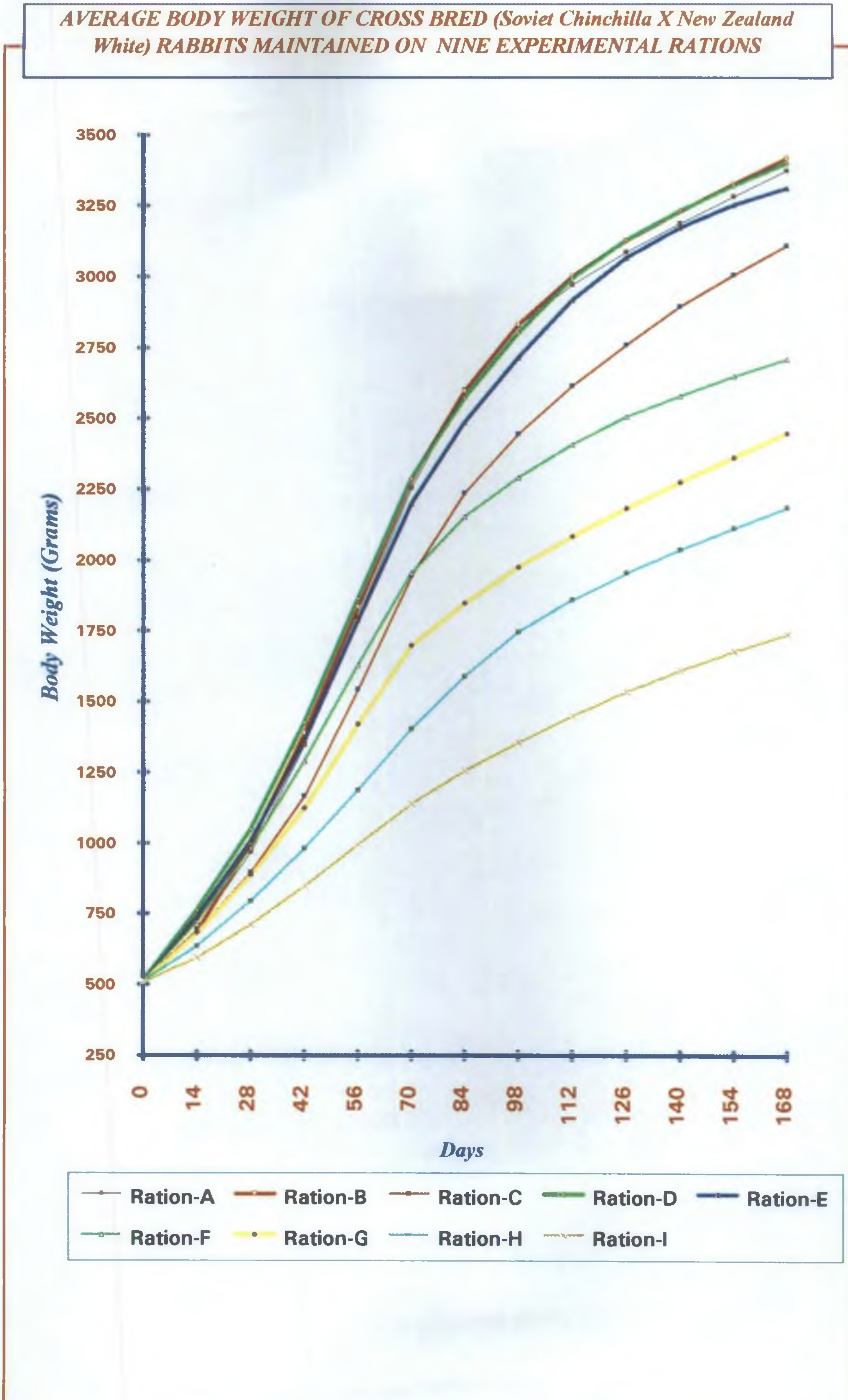
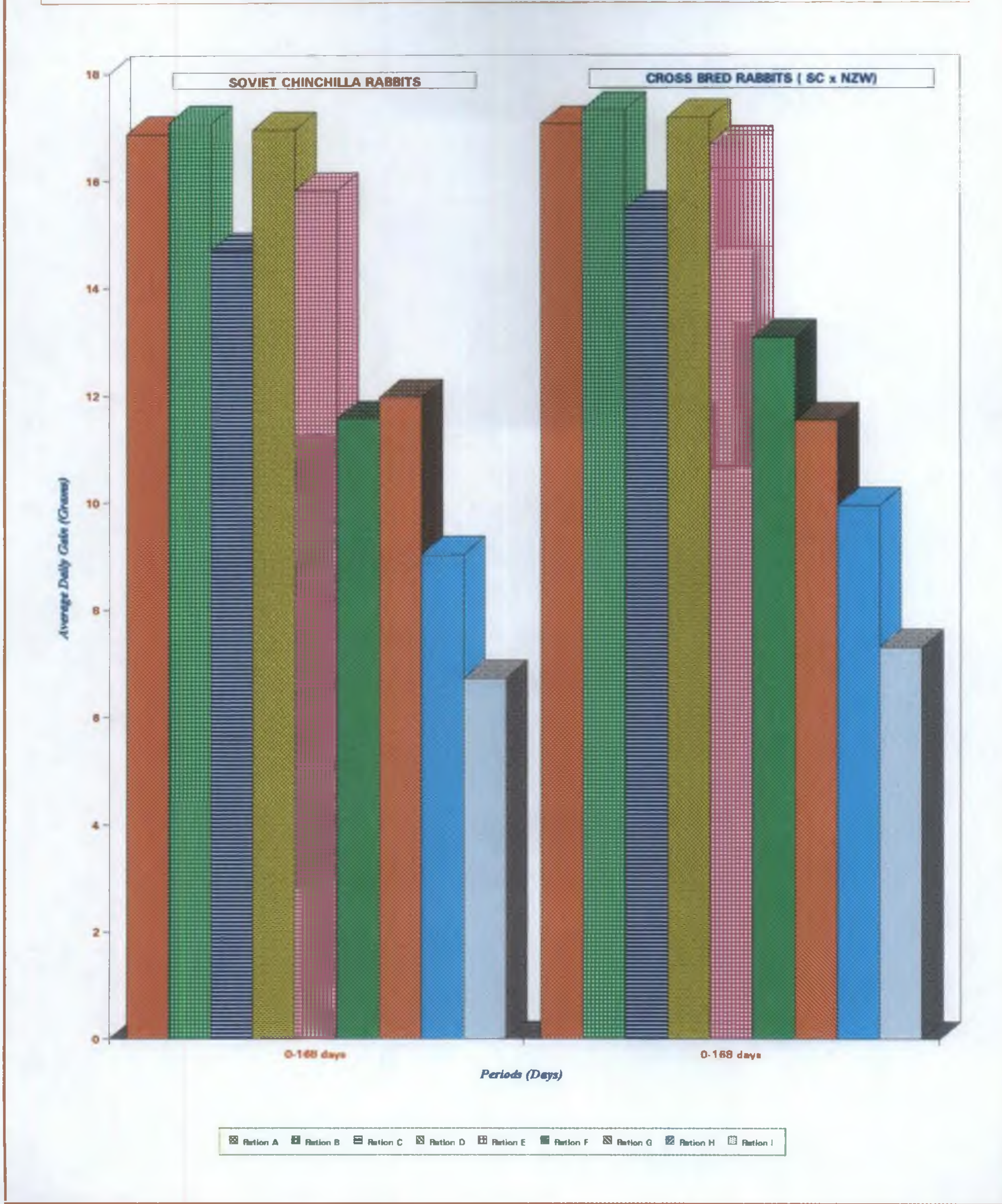

AVERAGE BODY WEIGHT OF CROSS BRED (Soviet Chinchilla X New Zealand White) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS
Body Weight (Grams)
3500
3250
3000
2750
2500
2250
2000
1750
1500
1250
1000
750
500
250
0
14
28
42
56
70
84
98
112
126
140
154
168
Days
Ration-A
Ration-B
Ration-C
Ration-D
Ration-E
Ration-F
Ration-G
Ration-H
Ration-I

Fig.3

AVERAGE DAILY GAIN OF SOVIET CHINCHILLA AND CROSS BRED (Soviet Chinchilla X New Zealand White) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS (0 - 168 DAYS)



response on ADG, as can be noticed from animals maintained on ration A attained only 16.87 g as against 16.95 g of ADG in animals maintained on ration D in SC rabbits and 17.05 g as against 17.17 g of ADG in CB rabbits respectively indicating that for optimum biological response a ration containing 2500 kcal DE need be sufficient for both SC and CB rabbits.

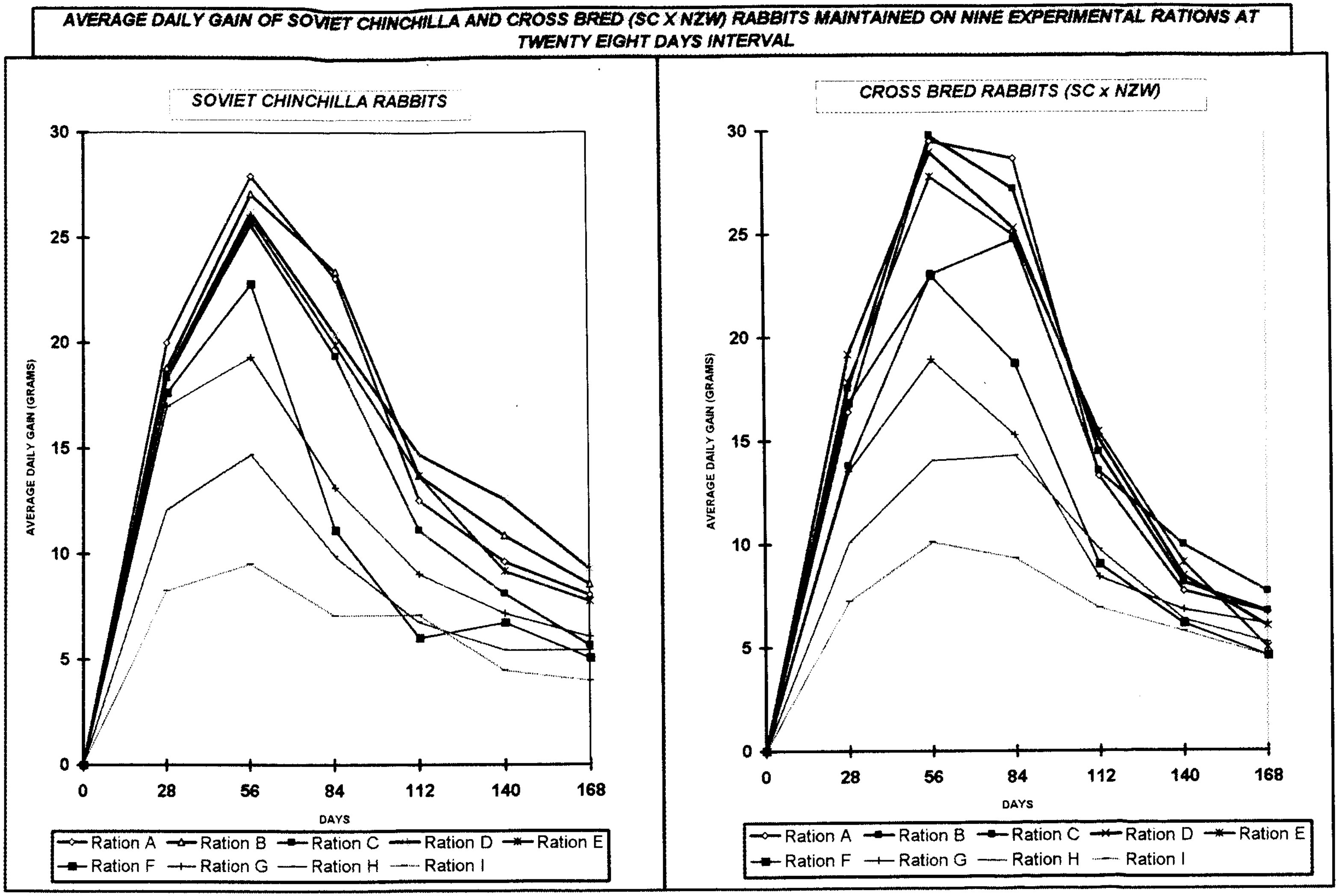
As between the animals maintained on rations B and D respectively containing 3000 and 2500 kcal DE and 16 and 20 per cent CP, a comparatively better growth response in presence of low level of CP was exhibited by the SC and CB animals maintained on ration B probably due to high energy content in the ration contributing better utilization of protein.

As between the periods viz., 0-56, 56-112 and 112-168 days of experiment, it was observed that the animals attained maximum ADG during the first 56 days of experiment and thereafter ADG gradually declines irrespective of the level of CP or DE in the ration (Table 5 and 6 and Fig. 4, 5a and 5b).

From a critical evaluation of data on ADG gathered from two sets of experiment it can be inferred that for optimum energy and protein utilization in rabbits, a ration containing either 3000 kcal DE with 16 per cent CP or 2500 kcal DE with 20 per cent CP would be more conducive.

The result reported by various workers on the growth rate and ADG during different age groups of various breeds of broiler rabbits are controversial. Romiero (1969) reported an average live weight of three kg for Chinchilla rabbits at three to four months of age. Ferrara et al. (1970) recorded an average live weight of 1.8 kg, 2.2 kg, 2.5 kg and 2.72 kg at 9^{th}, 11^{th}, 13^{th} and 15^{th} week of age in NZW rabbits. According to Titarev (1971 a) SC rabbits weighed on an average 761 g at 45 days and 2403 g at 120 days. Titarev (1971 b) on comparing the growth performance in White Giant, Grey Giant and SC rabbits recorded a body weight of 2501.5 g at 120 days and ADG of 28.7 g from 45 - 90 days and 15.9 g from 90 -120 days of age in SC rabbits. Damyanova (1973) reported an average body weight of 54.6 g at birth,

FIG. 4


AVERAGE DAILY GAIN OF SOVIET CHINCHILLA AND CROSS BRED (SC X NZW) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS AT TWENTY EIGHT DAYS INTERVAL
SOVIET CHINCHILLA RABBITS
CROSS BRED RABBITS (SC x NZW)
AVERAGE DAILY GAIN (GRAMS)
DAYS
0
28
56
84
112
140
168
0
5
10
15
20
25
30
Ration A
Ration B
Ration C
Ration D
Ration E
Ration F
Ration G
Ration H
Ration I

96.1

Fig. 5 a

AVERAGE DAILY GAIN OF SOVIET CHINCHILLA AND CROSS BRED (Soviet Chinchilla X New Zealand White) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT PERIODS OF EXPERIMENT

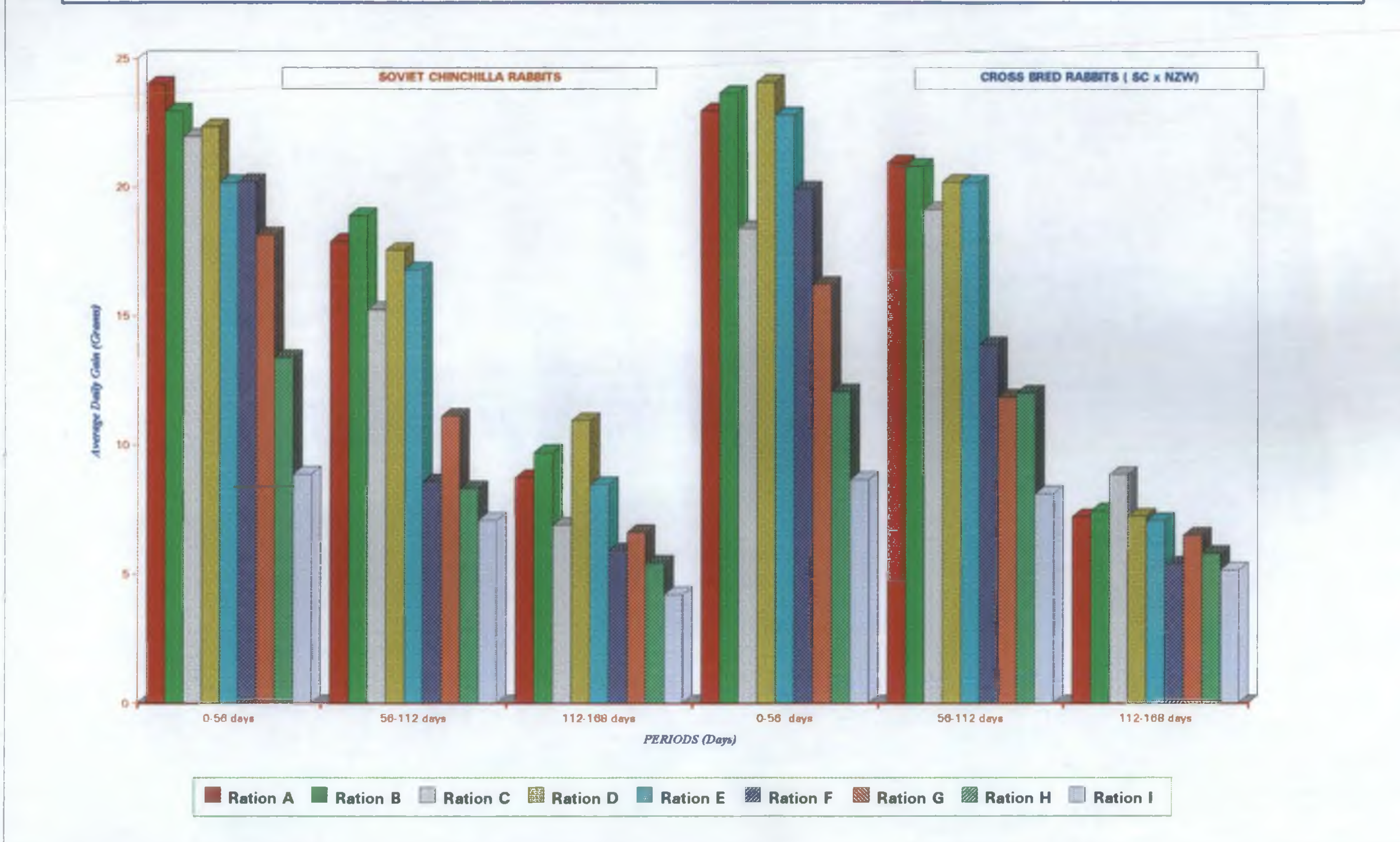
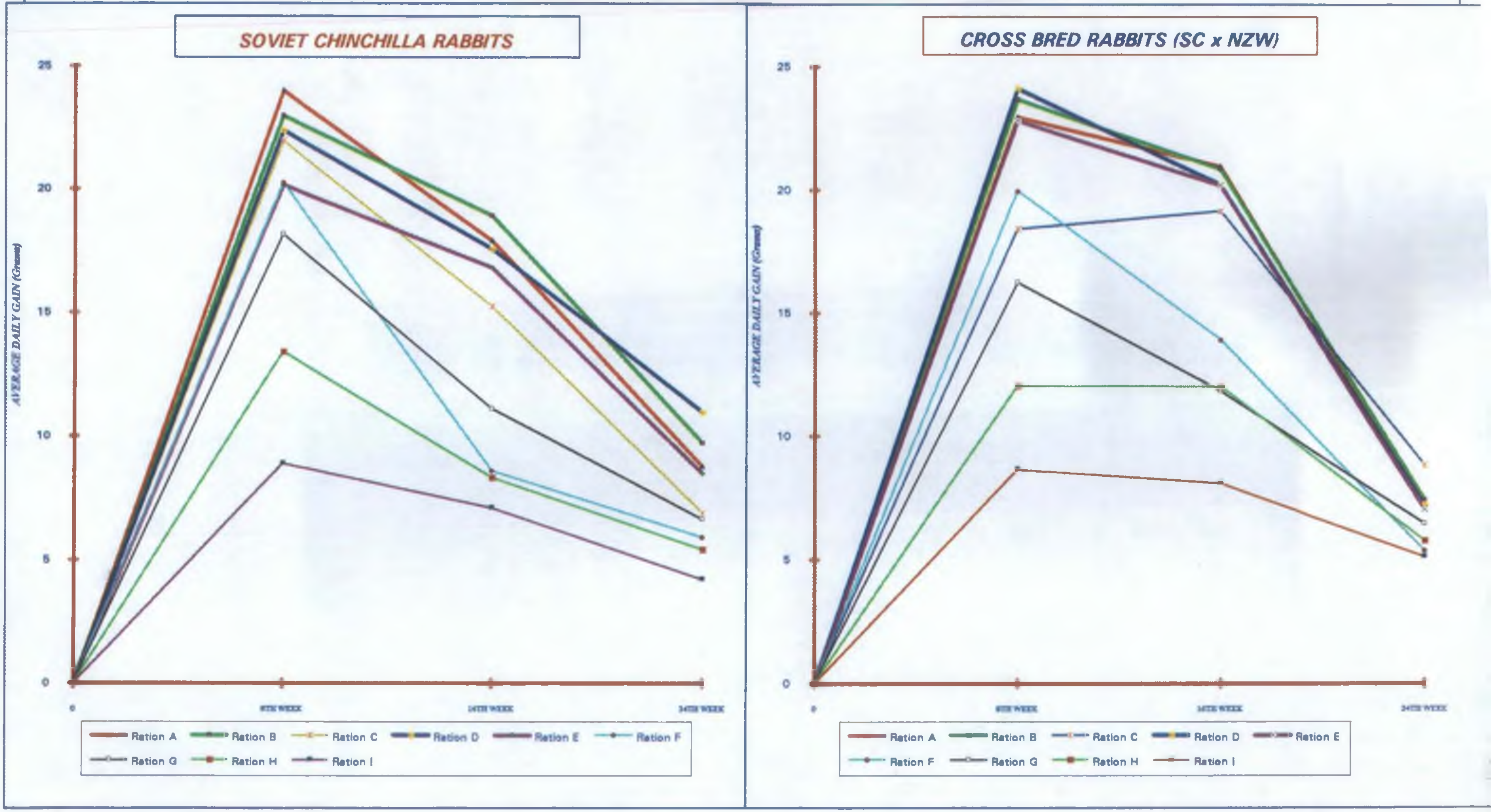


Fig. 5 b

AVERAGE DAILY GAIN OF SOVIET CHINCHILLA AND CROSS BRED (Soviet Chinchilla X New Zealand White) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT PERIODS OF EXPERIMENT



1226 g for male and 1132 g for female at two months, 2520 g for male and 2150 for female at four months in Chinchilla rabbits. Pomytko and Miroshichenko (1976) recorded an average body weight of 3426 g for SC, 3537 g for SC x NZW cross, 3400 g for NZW and 3710 g for NZW X SC cross at 120 days of age. Rao et al. (1977) reported an ADG of 9.3,30.9, 39.1 and 36.3 g during zero-two weeks, two - four weeks, four - six weeks and six - eight weeks respectively in NZW rabbits. Bednarz and Frindt (1977) recorded an average weight of two kg in 63 - 66 days of age and three kg at 104 days of age in NZW rabbits. Rudolph and Fischer (1982) reported an average body weight of 2431 g and 2689 g at 86 and 100 days of age respectively in NZW rabbits. Gogeliya et al. (1982) recorded an average body weight of 1080 g at 120 days in SC and Grey Giant rabbits with no significant breed difference. Pomytko and Makarova (1984) reported an average body weight of 1103, 1128, 1107, 1116 and 1117 g at 45 days of age and 2324, 2221, 2173, 2066 and 2106 g at 90 days of age in SC rabbits maintained under different systems of management. Damodar and Jatkar (1985) recorded an average body weight of 0.64, 0.92, 1.42 and 1.88 kg in NZW rabbits at 4th, 6th, 8th and 10th week of age respectively. Grobner et al. (1985 a) on maintaining different breeds of broiler rabbits on three levels of DE viz., low (2000 kcal/kg) medium (2500 kcal/kg) and high (3000 kcal/kg) observed that, for each breed the gain during the test period was lowest with the low energy diet and the medium energy level diet supported the best gain. Swai et al. (1986) recorded an average body weight of 1373.4 and 1163.4 g for male and female NZW x Chinchilla rabbits at 98 days of age. Lebas and Ouhayoun (1988) reported an overall mean live weight in NZW and NZW X Californian White rabbits for 77 days and the body weight and ADG from 28 - 77 days were 2183 g and 31.7 g respectively, the body weight and ADG were significantly higher for rabbits fed high protein diet than a low protein diet and suggested that in order to get similar growth rate at high and low environmental temperature dietary CP content should be increased in hot climate. Coan et al. (1988) recorded an average body weight of 2.35 kg at 9th week of age for NZW rabbits fed with 26 per cent CP diet and 2.36 kg for 20 per cent CP diet. ADG of 27.71, 26.77 and 27.22 g/day were reported in growing crossbred rabbits fed on three dietary protein levels viz., 16,18 and 20 per cent, from five to 12 weeks of age (Abdella et al. 1988). An ADG of 17.38, 17.71 and 17.68 from six weeks to 24 days of age was reported by Sankhyan et al. (1990) for rabbits fed on normal protein normal energy (NPNE 100 per cent NRC) low protein low energy (LPLE 15 per cent lower) and high protein high energy (HPHE 15 per cent higher) respectively in NZW rabbits. Rabbits fed high protein high energy diets showed maximum daily weight gain of 28.8 g for the first six weeks of growth after weaning and then maintained a plateau up to 24th week. Maximum body weight was observed with HPHE (2.23 kg) followed by NPNE (2.19 kg) and LPLE (2.17 kg). Maertens et al. (1990) from a study on effect of energy content and protein to energy ratio of the diet on fattening performance and body composition of meat rabbits maintained 180 rabbits on diets with DE 8.6 - 9.1 or 10.3 - 10.8 MJ/kg and DCP 12 or 14 g/MJ DE to appetite from five - 11 weeks in a factorial experiment and reported that mean daily gain for diets high in energy was 41.3 and 40.7 g with low and high protein to energy ratios and values for diets low in energy were 39.1 and 39.6 g respectively. Mishra (1990) recorded for NZW X SC cross rabbits an average body weight (g) of 800.61, 1008.80, 1273.94, 1635.81 and 1812.16 g at 8th, 12th, 16th, 20th and 24th week of age respectively and two kg at 200 days of age with an ADG of 8.47 g for eight - 12 weeks, 12.19 g for 12-16 weeks, 9.81 g for 16-20 weeks and 8.99 g for 20-24 weeks of age. David and Lebas (1991) from their study on effect of concentration of nitrogen in the diet on growth and productivity of young females reported that, body weight at 12 weeks was lower in rabbits given low protein (15.2 %) diet than those fed on medium (17.2%) and high (20.1%) protein diets. For NZW rabbits, Jiabi et al. (1991) reported an ADG of 27 g and body weight of 1.81 kg at 13th week of age. Shemin (1991) on studying the nutrient requirements of Angora rabbits observed an increase in ADG with an increase in DE from 2200 - 2600 kcal/kg and dietary CP from 12.45 - 17 per cent. Sundaram and Bhattacharyya (1991) recorded an average body weight of two kg at 16th week of age for SC rabbits with an ADG of 16 g during 4th week and 18 g during 16th week. Zimmerman (1992) recorded body weight of NZW rabbits in six litters and body weight at 56 days of age averaged 1654, 1751, 1762, 1769, 1741 and 1739 g and at 84 days, 2688, 2789, 2799, 2794, 2793 and 2758 g respectively. Bozac et al. (1992) recorded an ADG of 15.00, 28.19 and 31.17 from about 650 g live weight for nine weeks in Chinchilla rabbits and mean final weight of 2560, 2453 and 2628 g respectively. Deshmuk and Pathak (1993) maintained NZW rabbits from weaning (five weeks of age) on six dietary treatments having three protein levels viz., 13 per cent (low) 16 per cent (medium) and 20 per cent (high) and two energy levels viz., 56-57 per cent (low) and 63-65 per cent (high) up to one kg and reported that high protein high energy levels contributed highest ADG (14.08 g) while the ADG was lowest (9.47 g) in low protein low energy diet.

From the forgoing review it can be perceived that the body weight and ADG are essentially in agreement with the results obtained by various authors. The results obtained with regard to the influence of variation in energy and protein on the body weight and ADG is in accordance with the findings of Grobner et al. (1985 a), Lebas and Ouhayoun, (1988), Sankhyan et al. (1990), Maertens et al. (1990) David and Lebas (1991) and Deshmuk and Pathak (1993), who could also observe high protein high energy diet promoting higher weight gain and low protein low energy diet exhibiting lowest weight gain and the result obtained in the present investigation lend further evidence to support the view of the above authors.

Contrary to the above findings values obtained in the present investigation are not in agreement with the results reported by Spreadbury (1978) who observed maximum food intake and growth at a CP concentration of 14 and 15.6 per cent on growing NZW rabbits maintained on different CP levels ranging from 10.4 - 22.5 per cent for 28 days from four - eight weeks of age. Abdella et al. (1988) also reported higher ADG on low CP level on feeding CB rabbits on dietary protein levels of 16, 18 and 20 per cent from five - 12 weeks of age. The variation in results may be attributed to the breed difference, the period of trial and climatic variations.

5.2. Dry matter Consumption

Average dry matter (DM) consumption per day presented in Table 4, 5 and 6 represented by Fig. 6 - 9 with their statistical analysis in Appendix 25.1 and 25.2, gathered from growth study of SC rabbits maintained on nine ration treatments vary

Fig.6

AVERAGE DAILY DRYMATTER CONSUMPTION OF SOVIET CHINCHILLA AND CROSS BRED (Soviet Chinchilla X New Zealand White) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS (0 - 168 DAYS)

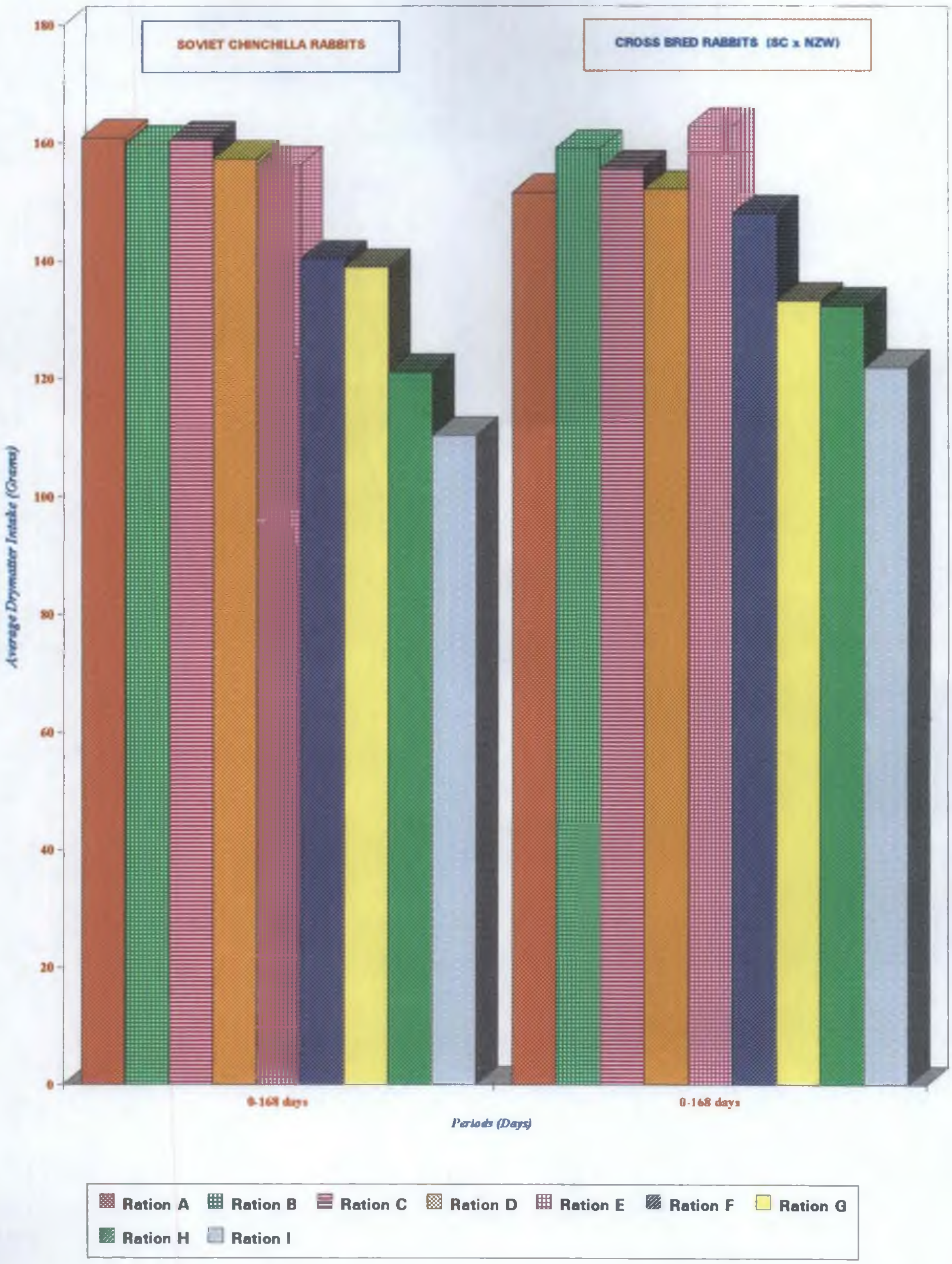
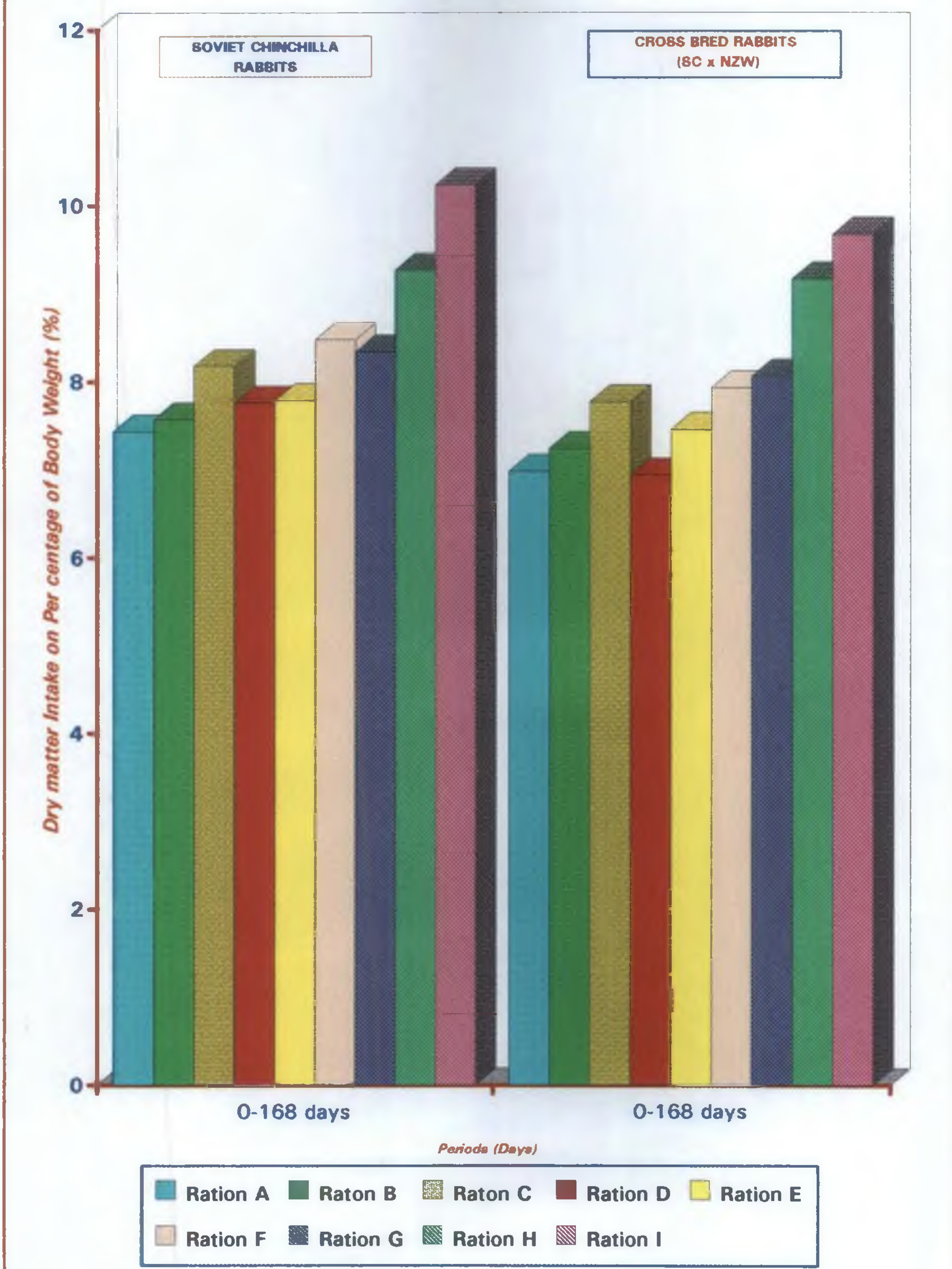


Fig. 7

AVERAGE DAILY DRY MATTER CONSUMPTION OF SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS WHEN EXPRESSED ON PER CENTAGE OF BODY WEIGHT MAINTAINED ON 9 EXPERIMENTAL RATIONS - 0 TO 168 DAYS



from 110.31 (ration I) to 160.87 g/day (ration A) but when it is expressed on per cent body weight the values recorded being 7.43 (ration A) to 10.23 (ration I), while the same for CB rabbits vary from 121.7 (ration I) to 162.64 g/day (ration E) and on per cent body weight basis the values recorded being 7.45 (ration E) to 9.67 (ration I).

The average DM consumption per day of both SC and CB rabbits maintained on rations A, B, C, D, E, F, G, H and I being 160.87 and 151.49; 159.75 and 158.93; 160.49 and 155.40; 157.21 and 152.04; 156.21 and 162.64; 140.22 and 147.86; 138.80 and 132.99; 120.95 and 132.19 and 110.31 and 121.70 g/day respectively but when it is expressed on per cent body weight basis, the values being 7.43 and 6.97; 7.56 and 7.23; 8.17 and 7.76; 7.65 and 6.93; 7.78 and 7.45; 8.47 and 7.92; 8.33 and 8.05; 9.26 and 9.16 and 10.23 and 9.67 per cent respectively.

On comparing the data on dry matter intake (DMI) as per cent of body weight when the DE levels being kept constant but with varying levels of CP, it can be noticed that in animals maintained on rations A, B and C containing 3000 kcal DE but with CP to the extent of 20, 16 and 12 per cent respectively, a significantly better ($P<0.01$) DM consumption is noticed in animals maintained on ration containing 12 per cent CP; likewise in animals maintained on rations D, E and F containing 2500 kcal DE and rations G,H and I containing 2000 kcal DE but with varying levels of CP to the extent of 20, 16 and 12 per cent respectively, a significantly higher ($P<0.01$) rate of DM consumption could be observed in animals maintained on lower level of CP in the ration indicating that the dietary level of CP influences DM consumption. Similarly when keeping the protein levels constant, on examining the data on animals maintained on rations A, D and G containing DE to the extent of 3000, 2500 and 2000 kcal and CP to the extent of 20 per cent in each respectively, a significantly better ($P<0.01$) DM consumption is seen recorded in animals maintained on low energy rations, likewise rations B, E and H as well as rations C, F and I containing DE to the extent of 3000, 2500 and 2000 kcal and CP to the extent of 16 per cent and 12 per cent in each respectively, contributing similar trend of results, confirming that dietary energy level significantly influences ($P<0.01$) the DM consumption of animals.

The data clearly show that as the animal advances in age, the DM intake as per cent body weight decreases irrespective of the treatment combinations.

Similar values and observations on DM consumption have been reported by various authors for growing rabbits of different breeds maintained on different dietary regimes. Kelverkamp (1975) from his work on feeds with different concentrations of nutrients for fattening rabbits observed that rabbits consumed comparatively less feed on high energy diets than those on low energy diets. Davidson and Spreadbury (1975) observed that, fattening rabbits maintained on six different diets in which the CF content ranged from three - 19 per cent adjusted their DM intake to keep growth rate constant. Similar observation has been made by Lebas (1975 a) on maintaining rabbit with diets containing 11 and 19 per cent CF with no significant difference in growth rate. According to Spreadbury and Davidson (1978) rabbits can adjust their DM intake to regulate the constant supply of energy. De Blas et al. (1981) reported an average DM intake ranging from 71.74 $\pm$2.88 to 119.07$\pm$2.12 g/day from weaning to slaughter on 12 experimental diets with varying CP levels viz., 12, 14, 16 and 18 per cent and CF levels viz., 7, 11 and 15 per cent in a factorial manner. High fibre content was associated with high DM intake and dietary CF content of seven, 11 and 15 per cent promoted similar live weight gains. On maintaining weaned rabbits upto 1.5 kg, two kg and three kg under two energy levels, Butcher et al. (1983) reported that rabbits on LE (6.84 MJ-ME/kg) diet consumed more DM than rabbits on the HE (9.87 MJ of ME/kg) diet ($P < 0.01$). Grobner et al. (1985 a) on feeding different breeds of rabbits with three energy levels of low (2000 kcal/kg) medium (2500 kcal/kg) and high (3000 kcal/kg) DE, observed that feed intake were highest with low energy diet for all breeds. The over all average daily feed intake (g) were 167, 162 and 137 for low, medium and high energy fed groups. Grobner et al. (1985 b) recorded a DM intake of 175.3 and 201.8 g/day for adult palomino and NZW rabbits. According to Shqueir et al. (1985) weanling NZW rabbits consumed on an average 67.98 g/day of pelleted feed, free choice from 30 - 60 days of age. In growing Baladi rabbits maintained on low fibre (13.6 per cent CF) and high fibre (23.62 per cent CF) diets from five - 15 weeks of age Abou-Ashour and Ahmed, (1986) recorded an average DM intake of 56.86$\pm$1.05 and 64.19$\pm$2.62 g/day. Ahmed and Abou-Ashour

Fig. 8

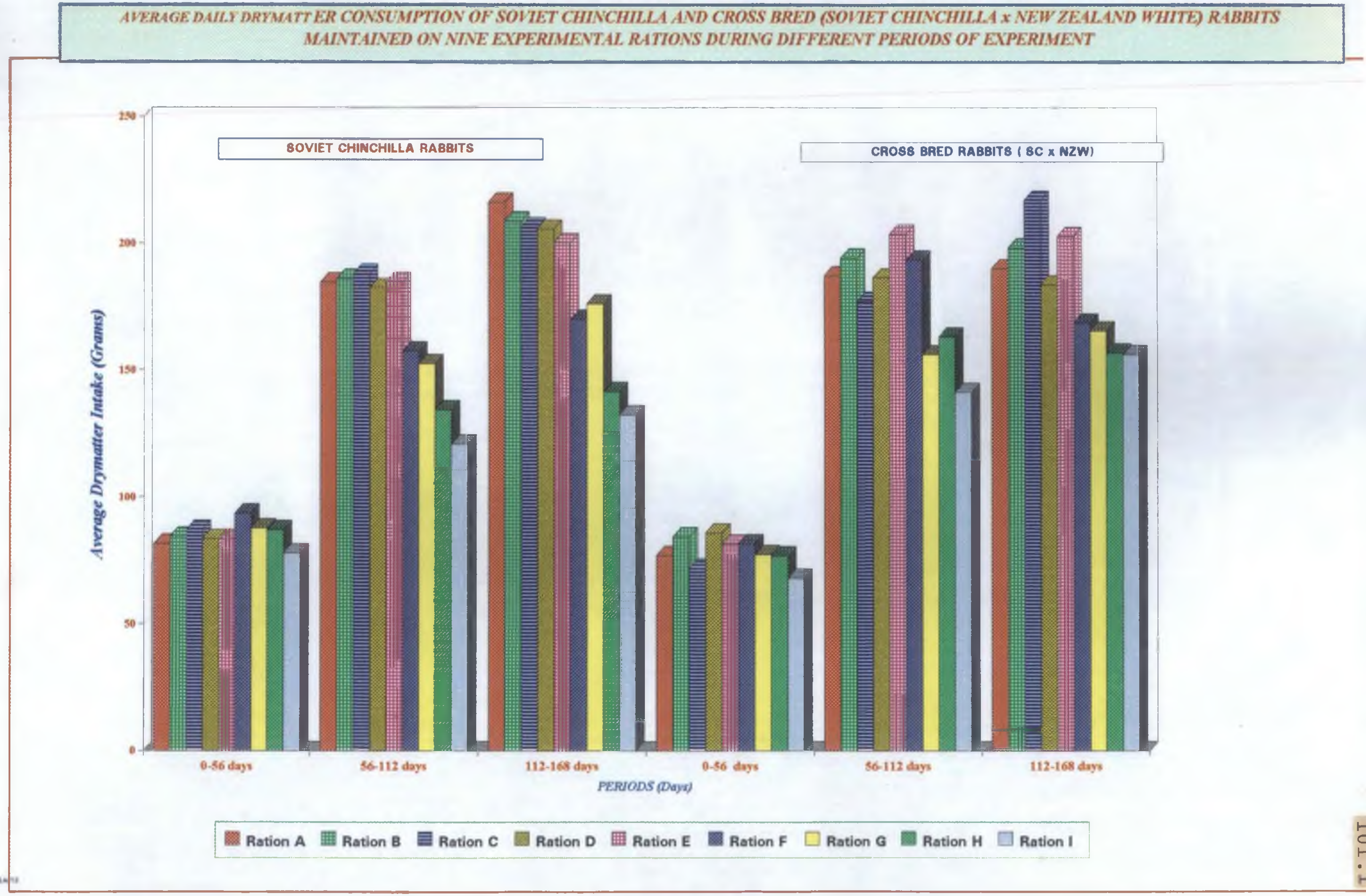

AVERAGE DAILY DRYMATTER CONSUMPTION OF SOVIET CHINCHILLA AND CROSS BRED (SOVIET CHINCHILLA x NEW ZEALAND WHITE) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT PERIODS OF EXPERIMENT
SOVIET CHINCHILLA RABBITS
CROSS BRED RABBITS (SC x NZW)
Average Drymatter Intake (Grams)
250
200
150
100
50
0
0-56 days
56-112 days
112-168 days
0-56 days
56-112 days
112-168 days
PERIODS (Days)
Ration A
Ration B
Ration C
Ration D
Ration E
Ration F
Ration G
Ration H
Ration I

Fig. 9

AVERAGE DAILY DRYMATTER CONSUMPTION OF SOVIET CHINCHILLA AND CROSS BRED (Soviet Chinchilla X New Zealand White) RABBITS WHEN EXPRESSED ON PERCENTAGE OF BODY WEIGHT MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT PERIODS OF EXPERIMENT

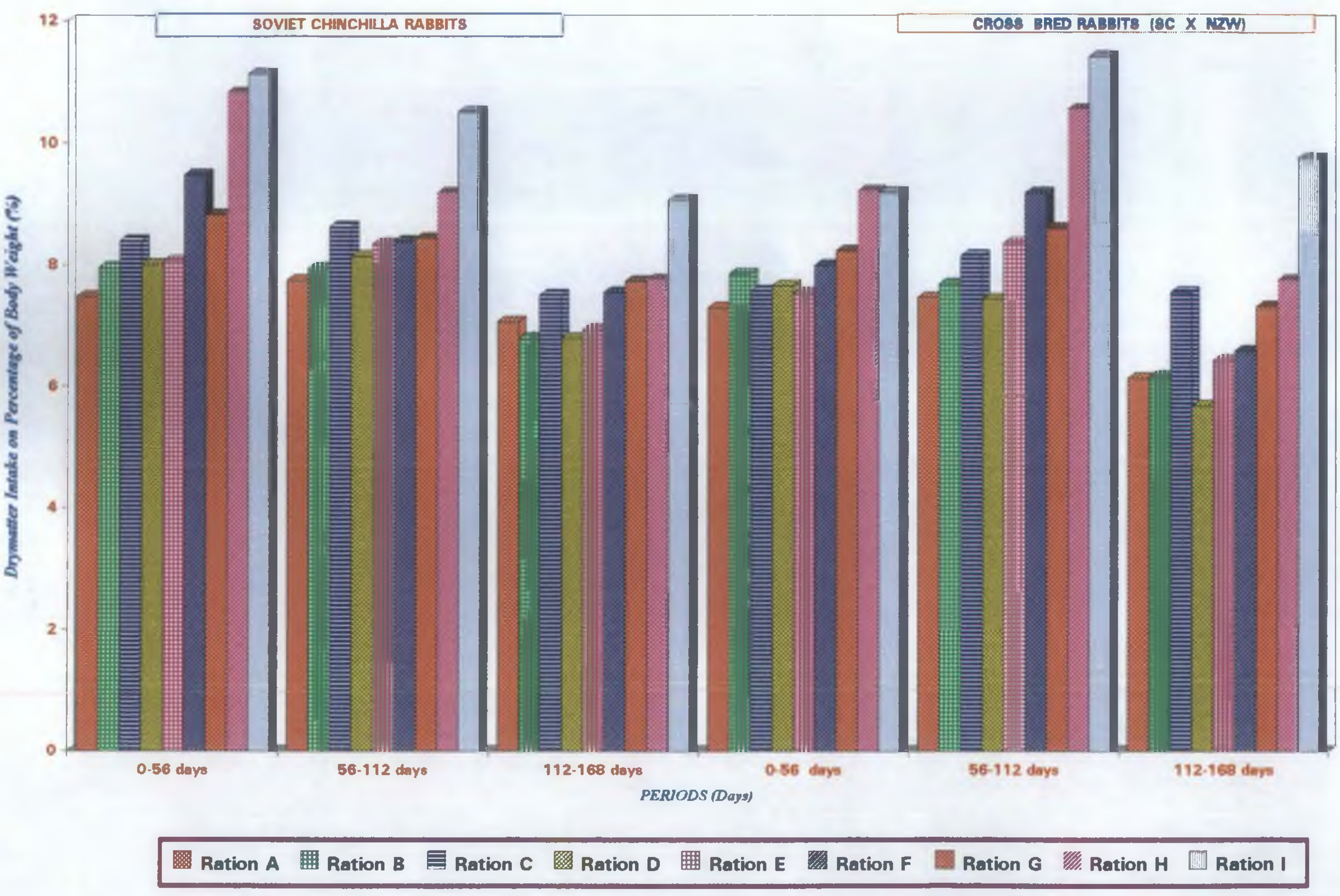
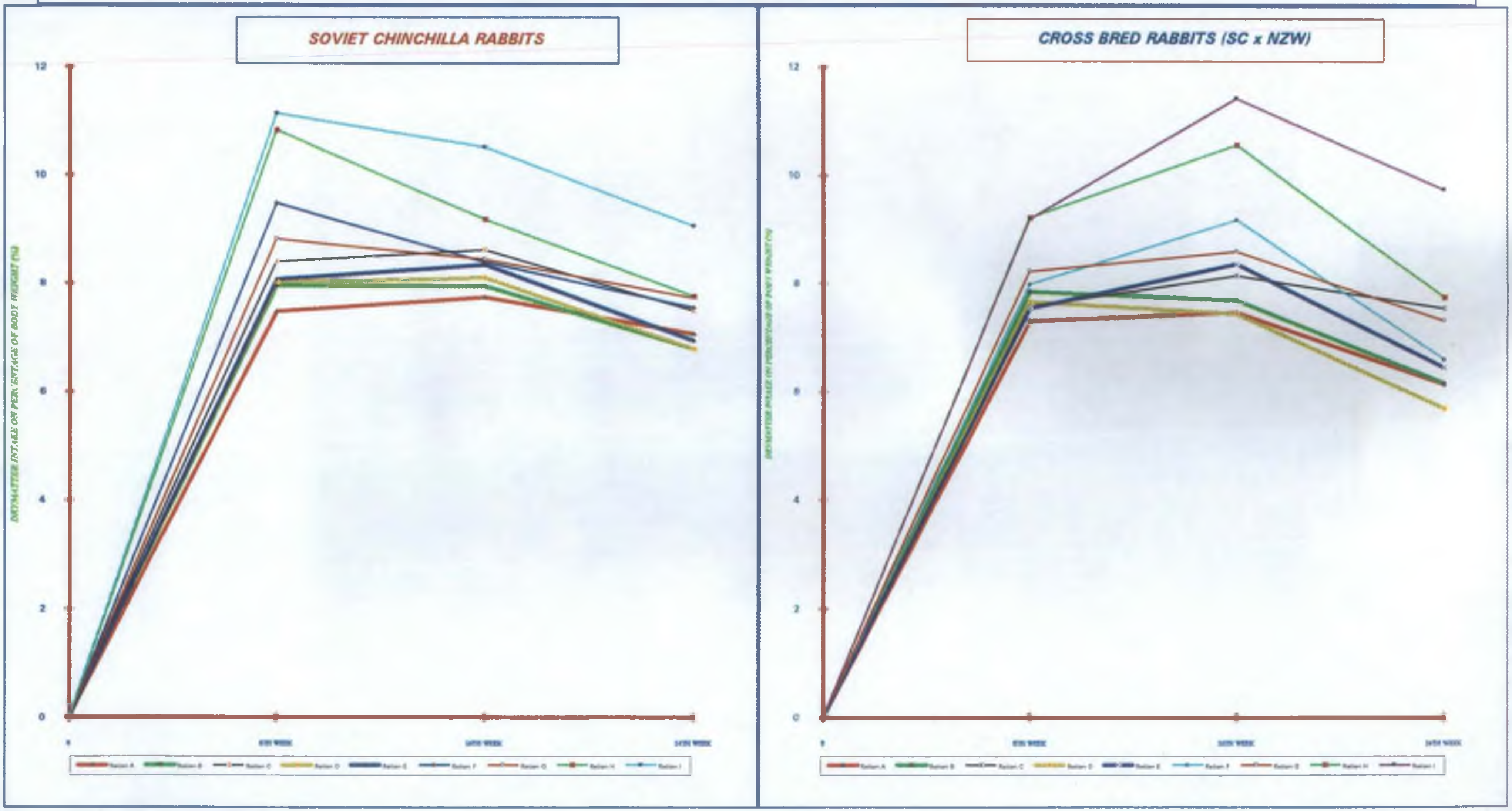


Fig. 9

AVERAGE DAILY DRYMATTER CONSUMPTION OF SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS WHEN EXPRESSED ON PERCENTAGE OF BODY WEIGHT MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT STAGES OF EXPERIMENT



(1987) from their study on protein quality and essential aminoacid requirements for growing Baladi rabbits of five weeks old for 10 weeks recorded a daily DM intake of 85.0, 92.2, 90.5 and 87.2 g on diets containing 16 - 17 per cent CP. Abdella et al. (1988) recorded a daily DM intake of 116.2, 106.2 and 119.9 g on diets containing 16, 18 and 20 per cent CP in cross bred rabbits from five - 12 weeks of age. Comparatively higher DM intake on low energy diet was also reported by Kasa et al. (1989), who compared the high energy, full fat rice bran with low energy lucerne meal as a fibre source for weaned rabbits at 22° and 30°C. Feed intake was 512 and 346 g/week on the low and high energy diets respectively.

Increased feed consumption on decreasing energy concentration of the diet observed in the present investigation was also reported by Sankhyan et al. (1990) on maintaining six weeks old cross bred rabbits with diets containing NPNE (100% NRC), LPLE and HPHE for 126 days, the corresponding DM intake being 136.13, 133.66 and 133.26 g/day respectively or 66.25, 63.03 and 61.36 g/kg w^{75}. Maertens et al. (1990) also observed increased feed intake on low energy diets who have reported that daily energy intake was eight per cent lower for low energy diets although feed intake was greater. However, on rearing NZW rabbits weaned at five weeks of age on six dietary treatments having three protein levels viz., 13 per cent (low), 16 per cent (medium) and 20 per cent (high) and two energy (TDN) levels viz., 56-57 per cent (low) and 63-65 per cent (high) upto one kg and 1.5 kg body weight, Deshmukh and Pathak (1993) reported a significantly higher ($P < 0.01$) intake of feed in high energy group, the result is at variance with that of the present investigation.

Another trend observed in the present investigation, that an increase in daily feed intake with increase in dietary CF content is in agreement with the results recorded by Lange et al. (1991) in growing NZW rabbits fed on four complete diet having CF per cent of 8, 10, 12 and 15, wherein the daily feed intake was 9-14 per cent higher in high fibre groups. Davidson and Spreadbury (1975), Lebas (1975 a) and Deblas et al. (1981) also reported a high DMI associated with high fibre content in the diet.

While the results on DM consumption are in agreement with the above authors, entirely different trend on DM consumption could be observed by various workers. On studying the protein and aminoacid requirement of growing NZW rabbits with diets having varying CP concentration from 10.4 - 25.5 per cent , Spreadbury (1978) observed maximum food intake and growth at a CP concentration of 14 and 15.6 per cent. Partridge and Allan (1983) on feeding diets with varying CP percentage of 17.3, 18.1, 22.4 and 24.3 at two levels H (330 g/day) or L (280 g/day) in lactating does reported that DM intakes on feeding level H were significantly higher than those on level L and the difference diminished as the CP concentration decreased. Reduction in food intake on decreasing the CP levels was reported by Reddy and Moss (1982) who observed that does fed on 14 per cent dietary protein consumed less ($P < 0.05$) than the does maintained on 18 per cent or 20 per cent dietary protein. Lall et al. (1984) obtained no significant variation in feed intake of rabbits on rations containing different protein levels viz., 25.38, 21.18, 19.32, 13.83 and 10.18 per cent in Angora rabbits of 12 - 14 months of age for three months. The DMI (g/day) were 87, 94, 113, 110 and 107 respectively. Raharjo et al. (1986 a) recorded the DM consumption (g/day) of growing NZW rabbits on diets with 21 per cent CP, 16 per cent CP, 16 per cent CP + methionine and 16 per cent CP + Urea as 41.4, 41.1, 41.0 and 38.7 g from 28 - 56 days of age. Lebas and Ouhayoun (1988) reported an over all average feed consumption of 107 g/day in NZW, NZW x CW rabbits and the corresponding values were significantly higher for rabbits fed a high protein diet than those fed a low protein diet.

From the results of the present study on DM consumption it can be construed that the DM consumption increases on decreasing the dietary energy and protein levels, as supported by an essentially similar trend of result by the various authors.

5.3. Feed efficiency

Feed efficiency (FE) values registered for animals maintained under different ration treatments presented in Table 4, 5 and 6 represented by Fig. 10, 11a and 11b and statistical analysis of the data in Appendix 25.1 and 25.2 for the period upto 168

Fig. 10

EFFECT OF DIETARY ENERGY AND PROTEIN LEVELS ON FEED / GAIN RATIO OF SOVIET CHINCHILLA AND CROSS BRED (Soviet Chinchilla X New Zealand White) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS (0 - 168 DAYS)

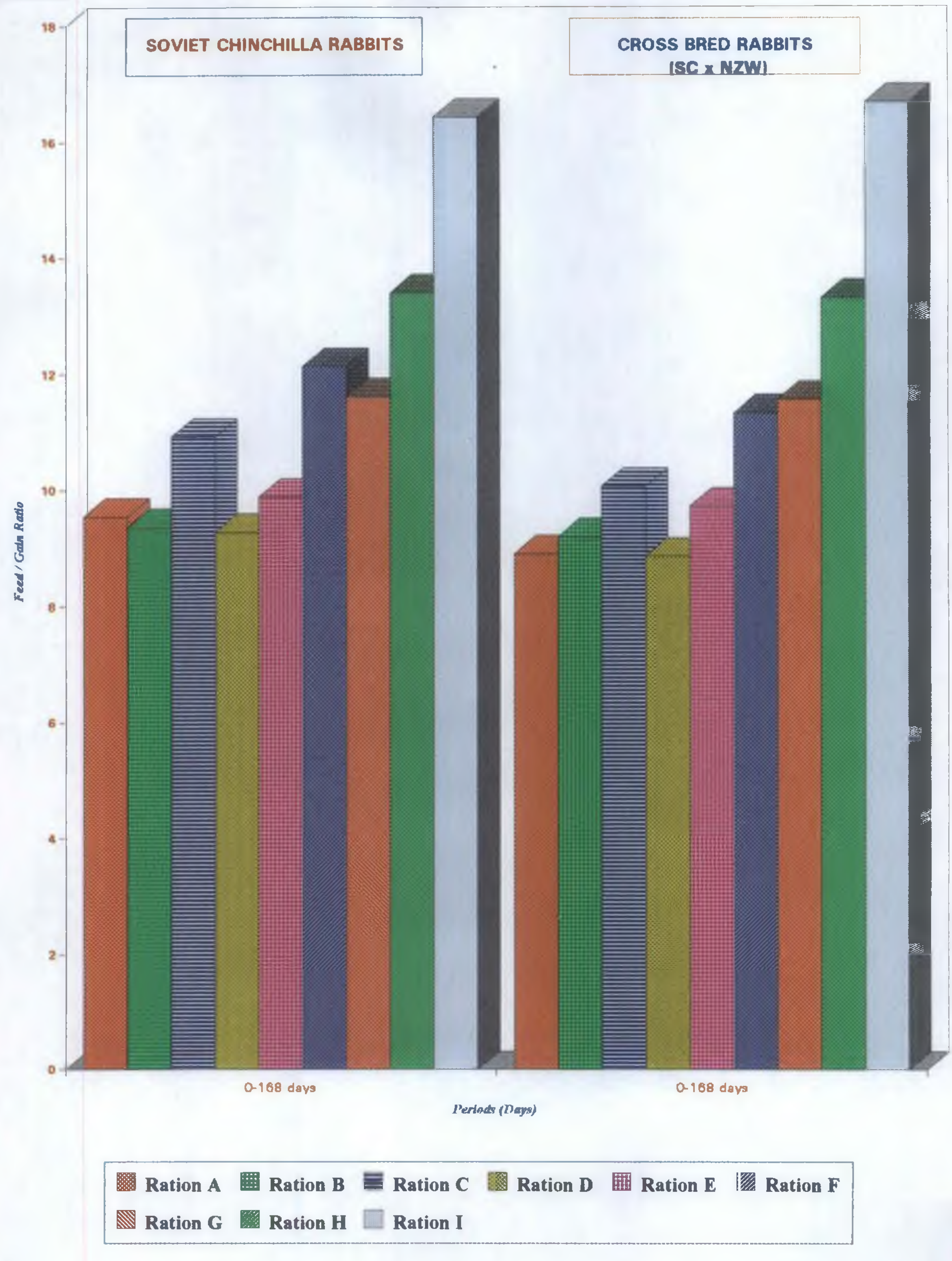
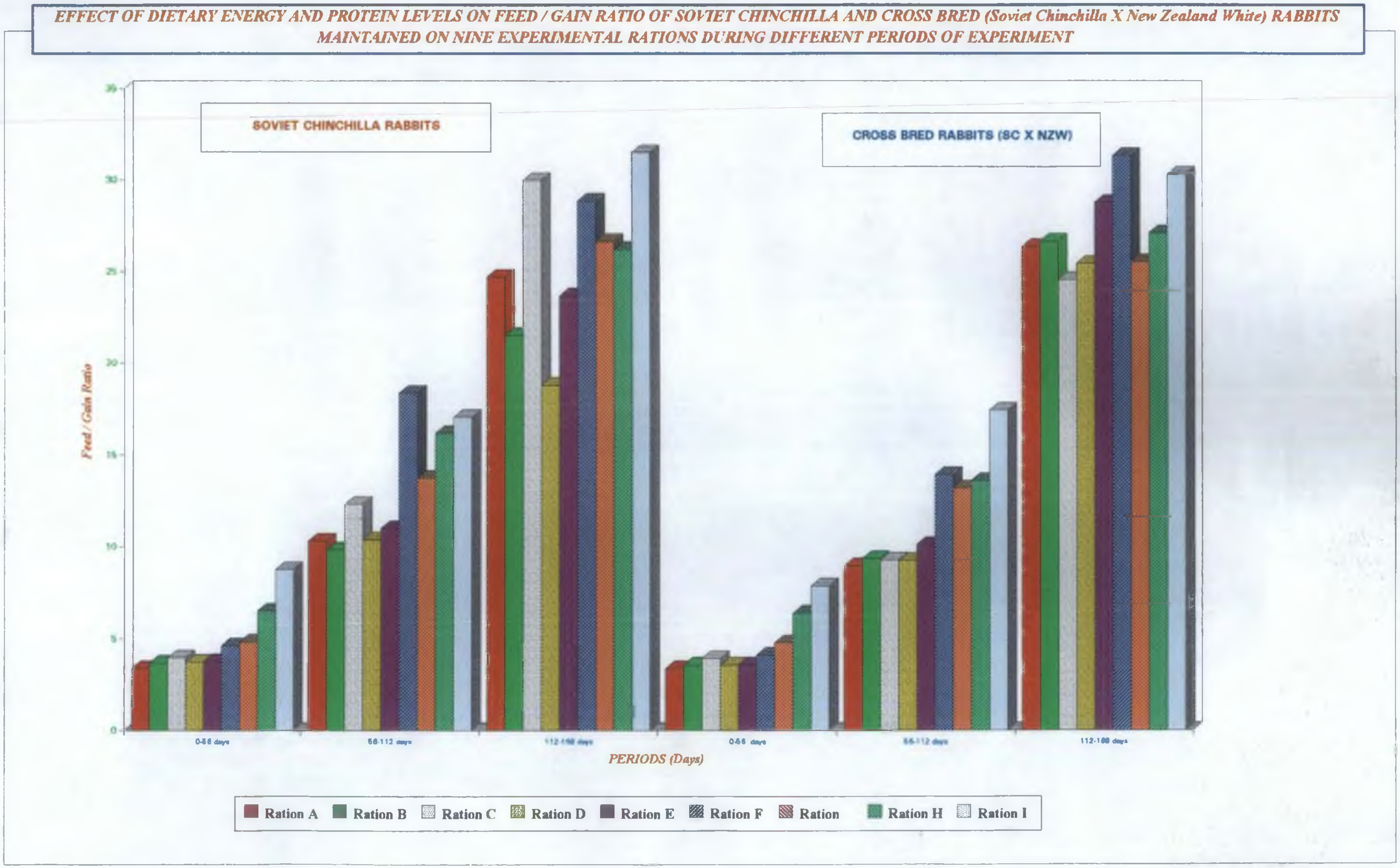


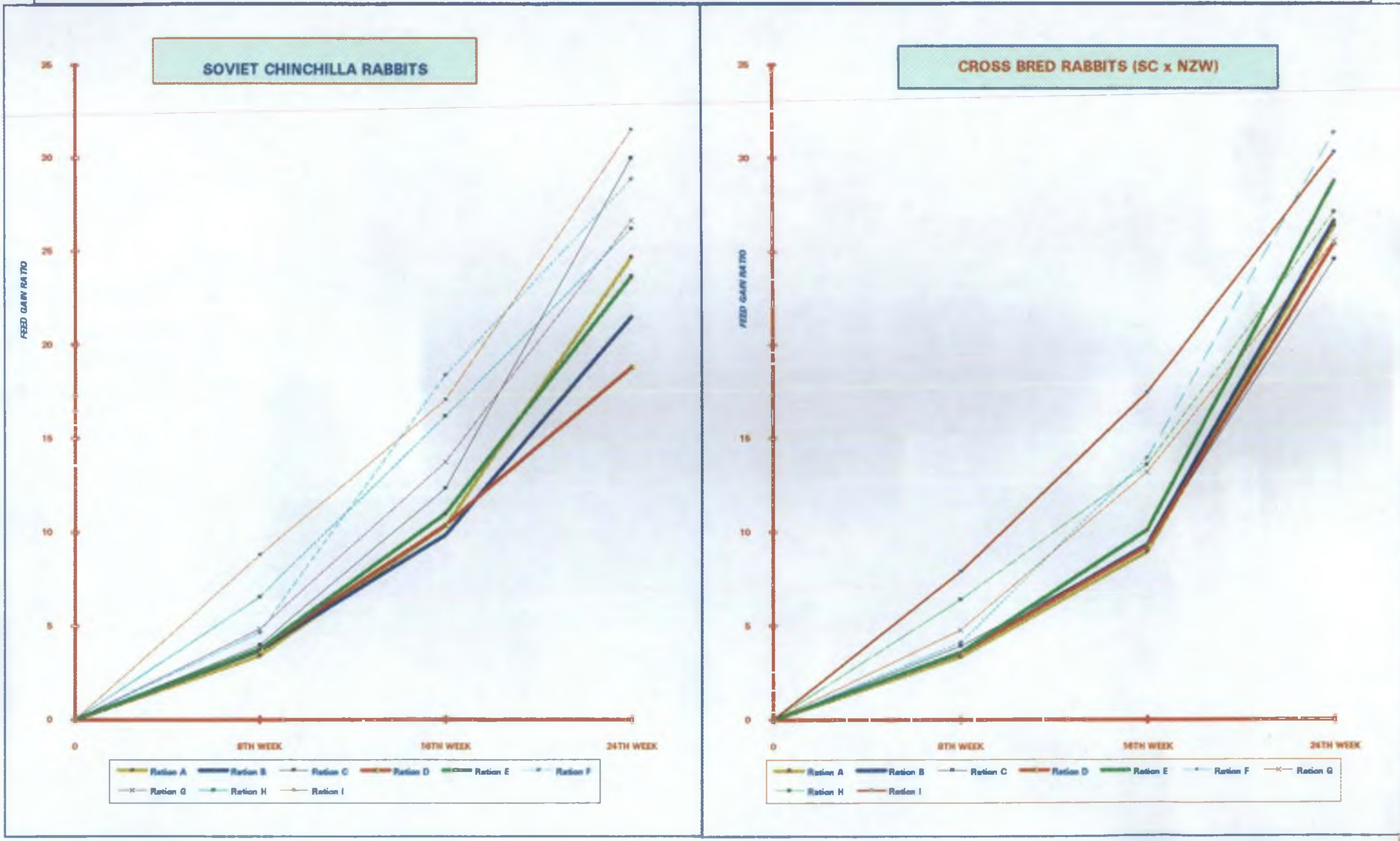
Fig. 11 a



GANGA.16

Fig. 11 b

EFFECT OF DIETARY ENERGY AND PROTEIN LEVELS ON FEED / GAIN RATIO OF SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT STAGES OF EXPERIMENT



days of experiment reveals that ration D containing 2500 kcal DE with 20 per cent CP recorded maximum FE for both SC and CB rabbits, an appreciably better FE values recorded over its corresponding group containing 3000 kcal DE with 20 per cent CP (ration A) indicating that further increase in DE from 2500 kcal to the extent of 3000 kcal would not contribute better FE as can be seen from the FE values for both SC and CB rabbits as 9.54 and 8.89 (ration A) and 9.27 and 8.85 (ration D) respectively. It can also be noticed that while animals maintained on ration containing 16 per cent CP with 2500 kcal DE (ration E) register FE values of 9.88 and 9.71 for both SC and CB rabbits, its corresponding group containing 16 per cent CP with 3000 kcal DE (ration B) registered a FE value of 9.36 and 9.18 for the SC and CB rabbits respectively (ration B and E are significant - $P < 0.01$). Still lower FE value of 9.27 and 8.85 has been registered for SC and CB rabbits maintained on ration D which when compared to that of animals maintained on ration B on statistical analysis, no significant difference could be noticed between the animals maintained on rations B and D in SC animals but a comparatively better FE in CB rabbits maintained on ration D when compared to that of ration B, tends to show that, for optimum FE, either a ration containing 3000 kcal of DE with 16 per cent CP or a ration containing 2500 kcal DE with 20 per cent CP may be found essential to support optimum growth.

On keeping the energy level constant, statistical analysis reveals that there is a significant decrease ($P < 0.01$) in FE as the CP level lowers, which can be appreciated from the FE values of rations A and C containing 3000 kcal DE with 20 and 12 per cent CP and rations D and F containing 2500 kcal DE with CP levels 20 and 12 per cent respectively and rations G and I containing 2000 kcal DE with 20 and 12 per cent CP for SC and CB rabbits respectively.

The data on FE revealed that maximum FE is observed during the first stage (0-56 days) of the experiment and there after there is a linear reduction in FE as the age advances in all the nine treatments and the finding is in agreement with various authors. An average feed efficiency of 3.48, 3.86, 4.29 and 4.76 for ages six - nine; six - 11; six - 13; six - 15 weeks were reported in NZW rabbits by Ferrara et al. (1970). Rodriguez et al. (1982) found poor FE with increased slaughter weights.

Lindeman et al. (1982) also reported a higher FE of 2.64 for four - six weeks of age when compared to 3.33 for six - eight weeks in NZW rabbits. Butcher et al. (1983) during the course of their study on the effect of slaughter weight upon the growth and carcass characteristics of rabbits fed on diets containing different ME levels also agreed that rabbits slaughtered at three kg were less efficient in converting DM to live weight gain than at 1.5 kg or 2.25 kg on both high and low energy levels, the FCR were 5.64, 6.34 and 10.67 for LE and 3.32, 3.34 and 5.25 for HE diets upto the slaughter weight of 1.5, 2.25 and 3 kg. James and Thomas (1988) also reported a higher FE of 3.33, 3.23 and 3.25 for 0 - 49 days in weaned American Chinchilla cross-bred kids given concentrate mixtures with 16, 20 and 24 per cent CP for a period of 126 days and the FE were lower as the age advances, the values being 4.71, 4.39 and 4.36 respectively for 0 - 91 days and 6.43, 5.56 and 5.3 for 0 to 126 days of experiment. According to Baumier and Retaillean (1988) feed conversion ratio ranged from 1.83 at 28-35 days of age to 5.58 at 77-80 days and averaged 3.45 for a strain selected for meat production. Improved FE during the initial period of growth has also been reported by Deshmukh and Pathak (1993) in a study on the growth performance and nutrient utilization by NZW rabbits maintained on different plane of nutrition from weaning to one kg body weight. They reported a feed/gain ratio ranging from 4.01 to 5.21 from weaning to one kg body weight and a still higher value of 8.05 - 10.05 from one kg to 1.5 kg body weight.

Several authors have also recorded comparable results on FE in broiler rabbits. Niedzwiadek (1980) recorded an average FE (Feed/gain) of 3.55, 3.67, 3.81, 3.64, 4.57, 3.76 and 3.81 from weaning at 28 days to 2.50 kg body weight in various cross breds between NZW, Polish white and Californian White rabbits. Sastry and Mahajan (1982) reported an average FE of 1:9.24, 1:5.51 and 1:4.66 in growing NZW rabbits from 10 to 20 weeks fed on tree leaves, barley grain, and bengal gram respectively each with white clover hay to meet 1/3 of total daily protein requirement. Chawan et al. (1982) reported FE ranging from 1.96 to 3.0 in a four week trial from four to eight weeks of age in NZW rabbits offered three levels of DE (2600, 2800 and 3000 kcal/kg) and protein (16,18 and 20 per cent) and crude fibre (10,12 and 14 per cent). An average FE value of 4.1 and 3.9 was recorded for the period from weaning to 56 days in Palmino and NZW rabbits by Grobner et al. (1985 b). Feed efficiency values of 4.18, 4.09 and 3.8 reported by Fekete and Hegedus (1986) in NZW rabbits from six - 11 weeks of age in their work on digested feathers in rabbits; an average feed intake of 3.7, 3.5, 3.5 and 3.2 g/g-gain from five - 13 weeks of age in Californian White (CW), New Zealand White (NZW), CW x NZW and NZW x CW rabbits recorded by Mach et al. (1987); 3.56, 3.52 and 3.73 kg feed/kg gain reported by Niedzwiadek et al. (1987) from weaning to 90 days in White Termonde x NZW, NZW x WT and WT breeds are in agreement with the FE values recorded during the course of present investigation.

Butcher et al. (1983) also observed higher FE on high energy fed groups and lower FE on low energy fed rabbits. High FE on higher plane of nutrition observed in the present study is also agreed with that of Sankyan et al. (1990) who from their study on effect of different levels of protein and energy on growth performances of rabbits for 126 days from six weeks of age observed that FE was highest in rabbits fed HPHE diet, followed by LPLE and NPNE diets, the values being 1:6.78, 1:8.1 and 1:9.16. On studying the growth performance of NZW rabbits as influenced by different plane of nutrition, Deshmuk and Pathak (1993) reported a significantly higher FE in MPHE followed by MPLE and LPLE groups.

Similar FE values as that observed during the course of the present investigation are also reported by various authors. Sanctisviana (1990) reported similar FE of about 3.5 in broiler rabbits of different breeds from weaning at 30th day to slaughter at two kg body weight. Similar FE values have been reported by Maertens et al. (1991), the values being 3.86, 3.77, 3.33 and 3.34 respectively in a factorial experiment for rabbits that were given mixed feeds with 8.56, 9.09, 10.29 and 10.75 MJ/kg and digestible protein 12.4, 14.3, 11.9 and 14.1g/1000 KJ DE from five - 11 weeks old, however, they could not find any significant influence of protein or energy on FE as observed in the present study. Castellini et al. (1991) also reported comparable FE of 3.9, 3.5 and 3.7 kg feed/kg gain in NZW rabbits of 40 days old fed on diets equal in protein, fibre and energy with or with out nine or 18 per cent peas partly replacing soybean meal for a period of 35 days.

Das and Nayak (1991) reported similar FE of 3.22, 3.93, and 3.78 g food per g gain respectively in SC and GG and WG rabbits from seven - 12 weeks.

Average feed conversion indices of 3.89, 4.15 and 4.01 reported by Bozac et al. (1992) in chinchilla rabbits from about 650 g live weight to 2560, 2453 and 2628 g respectively giving mixed pelleted feeds with 10, 20 and 30 per cent mycelia substrate also agrees with the present result.

A decrease in FE on high fibre diet obtained in the present study is supported by Lange et al. (1991) who found decrease in FE by nine - 18 per cent on 12 and 15 per cent fibre levels when compared to diet having eight and 10 per cent CF.

While the values obtained in the present study for efficiency of conversion of feed by the animals of the various groups receiving different energy protein levels are in agreement with the authors cited above, higher efficiencies of feed conversion have also been reported by various workers. According to Auxilia (1973) the food conversion ratio averaged 2.5, 2.2, 2.2, 2.2 FU/kg gain from 45 - 90 days for Burgandy Fawn (BF), Californian (Cal), BF x Cal and Cal x BF rabbits respectively. As against the present results, Spreadbury (1978) observed a high FE of 3.4:1 for lowest concentration of CP (10.4 per cent) with a maximum efficiency of 2.8:1 for a CP concentration of 14 - 15.6 per cent and no improvement at higher concentration of CP, on maintaining growing NZW rabbits for 28 days from four to eight weeks of age on eight experimental diets with CP concentration of 10.4, 11.2, 12.5, 14.0, 15.6, 16.8, 18.3 and 22.5 per cent. Rastogi (1986) reported a higher FE of 3.14 from weaning to 13 weeks in his study on FE and cost of rabbit meat production.Kawinska et al. (1987) also reported higher FE (3.17:1 and 3.26:1) in two groups of NZW rabbits housed on deep litter from 28 - 90 days of age. Very high FE of 2.78, 2.84, 2.95, 3.21 for NZW rabbits of five - eight weeks of age fed on four isonitrogenons and equicaloric diets with 0,10, 20 and 30 per cent olive pulp for a period of four weeks were reported by Tortuero et al. (1989). High conversion efficiency of 2.33, 2.81, 2.77

and 2.25 was reported by Eekeren et al (1991) when 0,6,12 and 18 per cent spent tea leaves mixed with broiler finisher diet was given for 28 days in 50 days old NZW rabbits and 2.97, 2.28, 1.90 and 1.69 kg/kg gain for the spent coconut diets fed at 0, 10, 20 and 30 per cent level mixed with broiler diet fed to 54 days old NZW rabbits weighing 977 - 1422 g.

Lower efficiency of conversion of feed has been observed in broiler rabbits by different authors. Martina (1987) reported FE of 3.519 in NZW rabbits from four - eight weeks of age on 17.3 per cent CP and 2612 kcal ME/kg. Pizzi and Crimella (1987) recorded a still lower efficiency with feed conversion indices of 5.108 and 4.997 from 45 - 75 days of age in two groups of NZW rabbits. When compared to the present study, lower FE was reported by Abdella et al. (1988) who obtained an average feed conversion rate of 4.19, 3.97 and 4.29 in growing cross bred rabbits fed on diets with 16, 18 and 20 per cent CP from five weeks - 12 weeks of age. Tangendjaja et al. (1990) reported a feed/gain ratio of 5.9, 6.7, 11.1 and 17.6 respectively in NZW rabbits fed on control diet (16 per cent CP and DE 2500 kcal/kg) and diets containing untreated leucaena leaf meal at 20, 40 and 60 per cent level from two months old for six weeks and 8.7, 10.5 and 19.2 on diet containing treated LLM at 20, 40 and 60 per cent respectively.

From the foregoing review it can be inferred that the variation in FE reported by different authors are due to the effect of diet, stage of growth, variation in breed etc.

5.4. **Protein efficiency**

Protein efficiency(PE) values recorded with respect to SC and SC x NZW rabbits maintained on different ration treatments (Table 4, 5 and 6; Fig. 12 and 13 and statistical analysis in Appendix 25.1 and 25.2) reveal maximum efficiency in animals maintained on ration C containing 12 per cent CP and 3000 kcal DE. A general trend noticed with regard to protein utilization in animals maintained under the nine experimental rations was that as the CP level in the feed decreases the efficiency of protein utilization seems to be enhanced. On scrutiny of the statistical

Fig. 12

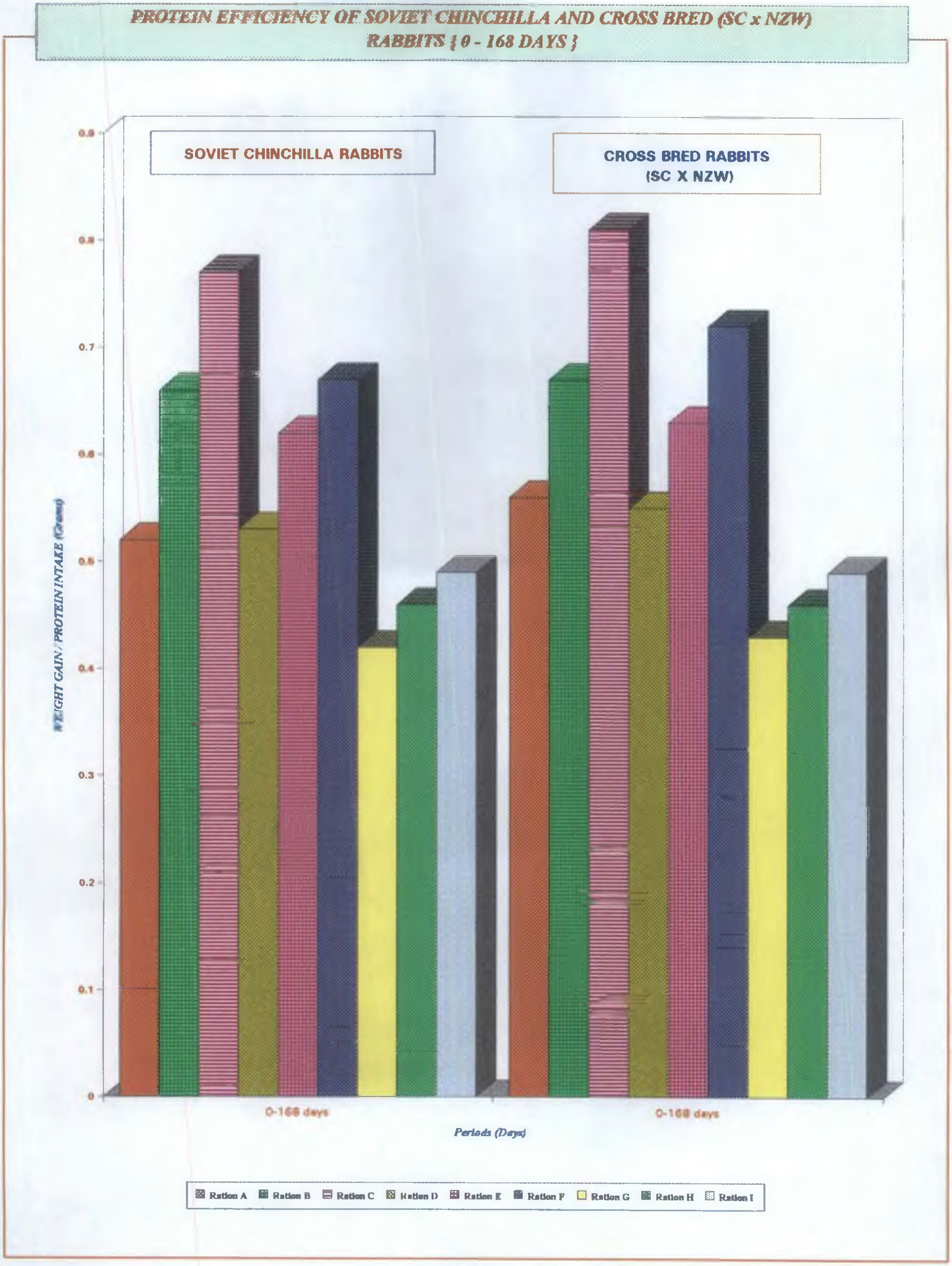
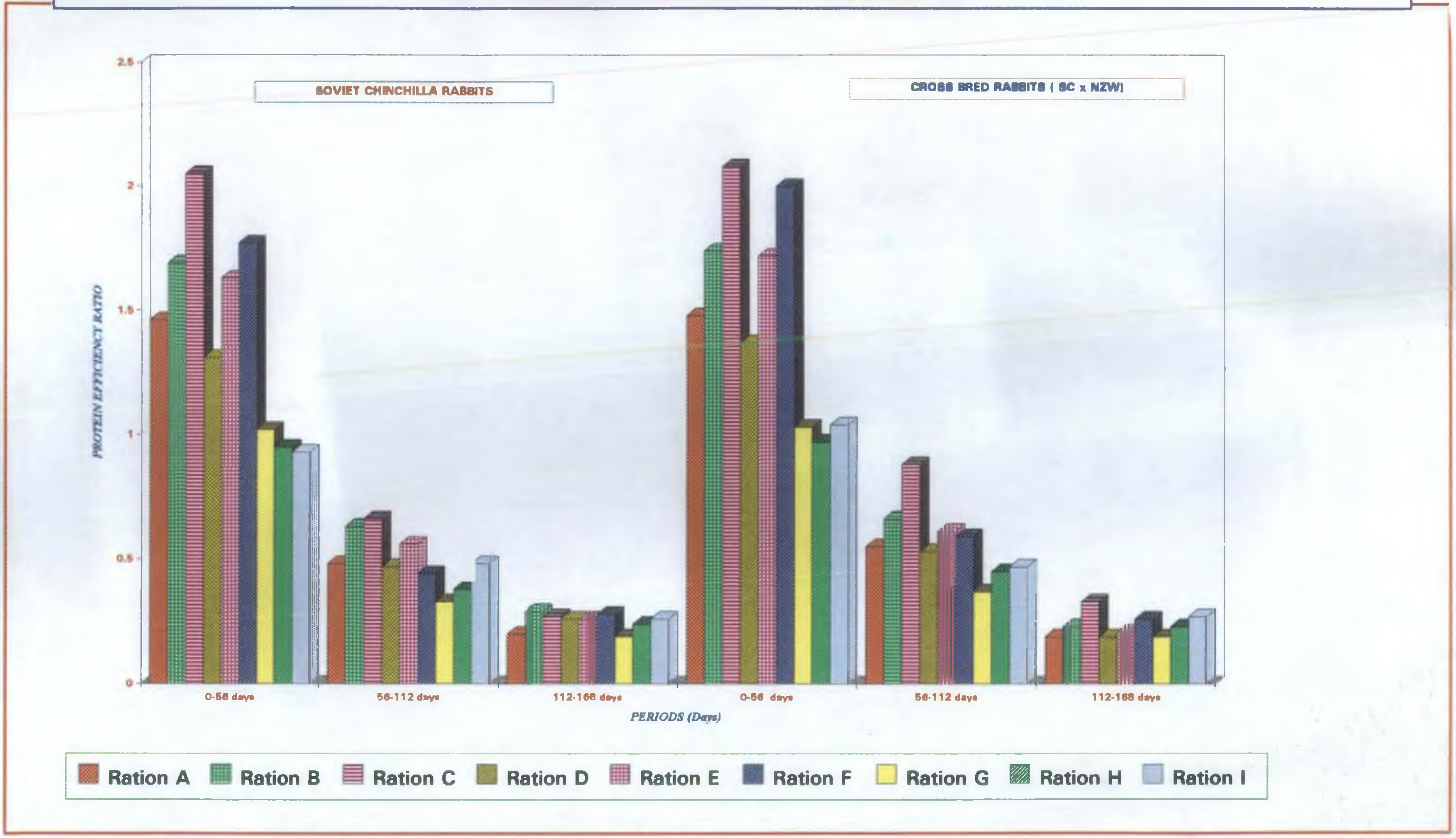

PROTEIN EFFICIENCY OF SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS (0 - 168 DAYS)
SOVIET CHINCHILLA RABBITS
CROSS BRED RABBITS (SC X NZW)
WEIGHT GAIN / PROTEIN INTAKE (Grams)
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0-168 days
0-168 days
Periods (Days)
Ration A
Ration B
Ration C
Ration D
Ration E
Ration F
Ration G
Ration H
Ration I

Fig. 13.

PROTEIN EFFICIENCY RATIO OF SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT PERIODS OF EXPERIMENT



analysis of the data, it can be noticed that animals maintained on rations A, D and G, rations B, E and H and rations C, F and I show a significant difference ($P<0.01$) between the groups with regard to PE values, indicating that dietary energy level influences protein utilization. A similar trend of result is obtained in animals maintained on rations A, B and C, rations D, E and F and rations G, H and I indicating that dietary levels of protein also influences efficiency of protein utilization as can be noticed from a statistically significant difference ($P<0.01$) between the corresponding groups.

An increasing trend in PE as the CP level lowers, as observed in the present work is in agreement with Abdella et al. (1988) who recorded a PE value of 1.49, 1.4 and 1.13 in three experimental diets having CP concentration of 16, 18 and 20 per cent respectively in cross bred rabbits (Bouscat x Balladi Red) from five - 12 weeks of age. James and Thomas (1988) also recorded higher PE on low protein diets in their work on growth studies on cross bred rabbits with three dietary protein levels, 16, 20 and 24 per cent in weaned American Chinchilla cross-bred rabbits for a period of 126 days.

Another trend observed in the PE of the experimental animals in the present study (Table 5 and 6, Appendix 1 - 18) is that as the age advances there is a linear reduction in PE in all the treatments. This is supported by James and Thomas (1988) who also observed a higher PE of 2.498, 2.192 and 1.918 for 0 - 49 days and thereafter a lower PE of 1.769, 1.618 and 1.434 for 0 - 91 days and then a still lower PE of 1.296, 1.281 and 1.171 for 0 - 126 days of experiment in weaned American Chinchilla cross bred kids given concentrate mixtures containing 16, 20 and 24 per cent CP for a period of 126 days.

Fekete and Hegedus (1986) recorded an average PE value of 1.47, 1.43 and 1.54 in growing NZW rabbits from six weeks of age given concentrate alone, concentrate + three per cent enzymatically digested feather meal and concentrate + three per cent treated feather meal + lysine for 35 days in a study on the feeding value of digested feathers for rabbits. When five weeks old Baladi rabbits were given for 10 weeks, four diets containing 16.1 - 17.1 per cent CP supplied by ground clover hay, maize grain, soybean meal, cotton seed meal and urea in different proportions, Ahmed and Abou-Ashour (1987) recorded an average PE ratio of 1:1.11, 1:0.85, 1:0.78 and 1:0.59. In American Chinchilla cross bred rabbits fed on concentrate mixtures with guinea grass or leucaena leaves ad lib. for 98 days from about one kg body weight, James et al. (1989) recorded a PER of 1:1.156 and 1:0.729 in guinea grass and leucaena fed groups respectively.

The PE values in the present study for SC and CB rabbits are similar to the values reported by the above authors (Fekete and Hegedus, 1986; Ahmed and Abou-Ashour, 1987; Abdella et al., 1988; James and Thomas, 1988 and James et al., 1989).

5.5. **Cost of Production**

Data on cost of production of both SC and CB rabbits under different ration treatments arrived at from cost per kg gain (Table 4, 5 and 6; Fig. 14 and 15) recorded during 0-168 days and at different intervals 0-56 days, 56-112 days and 112 - 168 days respectively disclose that for overall production, a cost per unit gain of Rs. 43.85 for SC and 41.86 for CB rabbits was recorded as the lowest figure when compared to all other groups indicating that for maximum biological and economic efficiency, a ration containing 20 per cent CP and 2500 kcal DE is found to be optimum for SC and CB rabbits under experimentation. But when the cost of production is evaluated in between the periods viz., 0-56 days, 56-112 days and 112-168 days the cost efficiency is seen maximum during 0-56 days of experiment and out of the nine treatments the animals maintained on rations D and E containing 2500 kcal DE with 20 and 16 per cent CP emerged out as the lowest cost per unit gain (Rs 17.64 for SC and 16.84 for CB rabbits on ration D; Rs 17.00 for SC and Rs- 16.10 for CB rabbits on ration E) Diminishing trend on cost efficiency beyond eight weeks of age is also reported by Chen et al., 1978 and James and Thomas, 1988.

Fig. 14

COST OF PRODUCTION OF SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS - { 0 - 168 DAYS }

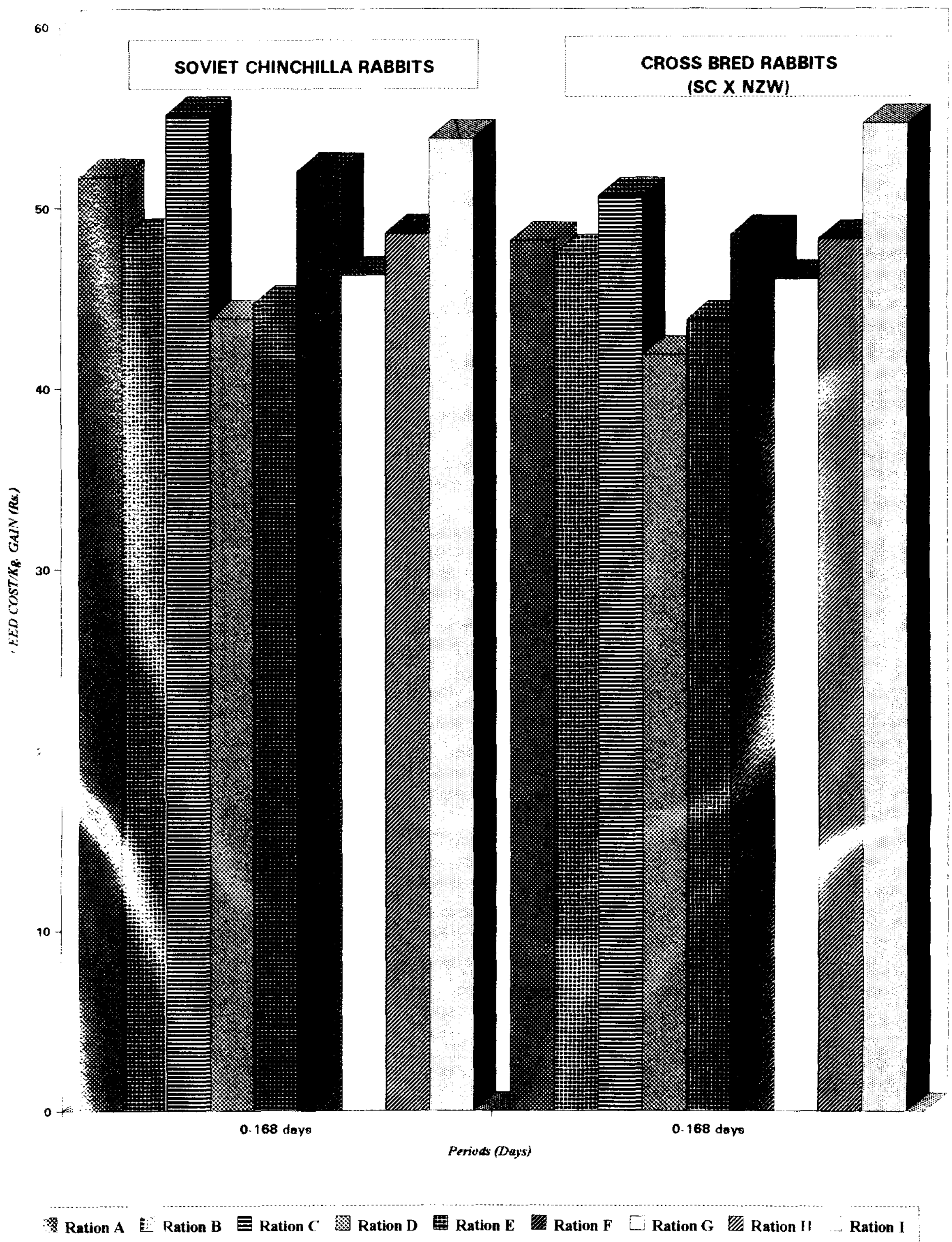
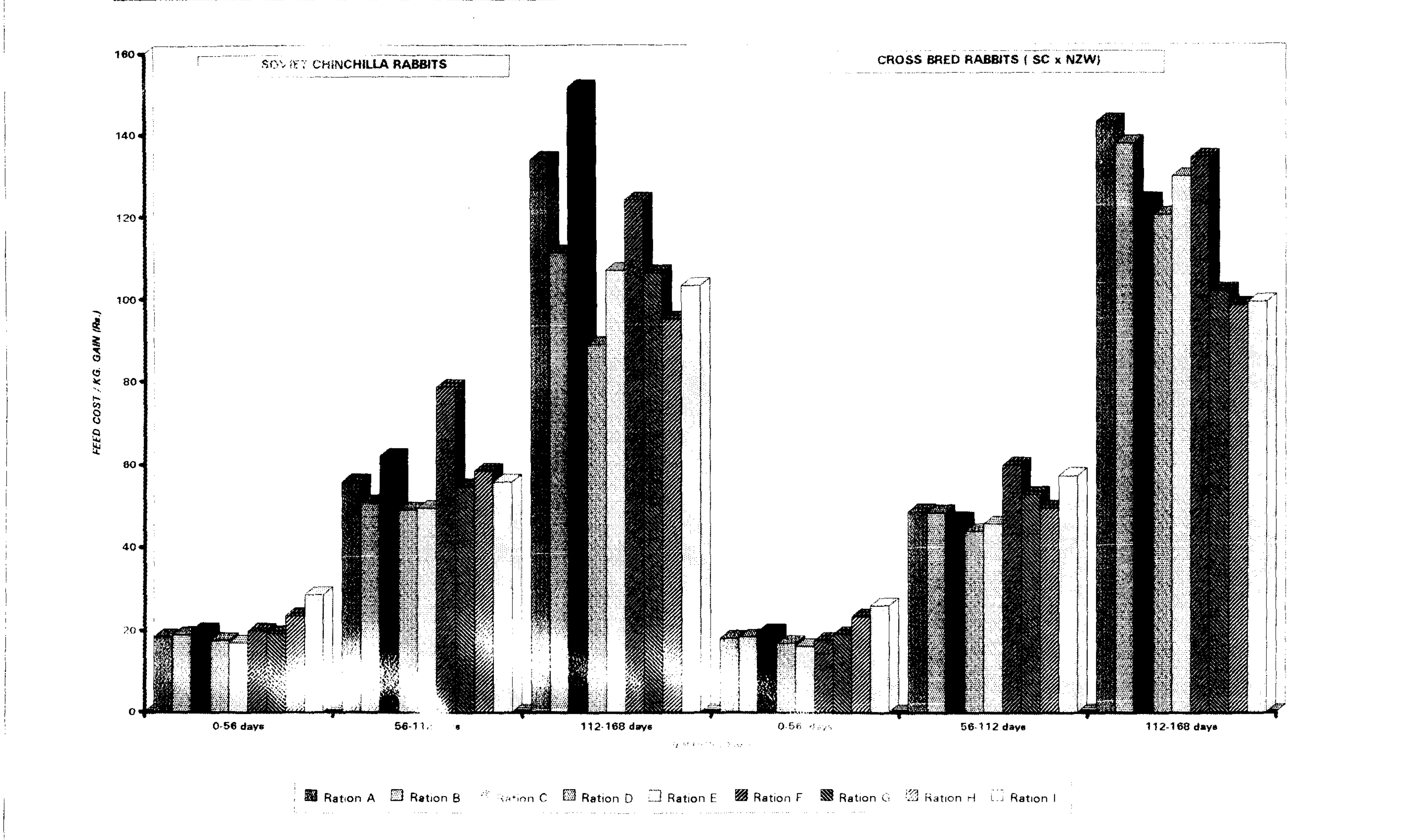


Fig. 15

COST OF PRODUCTION OF SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS DURING DIFFERENT STAGES OF EXPERIMENT



5.6. **Body Measurements**

Data collected on body measurements (body length, body height and chest girth) of the experimental animals at fortnightly intervals are presented in Appendix 19 - 24 and the summarized data showing the initial and final values on body measurement are set out in table 7 and 8 for SC and CB rabbits respectively with their statistical analysis in Appendix 25.3 and 25.4.

5.6.1. Fortnightly body length

The body length for rabbits in all the nine groups increased with increase in age from weaning to 24^{th} weak of experiment (Table 7 and 8).

Body length for rabbits in group I maintained on ration A increased from 20.4$\pm$0.39 - 36.55$\pm$0.58 cm at the 12^{th} fortnight for SC and 21.1$\pm$0.53 - 37.2$\pm$0.5 cm for CB rabbits respectively.

Body length for rabbits in group II (ration B) ranged from 21.1$\pm$0.4 - 36.6$\pm$0.72 cm at the 12^{th} fortnight for SC and 21.00$\pm$0.52 - 37.25$\pm$0.66 cm for CB rabbits.

For rabbits maintained on ration C (group III) body length increased from 21.05$\pm$0.36 - 34.80$\pm$0.69 cm at the 12^{th} fortnight for SC and 21.20$\pm$0.87 - 35.0$\pm$0.79 for CB rabbits.

Body length for rabbits in group IV (ration D) increased from 21.2$\pm$0.33 - 37.1$\pm$0.49 cm at 12^{th} fortnight for SC and 21.0$\pm$0.87 - 37.15$\pm$0.68 cm for CB rabbits.

Body length for animals in group V (ration E) increased from 21.15$\pm$0.52 cm - 36.4$\pm$0.29 at the last fortnight for SC and 21.2$\pm$0.64 - 36.2$\pm$0.63 cm for CB rabbits.

Body length for rabbits received ration F (group VI) increased from 20.1±0.64 - 33.25±0.82 cm at the 12th fortnight for SC and 21.0±0.05 - 35.10±0.55 cm for CB rabbits.

Body length for rabbits in group VII given ration G increased from 20.4 ±0.48 - 33.10 ±0.92 cm at the 12th fortnight for SC and 20.3 ±0.45 to 33.25 ±0.61 cm for CB rabbits respectively.

Body length for animals in group VIII maintained on ration H increased from 20.05±0.25 - 29.2±0.80 cm at the 12th fortnight for SC and 21.1±0.55 - 32.2±0.71 cm for CB rabbits respectively.

Body length for rabbits in group IX fed with ration I increased from 20.1±0.33 - 27.15±0.54 cm at the 12th fortnight for SC and 21.2±0.71 - 29.30±0.58 cm for CB rabbits respectively.

5.6.2. Fortnightly body height

The body height of rabbits in all the experimental group showed an increase as the animal advances in age from weaning to 24th week of experiment (Table 7 and 8, Appendix 19 - 34).

Rabbits in group I (ration A) showed an increase in height from 15.05 cm at weaning to 26.2 at 12th fortnight in SC and 15.10 - 26.4 cm respectively in CB rabbits with a total gain of 11.15 cm for SC and 11.3 cm for CB rabbits.

In the case of rabbits given ration B (group II) body height increased from the initial value of 15.1 - 26.6 cm at the last fortnight (12th fortnight) with a gain of 11.5 cm for SC and 15.05 - 26.7 cm respectively with a gain in height of 11.65 for CB rabbits.

Rabbits in group III received ration C showed an increase in height from 15.2 - 25.2 cm at the 24th week of experiment with a total gain of 10 cm in SC and 15.1- 25.5 cm respectively in CB rabbits with a gain in height of 10.4 cm.

The average body height recorded by animals of group IV (ration D) at the beginning was 15.2 cm with a final height of 26.4 cm at the 12th fortnight and the total gain being 11.2 cm for SC and 15.1 - 26.65 cm with a gain of 11.55 cm respectively in CB rabbits.

Rabbits belonging to group V given ration E registered an increase in body height from 15.1 - 25.5 cm at the last fortnight with a gain of 10.4 in SC and 15.05 cm - 26.2 cm with a gain of 11.15 cm respectively in CB rabbits.

Body height for rabbits in group VI maintained on ration F increased from 15.2 - 23.2 cm with a total gain of eight cm in SC and 15.1 - 23.95 with a gain of 8.85 cm respectively in CB rabbits.

Rabbits in group VII given ration G recorded an initial height of 15.2 cm and final height 23.1 cm with a gain in height of 7.9 cm in SC and 15.05 and 23.3 cm respectively in CB rabbits with a gain of 8.25 cm.

An increase in body height of 21.5 recorded at 12th fortnight from an initial height of 15.25 cm with a total gain of 6.25 cm was registered for SC and 22.1 cm from 15.15 cm with a gain of 6.95 cm respectively for CB rabbits belonging to group VIII (ration H).

Rabbits in group IX given ration I containing the lowest energy - protein levels registered the lowest gain in body height, from 15.2 - 20.6 cm for SC and from 15.25 - 21.1 cm for CB rabbits with the total gain being 5.4 and 5.85 cm for SC and CB rabbits respectively.

5.6.3. Fortnightly chest girth

Chest girth of animals in all the experimental groups showed considerable increase from weaning to 24th week of experiment (Table 6 and 7, Appendix 19 - 24). The rabbits in group I showed an increase in chest girth from 16.15 - 33.4 cm with a gain of 17.25 cm in SC and 16.2 - 34.1 cm respectively with a gain of 17.9 cm in CB rabbits.

In group II (ration B) SC rabbits registered an increase of 17.75 cm from 16.05 cm with a final value of 33.8 cm and in CB rabbits 18.3 from 16.2 to 34.5 cm respectively.

In group III (ration C) rabbits showed an increase in chest girth from 16.05 - 31.85 cm with a total gain 15.8 cm in SC and the corresponding values in CB rabbits being 16.25 - 32.1 cm and 15.85 cm respectively.

Rabbits belonging to group IV registered an initial value of 16.2 cm and final value of 33.8 cm for chest girth with a total gain of 17.6 cm in SC and 16.35 and 34.4 cm respectively with a gain of 18.05 cm in CB rabbits.

In the case of animals belonging to group V (ration E) SC rabbits showed an increase in chest girth from 15.25 to 32.9 cm with a gain of 17.65 cm and from 16.1 cm to 34.05 cm respectively in CB rabbits with a gain of 17.95 cm.

Rabbits in group VI (ration F) recorded an average initial chest girth of 16.05 cm and a final girth of 28.10 cm at 12th fortnight with a total gain of 12.05 cm in SC and 16.1 cm and 28.6 cm respectively in CB rabbits with a gain of 12.5 cm.

In group VII (ration G) rabbits showed an increase of chest girth from 15.5 cm to a final value of 27.1 cm at 24th week of the experiment with a gain of 11.6 cm in SC and from 16.05 to 27.05 cm respectively with a gain of 11 cm in CB rabbits.

Animals of group VIII (ration H) registered an increase of 8.4 cm from 16.2 cm with a final chest girth of 24.6 cm at 12th fortnight in SC and 9.4 cm from 16.3 with a final value of 25.7 cm respectively in CB rabbits.

In group IX (ration I) SC rabbits recorded an increase in average chest girth from 16.15 - 23.2 cm the gain being 7.05 cm and a gain of 7.85 cm from 16.25 to 24.1 cm respectively in CB rabbits.

On the whole a linear increase in body measurements is noticed with increase in body weight. Statistical analysis (Appendix 25.3 and 25.4) of the data on body length, height and chest girth taking into account the overall difference between the initial and final values, reveal that there is significant difference ($P<0.01$) between the various groups in the body length, height and chest girth. A greater gain in body measurements is observed with higher energy and protein levels.

On scrutiny of the data on various body measurements and their statistical analysis it can be observed that there is significant increase ($P<0.01$) in body measurement with increase in the level of DE as well as CP content of the rations as there is significant increase in body length of animals maintained on rations A when compared to ration G containing 20 per cent CP with 3000 and 2000 kcal DE/kg, ration B, when compared to H containing 16 per cent CP with DE 3000 and 2000 kcal/kg and ration C when compared to I containing 12 per cent CP with 3000 and 2000 kcal DE/kg respectively in both SC and CB rabbits. With regard to the influence of DE levels on body height and chest girth also there is significant increase ($P<0.01$) with in animals maintained on higher energy levels when compared to low energy rations, which can be appreciated from a significantly higher body height and chest girth in animals maintained on ration A compared to ration G, ration B when compared to ration H and ration C, compared to ration I in both SC and CB rabbits, suggesting that dietary energy influences the body measurements.

On considering the variation in CP by keeping energy level constant, it can be seen that there is significant reduction in length, height and chest girth of SC as well as CB rabbits on lowering the CP levels to 12 per cent from 20 per cent in all the three energy levels i.e., ration C containing 12 per cent CP when compared to ration A both having DE 3000 kcal, ration F when compared to ration D containing 12 and 20 per cent CP respectively with 2500 kcal DE and ration I when compared to ration G containing 12 per cent and 20 per cent CP with 2000 kcal DE respectively suggesting that not only DE but dietary CP also significantly influences the body measurements.

Increase in body measurements as age advances commensurate with the gain in body weight observed in the present study is also reported by Jiabi and Pelant (1990) in Sichuan White rabbit. They recorded an average body length of 30.42, 36.74, 40.3 and 40.80 cm with a corresponding chest girth of 22.22, 25.09, 26.2 and 27.5 cm in Sichuan White rabbits at body weights 1.42, 1.92, 2.35 and 2.74 kg respectively at 3^{rd}, 5^{th}, 8^{th} and 12^{th} months of age.

Slightly higher values of body length was recorded by Lukefahr et al. (1982) in Flemish giant, NZW and Terminal cross of 57 - 64 days of age, may be due to the breed difference and higher growth rate. However, Kuttinarayanan and Nandakumar (1989) reported comparable values on body length, who recorded from their study on various characteristics and yield of carcass in SC and NZW pure bred, an average carcass length of 35.81±1.72 cm and 34.0±1.12 cm respectively in SC and NZW rabbits having an average body weight of 2.59±0.15 kg and 2.37±0.12 kg respectively, Lukefahr and Ozimba (1991) also recorded an average body length of 30.3±0.16 cm and the corresponding body weight (g) 2111±18 is essentially in agreement with the present study.

Comparatively better body measurements exhibited in CB rabbits than SC pure bred in the present study is also supported by Lukefahr et al. (1982) who studied the carcass and meat characteristics of Flemish Giant and NZW pure bred and Terminal crosses to pure bred groups revealed that cross bred rabbits had advantages for body measurements ($P<0.05$).

5.7. **Haematological Data**

Data collected on haematological constituents of rabbits maintained on different dietary energy and protein levels presented in Table 9 - 13 and statistical analysis in Appendix 25.5 and 25.6 for SC and CB rabbits indicate that the blood values recorded during the course of the present study are well with in the normal range reported for the species.

5.7.1. Haemoglobin

The average values recorded for haemoglobin (g/100 ml) in SC as well as CB rabbits maintained on nine experimental rations at monthly intervals are presented in table 9 and the mean values of various periods for different groups ranges from 12.47 - 13.33 in SC and 12.91 - 13.73 in CB rabbits. The haemoglobin concentration observed in the present study are essentially similar to those reported by earlier workers (Weisbroth et al., 1974; Rathnakumar, 1989). Statistical analysis of the data shows no significant difference ($P > 0.01$) either between the various groups or the various periods.

5.7.2 . Serum Protein

Data presented for serum protein (g/100 ml) in table 10 for SC and CB rabbits indicate that the average values of various periods for animals maintained on nine ration treatments ranges from 6.11 - 6.32 g/100 ml in SC and 6.17 - 6.40g/100 ml in CB rabbits respectively, no statistically significant difference being noticed either between groups or between periods ($P > 0.01$). Fox et al. (1970) on studying the biochemical parameters of clinical significance in rabbits, also observed similar range of values for serum protein in strains fed either 15 or 20 per cent protein diet.

Comparable values as observed in the present study have been reported by various workers.(Weisbroth et al., 1974, Gascon and Verde, 1985 and Ekpenyong, 1986).

5.7.3. Serum Calcium.

Average values for calcium contents (mg/100 ml) of the blood serum of rabbits maintained on nine energy-protein combinations recorded at monthly intervals are presented in table 11 for SC and CB rabbits and the mean values of different periods for the various group ranges from 13.82 - 14.65 mg per cent in SC rabbits and 13.76 - 14.62 mg per cent in CB rabbits. No significant difference between groups or between period is observed on statistical analysis (P >0.01). The values obtained in the present study for serum calcium are slightly higher than the values reported by Weisbroth et al. (1974) for rabbits, however, still higher values of 15.91 mg per cent and 16.03 mg per cent had been reported for normal rabbits by Gascon and Verde (1985) and Ekpenyong (1986) respectively.

5.7.4. Inorganic phosphorus.

From table 12 it can be seen that the inorganic phosphorus content in the blood serum of rabbits of the nine experimental groups recorded at monthly intervals are with in the normal range reported for the species, the mean values for various groups ranges from 4.39 - 4.52 mg per cent and 4.39 - 4.71 mg per cent for SC and CB rabbits respectively and the values being statistically non significant (P > 0.01). Essentially similar values on serum phosphorus have been reported by Fox et al. (1970) Weisbroth et al. (1974).

5.7.5. Serum Magnesium.

Data on serum Mg concentration of the experimental rabbits collected at monthly intervals are presented in tables 13 and the total average of various periods for the nine experimental rations ranges from 3.19 - 3.23 mg per cent and 3.14 - 3.27 mg per cent in SC and CB rabbits respectively. Neither dietary energy nor protein levels were found to influence serum concentration of Mg, as it is evident from a non-significant difference between the various groups for serum Mg values, on statistical analysis. Non-significant difference (P > 0.01) could be observed between the various periods also. The values estimated in the present study agree well with the standard values on serum Mg reported for rabbits (Weisbroth et al., 1974).

From a perusal of the data on the various haematological values obtained in the present study it is clear that either the dietary energy or protein levels used in the present experiment has no adverse influence on the physiological well being of the animals as evidenced by the non-significant differences obtained on statistical analysis of the parameter. Though statistically non-significant comparatively lower concentrations of haemoglobin, total protein, inorganic phosphorus and calcium were obtained for animals maintained on low energy low protein diets.

5.8. **Metabolism Trial Data**

5.8.1 Digestibility of Nutrients.

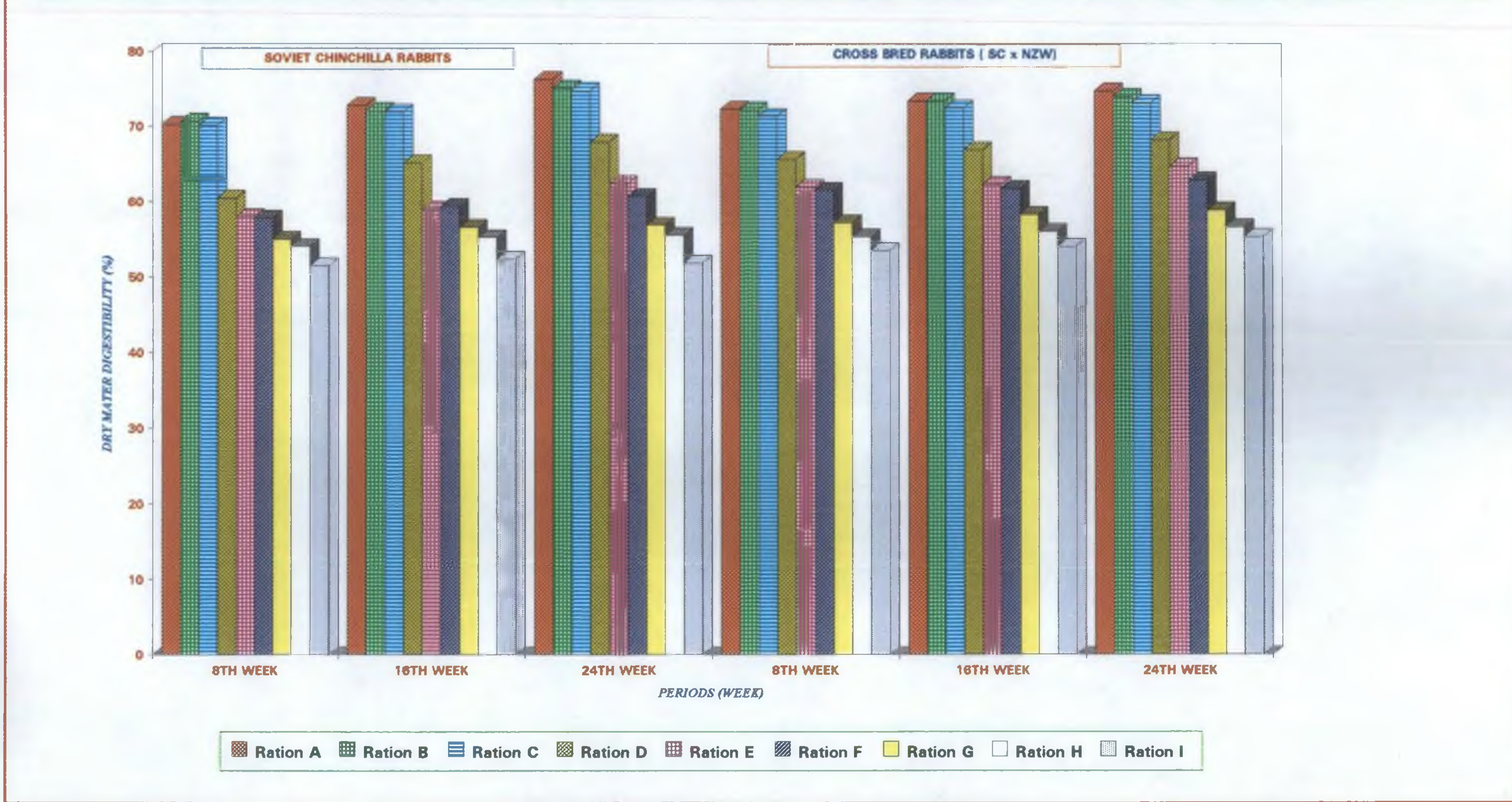
Digestibility of nutrients estimated from the first (8th week) second (16th week) and third (24th week) metabolism trials of both SC and CB rabbits are presented in table 14 - 19 and discussed under separate heads.

5.8.1.1 Dry matter

On scrutiny of the data (Table 14 - 19 and 19.1 represented by Fig. 16 with the statistical analysis in Appendix 25.7 and 25.9) on digestibility of DM in the nine treatment groups there is a decrease in DM digestibility as the level of CP and DE of the ration is decreased, or in other words both the CP and DE in the ration influences the digestibility of DM. Statistical analysis of the data reveal that a significant difference (P<0.01) exists between the groups receiving rations A,D and G i.e., ration containing DE to the extent of 3000, 2500 and 2000 kcal respectively with 20 per cent CP and rations B, E and H containing DE to the extent of 3000, 2500 and 2000 kcal

Fig. 16

DRY MATTER DIGESTIBILITY IN SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT STAGES OF EXPERIMENT



respectively with 16 per cent CP and rations C, F and I containing DE to the extent of 3000, 2500 and 2000 kcal respectively with 12 per cent CP indicating a significant decrease in digestibility of DM on decreasing the DE level from 3000 - 2000 kcal. Though not any significant difference exist between animals maintained on rations A, B and C containing varying levels of CP to the extent of 20, 16 and 12 per cent with 3000 kcal DE during 1st, 2nd and 3rd metabolism trial, there is a significant decrease ($P<0.01$) in DM digestibility of rations D, E and F containing 2500 kcal DE with CP levels 20, 16 and 12 per cent respectively during the 2nd and 3rd metabolism trial in SC and 1st, 2nd and 3rd metabolism trial in CB and ration I when compared to G both containing DE 2000 kcal with CP levels 12 per cent and 20 per cent respectively during the three metabolism trials in CB and 2nd and 3rd metabolism trial in SC rabbits, indicating that the dietary CP significantly influences the DM digestibility in both SC and CB rabbits, at medium (2500 kcal) and low (2000 kcal) levels of DE.

The data clearly show that the digestibility of DM is increased as the age of the animal advances, irrespective of ration treatments, maximum digestibility is observed on high energy high protein ration (ration A).

Lall et al. (1984) from their study on optimum level of protein in common rations of Angora rabbits for wool production, observed an increased dry matter digestibility as the dietary CP level increases which also agrees with the present result. Increased DM digestibility along with an increase in dietary energy as observed in the present study is in agreement with Grobner et al. (1985 a) who observed from their study on utilization of low and high energy diets by different breeds of rabbits, that DM digestibilities were lower for all breeds on the low energy diet (2000 kcal DE/kg) when compared to medium (2500 kcal/kg) and high energy (3000 kcal DE/kg) diet and overall mean for DM digestibility in various breeds were 51.7, 64.4 and 67.9 for low, medium and high energy diets. Significantly higher dry matter digestibility with high protein high energy and normal protein normal energy than low protein low energy diet has also been reported by Sankhyan et al. (1990) in growing cross bred rabbits.

An average DM digestibility of 74.2, 66.3, 60.6, 56.3, 54.9 and 48.2 per cent on rations with varying fibre levels viz., 9.1, 11.7, 14.8, 17.4, 19.5 and 23.9 per cent respectively in growing NZW rabbits as reviewed by Cheeke (1987) is essentially in agreement with the present study. As observed in the present investigation an increase in dry matter digestibility as the CF level lowers in the ration has also been reported by Grigorov (1991) in his study on effect of the amount of CF on digestibility of mixed feed and nitrogen-balance in NZW rabbits with crude fibre levels of 10.40, 12.51 and 14.59 per cent, the corresponding dry matter digestibilities were 72.13, 67.63 and 68.87 per cent respectively. Reduction in nutrient digestibility with increase in CF level is also supported by Sartika and Raharjo (1992) in his study on effect of various fibre levels on the performance, carcass percentage and skin quality of Rex rabbits.

Comparable values on DM digestibility as observed in the present study have also been reported by several workers. While Stephens (1976) reported the DM digestibility of 60.8 for standard laboratory diets in rabbits, Lall et al. (1985) recorded digestibility coefficients of 71.4, 64.0, 60.4 and 65.06 for DM in adult Angora rabbits fed on complete rabbit feed ad lib. (group I) 25 per cent and 50 per cent concentrate moiety replaced with berseem hay meal (group II and III) and 50 per cent concentrate moiety was replaced by Grewia optiva leaf meal (group IV) respectively. A very high DM digestibility of 88 per cent was reported by Pascual and Carmona (1985) for dried citrus pulp in rabbit. According to Robinson et al. (1985) rabbits fed on high alfalfa pellets registered a DM digestibility of 48.3 per cent while that in rabbits fed on fresh grass was 59.8 per cent. In adult palomino and NZW rabbits, Grobner et al. (1985 b) reported an average dry matter digestibility of 62.5 and 59.1 per cent in ration based on soybean meal, wheat mill run and 54 per cent alfalfa meal Robinson et al. (1986 b) on feeding NZW rabbits of about two kg body weight, diets with wheat bran in different forms alone and along with hay reported a DM digestibility ranging from 53 to 59.7 per cent. Szendro et al. (1989) reported DM digestibility ranging from 64.02 to 72.48 per cent in adult NZW rabbits fed for different periods and the highest digestibilities were achieved by the groups fed four hours per day. Dry matter digestibility of 73.77, 69.83, 70.16 and 66.87 per cent reported by Singh and Negi

(1987) from an evaluation of peanut, mustard, liseed and cotton seed meal for wool production in Angora rabbits is in agreement with the present work. Rao et al. (1987) also reported similar values. However, Adegbola et al. (1985) obtained comparatively lower values for DM digestibility, the values being 46, 38, 46, 57 and 66 per cent in 16-18 weeks old NZW rabbits maintained on all forage (300 g guinea grass or Stylosanthus), forage plus concentrate (150 g guinea grass or stylo + 60 g concentrate) and all concentrate (120 g pelleted concentrate) diet for three weeks.

Agbidye et al. (1990) recorded a digestibility coefficient of 62.59, 70.40, 71.95, 69.43 70.27 and 73.17 for DM when four week old NZW rabbits were fed a standard diet based on dried lucerne, Soybean meal and wheat mill run or a diet based on ground maize, dried lucerne, soybean meal and wheat mill run (34 per cent) containing 0, 10, 20, 40 and 60 per cent buck wheat replacing maize and wheat mill run. Gupta et al. (1993 b) also recorded an average DM digestibility of 68.38 per cent, 70.97 per cent and 73.06 per cent in Adult SC rabbits fed on three complete diets with 25 parts of stylo, rice bean or pea-meal respectively.

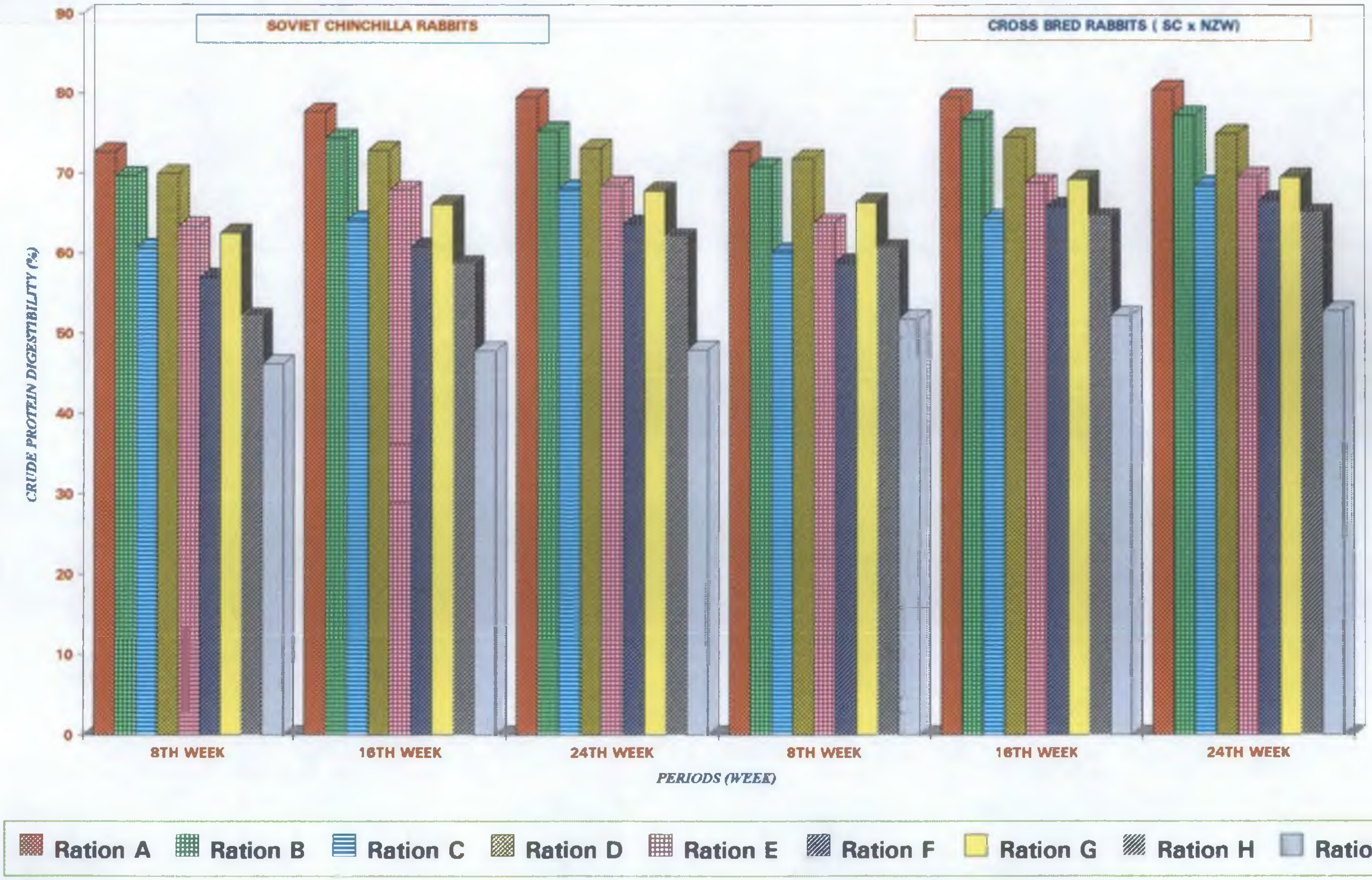
Another trend noticed in dry matter digestibility is the improvement in digestibility as the age advances. Robinson et al. (1986 a) also observed higher rate of nutrient digestibility in adult NZW rabbits when compared to that in NZW fryers.

5.8.1.2 Crude protein

Data on CP digestibility of SC and CB rabbits maintained on the nine dietary treatments during the 8th, 16th and 24th week of experiment set out in table 14 - 19 and 19.2 represented by Fig. 17 and their statistical analysis set out in Appendix - 25.7 and 25.9 clearly show that an increase in the rate of CP digestibility can be noticed in animals maintained on high level of CP. It can be further noticed that the CP digestibility is enhanced with increase in DE content in the ration. Similar trend of result can be noticed with regard to the digestibility of CP during the period of 16thand 24thweek of experiment. Data on statistical analysis reveal that while a significant difference (P<0.01) exists between animals maintained on rations A, B and

Fig. 17

CRUDE PROTEIN DIGESTIBILITY IN SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS DURING DIFFERENT STAGES OF EXPERIMENT



C containing CP to the extent of 20, 16 and 12 per cent with 3000 kcal DE, rations D, E and F containing 20, 16 and 12 per cent CP respectively, with 2500 kcal DE and rations G, H and I containing 20, 16 and 12 per cent CP respectively with 2000 kcal DE showing a significant increase in digestibility of CP on increasing the level of CP in the rations, similar trend of results, when increasing the levels of DE from 2000 - 3000 kcal could be arrived at from the existence of a statistical significance ($P<0.01$) between the animals maintained on rations A, D and G containing 3000, 2500 and 2000 kcal DE with 20 per cent CP, rations B, E and H containing varying levels of DE with 16 per cent CP and rations C, F and I containing varying levels of DE with 12 per cent CP respectively with regard to an increase in the digestibility of CP on increasing the level of DE in the ration. Further scrutiny of the data clearly show that the CP digestibility show a significant increase ($P<0.01$) with the advancement of age irrespective of whether the animals are maintained on high energy low protein or low energy high protein ration.

Influence of energy and protein level on protein digestibility as seen in the present study is supported by other workers. Grobner et al. (1985 a) reported higher CP digestibilities in high energy (3000 kcal/kg) and medium energy (2500 kcal/kg) rations than in low energy (2000 kcal DE/kg) ration in each of the different breeds of rabbits studied. These findings are in agreement with the results of Talpada et al. (1973) who reported that higher levels of protein in the ration increased protein digestibility. Sankhyan et al. (1990) also reported significant reduction in CP digestibility with LPLE diet than HPHE and NPNE diets. However, Spreadbury (1978) did not find a significant influence of protein level on DCP in seven diets based on concentrate feeds in which the CP content ranged from 10.4 to 25.5 per cent Deblas et al. (1981) reported that the CP digestibility ranged from 66.42 to 76.82 for diets with different CP concentrations Viz., 12, 14, 16 and 18 per cent with CF content of 7, 11 and 15 per cent and both CP and CF contents showed no significant effect on digestibility of protein.

Deblas et al. (1978) reported a high CP digestibility of 78.6 per cent for concentrate feeds while that of forage was only 60.5 per cent and this favours the present result. Robinsion et al. (1985) recorded a digestibility coefficent of 64.9 per cent for nitrogen in rabbits fed on high alfalfa pellets and 77.6 per cent on fresh grass.

Digestibility of CP in different experimental rations observed during the course of present study can be compared very well with several studies. While Grobner et al. (1985 b) reported a CP digestibility of 62.5 and 59.1 per cent in adult palomino and NZW rabbits respectively, Lall et al. (1985) recorded a CP digestibility of 81.5, 69.6, 67.2 and 70.6 per cent in Adult Angora rabbits fed on complete rabbit feed ad lib., 25 per cent and 50 per cent concentrate moiety replaced with berseem hay meal and 50 per cent concentrate moiety replaced by Grewia optiva leaf meals respectively. Nitrogen digestibility in NZW fryers and adults were reported by Robinson et al. (1986 a) and the values recorded were 69.55 and 72.13 per cent for a basal diet, 70.68 and 70.92 per cent for basal diet + soybean meal and 78.53 and 77.54 per cent for basal diet + urea respectively. Singh and Negi (1987) obtained a nitrogen digestibility of 76.2, 71.02, 73.65 and 73.99 per cent for isonitrogenous concentrate mixtures containing different oil meals in Angora rabbits. Maertens et al. (1988) reported an average digestibility coefficient of 73.1 for CP in rabbits based on 44 different diets. An average CP digestibility of 78.1 and 66.1 per cent was reported by Tortuero et al. (1989) in growing NZW rabbits with isonitrogenous and equicaloric diets (19 per cent CP and 12.6 MJ DE/kg) containing 27.65 per cent alfalfa hay and 30 per cent olive pulp respectively. Tangendjaja et al. (1990) observed an average digestibility coefficient of 73, 41 and 38 per cent for CP in a control diet and ration with 60 per cent untreated and treated leucaena leaf meal respectively. Crude protein digestibility of 75.74, 72.2, 74.96, 73.31, 76.03 and 75.66 per cent were reported by Agbidye et al. (1990) on standard diets based on dried lucerne, soybean meal, ground maize, wheat mill run and buck wheat. Villamide and Blas (1991) in their study on nutritive value of cereal grains for rabbits reported a CP digestibility of 67.2 with 60 per cent barley diet and 59.9 per cent for dietary maize. Gupta et al. (1993 b) estimated an average CP digestibility of 76.88, 78.33 and 78.02 per cent in adult SC rabbits fed on three complete diets with 25 parts of stylo, rice bran or pea-meal respectively. The result on CP digestibility obtained in the present study are essentially in agreement with the above authors (Talpada et al., 1973; Spreadbury, 1978; Deblas et al., 1981; Robinson et al., 1985; Grobner et al., 1985; Lall et al., 1985; Robinson et al., 1986 a; Singh and Negi, 1987; Maertens et al., 1988; Tortuero, et al., 1989; Tangendjaja et al., 1990; Sankhyan et al., 1990; Villamide and Blas, 1991; Agbidye et al., 1992 and Gupta et al., 1993 b).

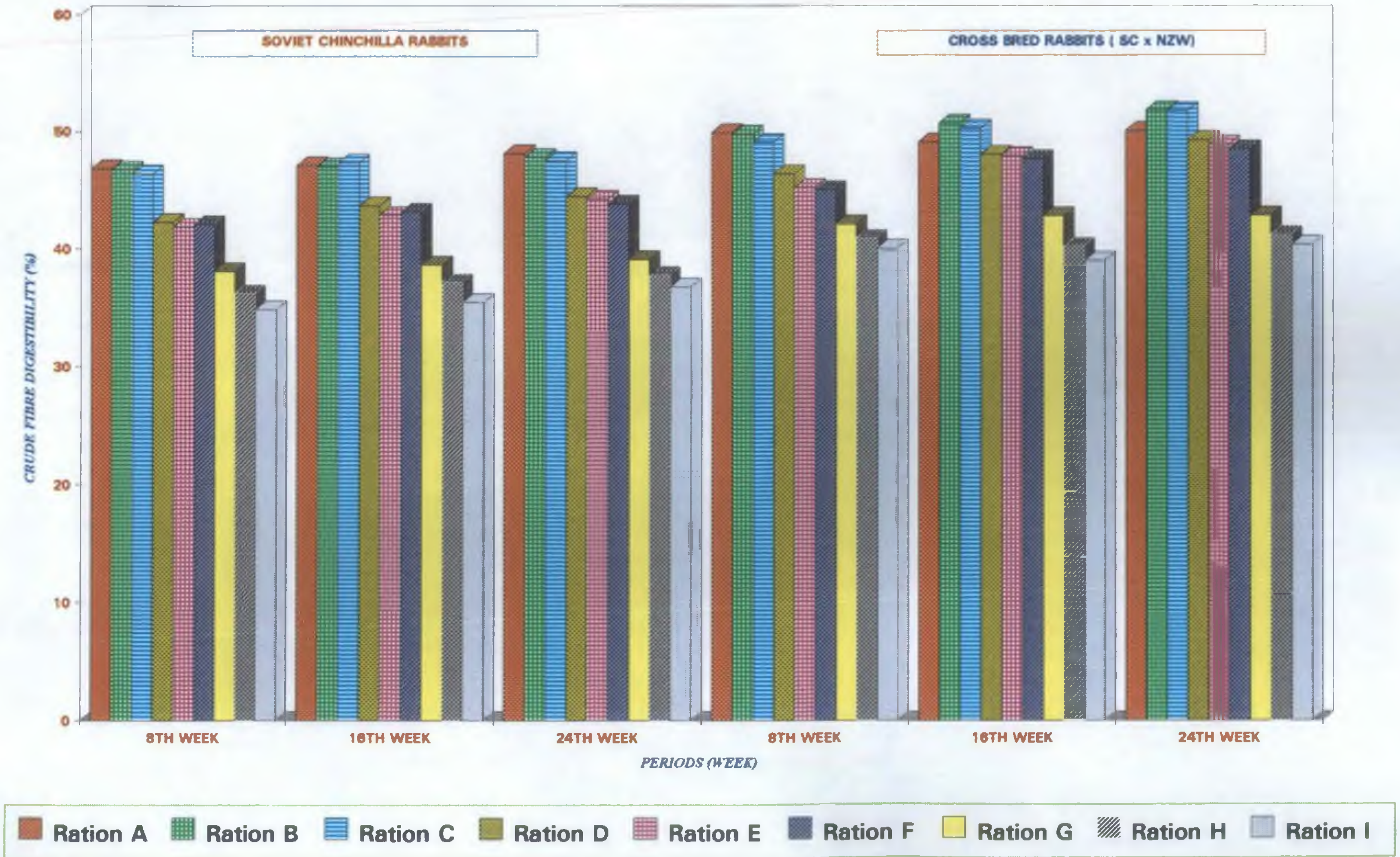
Comparatively lower CP digestibility observed in the ration containing 12 per cent CP with 2000 kcal DE in the present study may be due to its lowest CP and energy level and high CF and ADF content. The result is in agreement with Blas et al. (1986) who on feeding NZW rabbits with six diets differing in fibre content (12.6 - 32.7 per cent ADF) observed that fibre content in the diet influenced its digestive utilization and CP digestibility decreased by 0.64 units per each one per cent increment in ADF content of diet. Similarly, Partridge et al. (1989) observed that the digestibility of dietary protein and energy declines with increase in CF content in the ration of rabbits. However, Sartika and Raharjo (1992) did not find any reduction in nitrogen digestibility with increase in dietary ADF ranging from 17, 20, 23 or 26 per cent in four isoenergic isonitrogenous diets.

5.8.1.3. Crude Fibre Digestibility

Data on crude fibre digestibility among SC and CB rabbits presented in table 14-19 and 19.3 represented by Fig. 18 and statistical analysis set out in Appendix 25.7 and 25.9 disclose a significantly lower rate of crude fibre digestibility as the DE content of feed decrease as can be appreciated from a significant difference ($P<0.01$) between the animals maintained on rations A, D and G containing 20 per cent CP with 3000, 2500 and 2000 kcal DE, rations B, E and H containing 16 per cent CP with varying levels of DE, rations G, H and I containing 12 per cent CP with varying levels of DE to the extent of 3000, 2500 and 2000 kcal respectively, but no significant difference in the rate of crude fibre digestibility could be noticed on increasing or decreasing the level of CP in the ration as can be substantiated from a non-significant difference between animals maintained on rations A, B and C, rations D, E and F and rations G, H and I respectively. On further scrutiny of the data on

Fig. 18

CRUDE FIBRE DIGESTIBILITY IN SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT STAGES OF EXPERIMENT



crude fibre digestibility between the periods 8th, 16th and 24th week of experiment there is a tendency for an increased rate of crude fibre digestibility as the age of animal advances irrespective of whether the animals are maintained on varying levels of CP or DE.

Similar rate of digestibility for crude fibre as observed in the present study have been reported by different authors. Fekete and Gippert (1985) on the basis of digestibility trial in rabbits with feed mixtures of various fibre and protein contents reported a crude fibre digestibility of 42 per cent in low protein low fibre diet. Lall et al. (1985) reported a crude fibre digestibility of 24.4, 37.7, 52.4 and 64.5 per cent in adult Angora rabbits. Singh and Negi (1987) estimated a crude fibre digestibility of 39.57, 31.79, 38.43 and 45.84 per cent in adult Angora rabbits maintained on four isonitrogenous concentrate mixtures containing different oil meals. Digestibility coefficient of 41.98 37.97 and 34.91 for crude fibre was reported by Grigorov (1991) in NZW rabbits given pelleted diet with fibre levels of 10.4, 12.51 and 14.59 per cent. Similar crude fibre digestibility of 37.75, 46.34 and 47.31 per cent respectively were also reported by Guptha et al. (1993 b) in adult SC rabbits given three complete diets with 25 parts of stylo, rice bean or pea-meal respectively.

While the crude fibre digestibility estimated in the present investigation are in agreement with the above authors, lower rate of crude fibre digestibility have also been reported in rabbits by different workers. Blas et al. (1986) observed a crude fibre digestibility of 32.2 per cent for low fibre diet (12.6 per cent crude fibre) and 17.5 per cent for high fibre diet (32.7 per cent crude fibre). While a lower crude fibre digestibility of 17.4 per cent was reported in rabbits by Maertens et al. (1988), an average digestibility coefficient of 29.9 and 17.7 for crude fibre was also reported by Tortuero et al. (1989) in growing NZW rabbits with isonitrogenous and equicaloric diets containing 27.65 per cent alfalfa hay and 30 per cent olive pulp respectively. Contrary to the above observations, Pascual and Carmona (1985) reported a very high crude fibre digestibility of 83 per cent for dried citrus pulp in NZW rabbits. The difference in crude fibre digestibility reported by various authors may be attributed to the type of feed and structural variation in its crude fibre content.

5.8.1.4. Ether Extract Digestibility

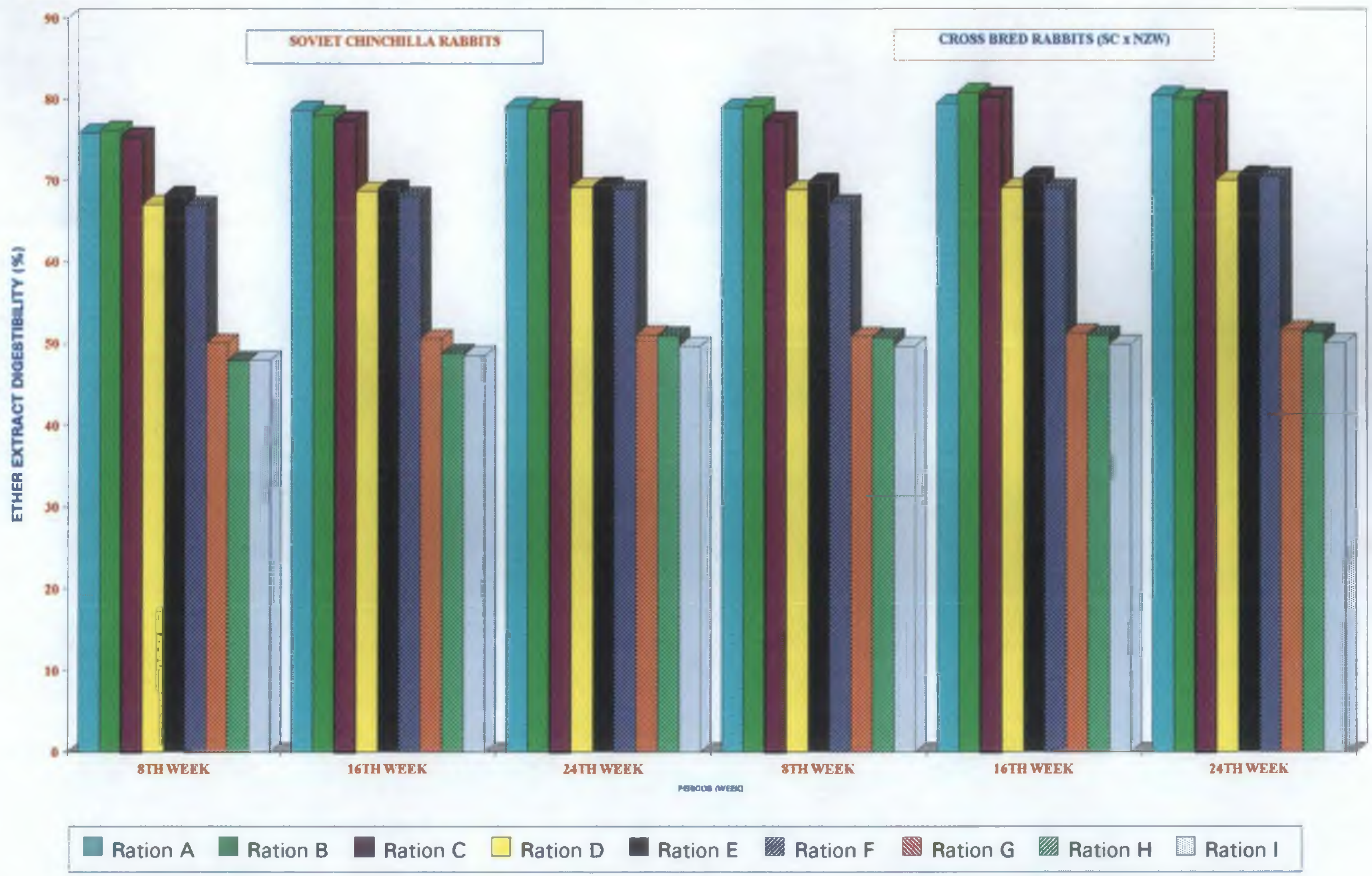
Data on ether extract digestibility of SC and CB rabbits presented in table 14 - 19 and 19.4 represented by Fig. 19 and their statistical analysis in Appendix 25.7 and 25.9 reveal a significant difference ($P<0.01$) in between the animals maintained on rations A, D and G containing DE to the extent of 3000, 2500 and 2000 kcal with 20 per cent CP, rations B, E and H containing varying levels of DE with 16 per cent CP and rations C, F and I containing varying levels of DE with 12 per cent CP respectively indicating that the level of DE in the ration influencing the ether extract digestibility while the level of CP in the ration seems to have no influence on digestibility of ether extract as there is no significant difference in the rate of digestibility of ether extract noticed in between the groups of animals maintained on rations A, B, and C or rations D, E and F or rations G, H and I respectively. Essentially similar trend of result could be noticed during the 16^{th} and 24^{th} week of experiment. As between the periods, the data show an apparent increase in the rate of digestibility of ether extract since higher rate of digestibility could be observed in the trial during the 24^{th} week of experiment compared to that of 8^{th} week of experiment tending to suggest that the digestibility of ether extract enhances as the age of the animal advances.

Higher rate of ether extract digestibility on increasing the DE and CP as observed in the present study is in agreement with that of Sankhyan et al. (1990) who obtained significantly higher ether extract digestibility in HPHE diets but the digestibility values of 52.11, 42.49 and 57.83 per cent reported for ether extract in NPNE, LPLE and HPHE diets respectively were slightly lower when compared to the present study.

Almost similar rate of digestibility for ether extract in rabbits has been reported by several workers. Lall et al. (1985) recorded an ether extract digestibility of 86.9, 76.7, 65.7 and 29.3 in adult Angora rabbits with four complete rations containing various proportions and type of roughages. An average digestibility of 78.88, 69.17,

Fig. 19

ETHER EXTRACT DIGESTIBILITY IN SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS DURING DIFFERENT STAGES OF EXPERIMENT

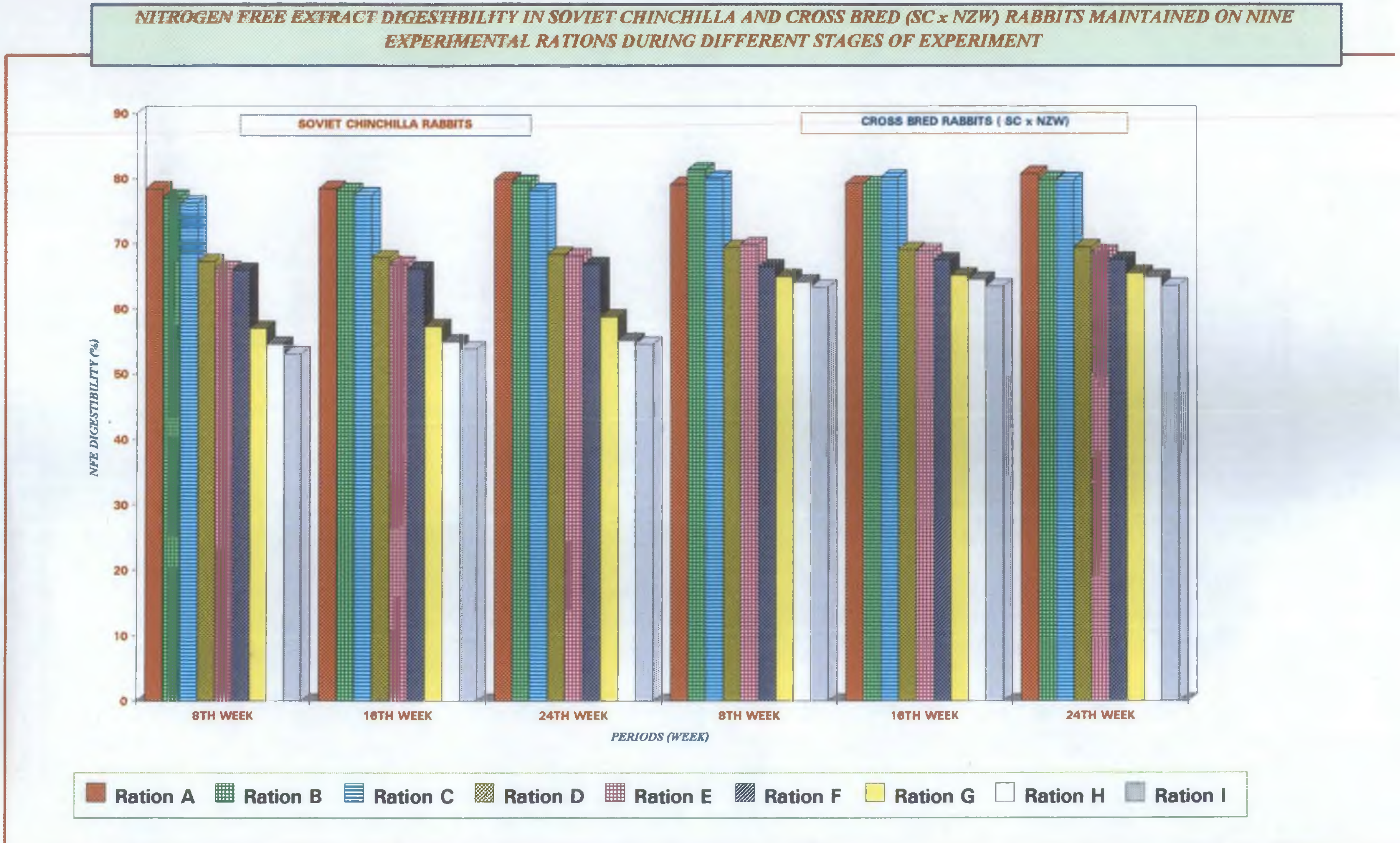


70.16 and 75.35 per cent in standard concentrate mixtures containing different oil meals was reported by Singh and Negi (1987) for Angora rabbits. Maertens et al. (1988) obtained a digestibility of 74.8 per cent for ether extract from their study on prediction of apparent DE content of commercial pelleted feeds for rabbits. Grigorov (1991) reported an ether extract digestibility of 78.74, 75.23 and 76.27 per cent in NZW rabbits on standard diets with 10.41, 12.51 and 14.59 per cent crude fibre and observed an average digestibility coefficient of 81.52, 65.87 and 78.46 per cent for ether extract observed by Gupta et al. (1993 b) in adult SC rabbits given three complete diet with 25 parts of stylo, rice bean or pea-meal respectively, are also concurring the results of the present investigation.

5.8.1.5. Nitrogen Free Extract Digestibility (NFE)

Data on nitrogen free extract (NFE) digestibility of SC and CB rabbits presented in table 14-19 and 19.5 and represented by Fig. 20 with statistical analysis in Appendix 25.7 and 25.9 disclose a significantly lower nitrogen free extract digestibility in animals maintained on low DE ration (ration G) when compared to that of animals maintained on high DE ration (ration A) as can be noticed from a significant difference between animals maintained on rations A, D and G containing 3000, 2500 and 2000 kcal DE with 20 per cent CP, rations B, E and H containing varying levels of DE with 16 per cent CP and rations C, F and I containing varying levels of DE with 12 per cent CP respectively, confirming that varying levels of DE influences the nitrogen free extract digestibility. It can be further noticed that there is no appreciable difference in the rate of nitrogen free extract digestibility in animals maintained on varying levels of CP to the extent of 20, 16 and 12 per cent with 3000 kcal DE in rations A, B and C, 2500 kcal DE in rations D, E and F and 2000 kcal DE in rations G, H and I respectively indicating that levels of CP in the rations does not seem to influence the nitrogen free extract digestibility. It can be further noticed that nitrogen free extract digestibility seems to be not influenced by the periods as there could not be observed any significant difference in the rate of digestibility of nitrogen free extract between the periods indicating that the age of the animals does not seem to influence the nitrogen free extract digestibility.

Fig. 20



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Digestibility coefficient of NFE estimated in the present study for various rations are in agreement with other workers. Lall et al. (1985) observed an NFE digestibility of 80.7, 67.6, 61.2 and 65.2 per cent from their study on effect of partial replacement of concentrate by roughages in the diet of Angora rabbits on wool production. Singh and Negi (1987) from an evaluation of pea nut, mustard, linseed and cotton seed meal in rabbits reported an NFE digestibility of 80.24, 77.45, 77.76 and 72.27 per cent in four isonitrogenous concentrate mixtures. Maertens et al. (1988) reported an average digestibility coefficient of 70.6 $\pm$ 4.0 in rabbits based on 44 diets. Grigorov (1991) from his study on effect of the amount of crude fibre on digestibility of mixed feed and nitrogen balance in rabbits observed an NFE digestibility of 78.27, 72.76 and 74.56 per cent with standard pelleted diets containing crude fibre levels of 10.4, 12.51 and 14.59 per cent respectively. Gupta et al. (1993 b) also reported similar digestibility coefficient for NFE, the values being 76.81, 78.41 and 77.19 per cent in adult SC rabbits. While the NFE digestibility of the present study are in agreement with the results of various authors cited above, Sankhyan et al. (1990) could observe only a lower digestibility coefficient of 58.57, 52.61 and 53.95 for NPNE, LPLE and HPHE diets respectively without any significant difference between the rations.

5.8.2. Digestibility of Fibre Fractions.

Digestibility of fibre fractions estimated from the digestibility trial of SC and CB rabbits maintained on nine ration treatments during the period 8th, 16th and 24th week of experiment are presented in table 14 - 19 and 19.6-19.9 with their statistical analysis in Appendix 25.8 and 25.10 and discussed under separate heads.

5.8.2.1. Acid Detergent Fibre

It can be seen from the data presented in table 14-19 and 19.6 with statistical analysis in Appendix 25.8 and 25.10 that there is a decreasing trend in acid detergent fibre (ADF) digestibility as the level of DE in the ration decreases, as can be noticed from a significant decrease in ADF digestibility in ration G containing 2000 kcal DE with 20 per cent CP when compared to that of ration A containing 3000 kcal DE with 20 per cent CP, ration H containing 2000 kcal DE with 16 per cent CP when compared to that of ration B containing 3000 kcal DE with 16 per cent CP, ration I containing 2000 kcal DE with 12 per cent CP when compared to that of ration C containing 3000 kcal DE with 12 per cent CP respectively indicating that dietary level of DE influences the ADF digestibility. Similar trend of results could be noticed on 16^{th} and 24^{th} week of experiment with regard to ADF digestibility.

A decreasing trend in ADF digestibility as the level of CP decreases in the ration during the 8^{th} week of experiment is further supported by a significant decrease ($P<0.01$) in digestibility of ADF in ration C containing 3000 kcal DE with 12 per cent CP when compared to that of ration A containing 3000 kcal DE with 20 per cent CP during the 16^{th} and 24^{th} week of experiment, ration F containing 2500 kcal DE with 12 per cent CP when compared to that of ration D containing 2500 kcal DE with 20 per cent during the 24^{th} week of experiment and ration I containing 2000 kcal DE with 12 per cent CP when compared to that of ration G containing 2000 kcal DE with 20 per cent CP during the 16^{th} and 24^{th} week of experiment in both SC and CB rabbits respectively. As between the periods it can be noticed that the ADF digestibility significantly ($P<0.01$) enhances, as the age of the animal advances, irrespective of the ration treatments.

Literature on the digestibility values of fibre fractions of the feeds in rabbits are rather scanty. Most of the published data revealed only lower rate of ADF digestibility in rabbits. While Stephens (1976) reported a digestibility coefficient of 15.7 for ADF in rabbits, Grobner et al. (1985 b) estimated an average ADF digestibility of 18.5 and

10.5 per cent respectively in adult palomino and NZW rabbits. Robinson et al., (1985) recorded an average ADF digestibility of 13.1 per cent in rabbits fed on high alfalfa pellets and 20.4 per cent for ADF when fed on fresh grass. Grobner et al. (1985 a) recorded in various breeds of rabbits, an overall mean of 17.9, 22.1 and 15.3 per cent for ADF digestibility in low, medium and high energy diets having ADF content of 28.62, 19.35 and 14.79 per cent respectively. On feeding NZW rabbits weighing about two kg with wheat bran in different forms alone and along with hay, Robinson et al. (1986 b) reported an ADF digestibility of 8.1 - 12.5 per cent. Comparatively low digestibility was also reported by Tortuero et al. (1989) who obtained an ADF digestibility of 15.5 and 12.2 per cent in growing NZW rabbits with isonitrogenous and equicaloric diets (19 per cent CP, 12.6 MJ DE/kg) containing 27.65 per cent alfalfa hay and 30 per cent olive pulp respectively.

However, ADF digestibility obtained in the present study are in agreement with Singh and Negi (1987) who reported an ADF digestibility of 33.64 and 40.64 for concentrate mixtures containing different oil meals in Angora rabbits and also that of Villamide and Blas (1991) who reported digestibility coefficient of 30.1 per cent with 60 per cent barley diet and 42.7 per cent for 30 per cent maize diet from their study on nutritive value of cereal grains for rabbits.

5.8.2.2. Neutral Detergent Fibre Digestibility

Data on coefficient of digestibility of neutral detergent fibre (NDF) presented in table 14-19 and 19.7 with statistical analysis in Appendix 25.8 and 25.10 for SC and CB rabbits show a decreasing trend towards a decreasing level of CP in the ration during the 8^{th}, 16^{th} and 24^{th} week of experiment as can be appreciated from the digestion coefficient of NDF registered for ration A,B and C containing DE to the extent of 3000 kcal with CP levels 20,16 and 12 per cent respectively, rations D,E and F containing 2500 kcal DE with 20, 16 and 12 per cent CP respectively and rations G, H and I containing 2000 kcal DE with 20,16 and 12 per cent respectively. Statistical analysis of the data also disclose a significant difference ($P < 0.01$) between the groups receiving rations A and C containing 20 and 12 per cent CP with

3000 kcal DE during the 16^{th} and 24^{th} week in CB rabbits and 16^{th} week in SC rabbits with a significant difference between the rations D and F containing 2500 kcal DE with 20 and 12 per cent CP respectively and rations G and I containing 2000 kcal DE with 20 and 12 per cent CP respectively in both breeds during the three stages of experiment indicating that at all the three energy levels dietary protein levels significantly ($P<0.01$) influence the NDF digestibility.

A similar trend of observation can be noticed in the case of variation in the DE of the ration during the three periods of trials as much as a significant decrease ($P<0.01$) in digestibility of NDF in animals maintained on rations D, E and F containing 2500 kcal DE with 20, 16 and 12 per cent CP and rations G,H and I containing 2000 kcal DE with 20, 16 and 12 per cent CP respectively when compared to their corresponding high energy rations A,B and C with 20, 16 and 12 per cent CP and 3000 kcal DE respectively on keeping the protein levels constant, during the Ist, 2nd and 3rd stage of experiment in both SC and CB rabbits, suggesting that dietary energy level significantly influences the digestibility of NDF.

No definite conclusion could be arrived on statistical analysis of the data between the periods.

Published data on NDF digestibility of feeds in rabbits are very few. Singh and Negi (1987) in their study of on evaluation of different oil meals for wool production in Angora rabbits obtained an NDF digestibility of 59.10, 53.32, 50.57 and 48.53 for isonitrogenous concentrate mixtures containing pea nut, mustard, linseed or cotton seed meal respectively and is essentially in agreement with the NDF digestibility estimated in the present investigation. However, a lower digestibility values of 26.0 and 20.8 per cent was also reported by Tortuero et al. (1989) in growing rabbits. Comparable data on digestibility of NDF on increasing or decreasing the energy or protein levels in the ration is not available in the literature.

5.8.2.3. Hemicellulose Digestibility

The digestibility of hemicellulose, (Table 14-19 and 19.8 with statistical analysis in Appendix 25.8 and 25.10) is seen decreasing with decrease in the level of protein in the ration as can be noticed from a significant decrease ($P<0.01$) in digestibility figures between the animals maintained on ration C containing 3000 kcal DE with 12 per cent CP when compared to that of ration A containing 3000 kcal DE with 20 per cent CP and ration F containing 2500 kcal DE with 12 per cent CP when compared to that of ration D containing 2500 kcal DE with 20 per cent CP and ration I with 2000 kcal DE and 12 per cent CP when compared to that of ration G containing 2000 kcal DE with 20 per cent CP respectively, during the 1st, 2nd and 3rd metabolism trials, suggesting that level of dietary CP influences the hemicellulose digestibility.

Likewise, a trend towards a decrease in digestibility of hemicellulose can be noticed with a decrease in level of DE in the ration during the three periods as can be appreciated from a significant difference ($P<0.01$) in digestibility of hemicellulose in animals maintained on rations A, D and G containing varying levels of DE to the extent of 3000, 2500 and 2000 kcal with 20 per cent CP, rations B, E and H containing 3000, 2500 and 2000 kcal DE with 16 per cent CP and rations C, F and I containing 3000, 2500 and 2000 kcal DE with 12 per cent CP respectively, indicating that DE levels of the ration influence the digestibility of hemicellulose.

As between the periods there is an increasing trend in the hemicellulose digestibility as the age advances in both SC and CB rabbits.

Essentially similar values on hemicellulose digestibility were reported by Singh and Negi (1987), the values being 73.3, 71.3, 69.5 and 58.3 per cent in Angora rabbits maintained on concentrate mixtures containing different oil meals.

5.8.2.4. Cellulose Digestibility

Data presented in table 14-19 and 19.9 with statistical analysis in Appendix 25.8 and 25.10 on the cellulose digestibility of both SC and CB rabbits maintained on the nine experimental rations indicate that the digestibility of cellulose decreases with a decrease in the level of protein ($P<0.01$). Statistical analysis of the data reveal that there is a significant decrease in digestibility of cellulose ($P<0.01$) in animals maintained on ration C containing 12 per cent CP with 3000 kcal DE when compared to that of ration A containing 20 per cent CP with 3000 kcal DE, an apparent decrease in animals maintained on ration F containing 12 per cent CP with 2500 kcal DE when compared to that of ration D containing 20 per cent CP with 2500 kcal DE and a significant decrease ($P < 0.01$) in ration I containing 12 per cent CP with 2000 kcal DE when compared to that of ration G containing 2000 kcal DE with 20 per cent CP during the Ist metabolism trial and during the 2nd and 3rd stage, a significant decrease ($P<0.01$) in cellulose digestibility in ration C when compared to ration A, ration F when compared to that of ration D and an apparent decrease in ration I when compared to ration G indicating that variation in CP in the ration influences the cellulose digestibility.

It can be further probed from the digestibility data on cellulose that a significant decrease in digestibility of cellulose could be noticed in animals maintained on ration G containing 2000 kcal DE with 20 per cent CP when compared to that of ration A containing 3000 kcal DE with 20 per cent CP, ration H containing 2000 kcal DE with 16 per cent CP when compared to that of ration B containing 3000 kcal DE with 16 per cent CP and ration I containing 2000 kcal DE with 12 per cent CP when compared to ration C containing 3000 kcal DE with 12 per cent CP respectively during the I^{st}, 2^{nd} and 3^{rd} metabolism trial indicating that, DE level in the diet influences the cellulose digestibility in animals.

As between the periods the digestibility of cellulose seems to be increased as the animal advances in age irrespective of the level of protein and energy in the ration ($P<0.01$).

Values on digestibility of cellulose fractions of the feeds in rabbit is limited in the literature. No comparable data is available on the digestibility of cellulose on increasing or decreasing the CP or energy levels in the diet of rabbit.

5.8.3. Nitrogen and Mineral Balances.

Data on nitrogen and mineral balances of experimental animals maintained on different treatments during the 8^{th}, 16^{th} and 24^{th} week of experiment are set out in table 20 -25 and discussed under separate heads.

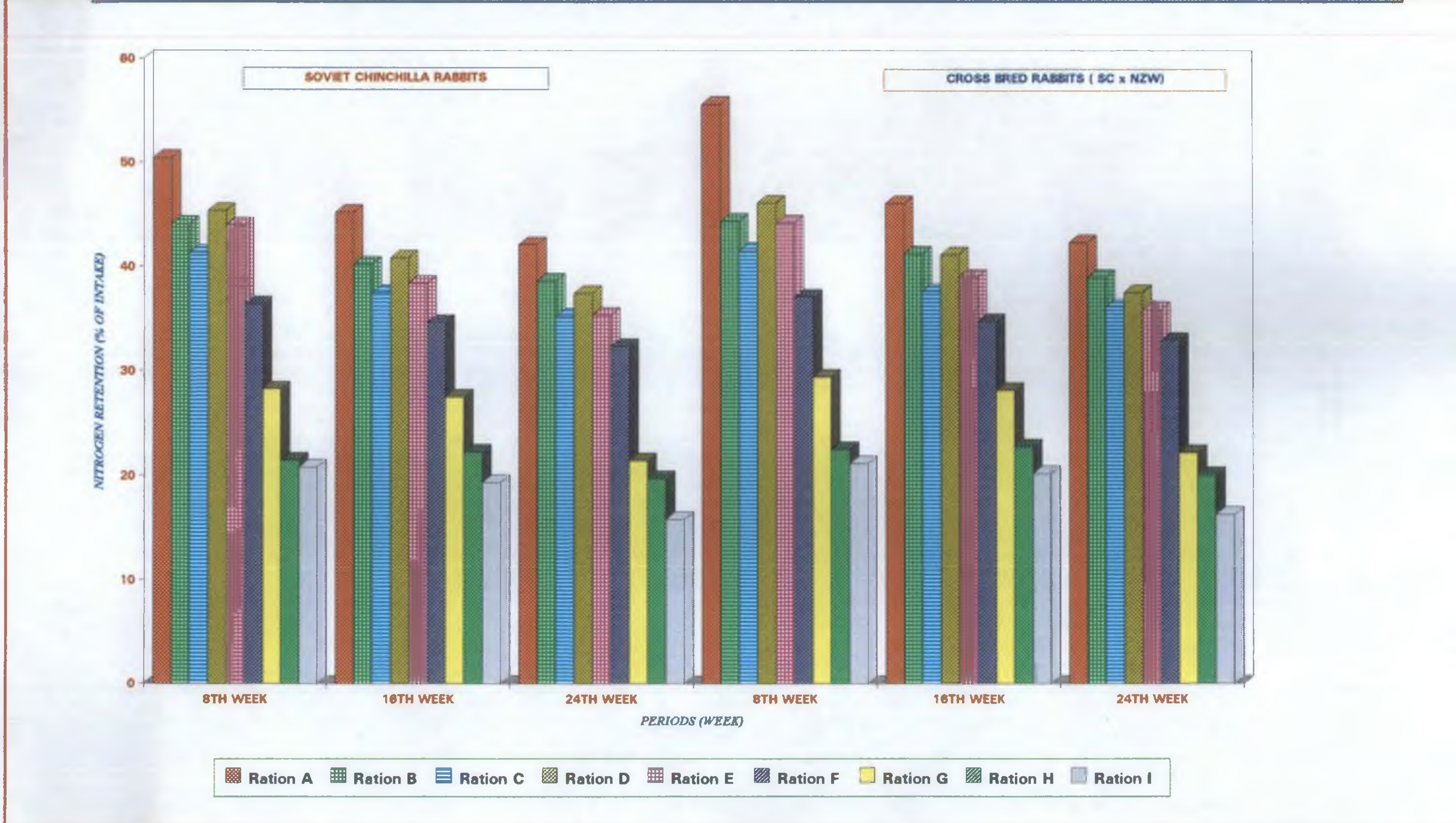
5.8.3.1. Nitrogen Balance

Data on nitrogen intake, outgo through urine and faeces and percentage retention presented in table 20 and 21 represented by Fig. 21 with their statistical analysis in Appendix 25.11 and 25.12 for SC and CB rabbits show a significant decrease in percentage retention of nitrogen in animals maintained on lower levels of CP in the ration. Statistical analysis of the data reveal that there is a significant decrease ($P<0.01$) in percentage retention of nitrogen in animals maintained on ration C containing 3000 kcal DE with 12 per cent CP when compared to that of ration A containing 3000 kcal DE with 20 per cent CP, ration F containing 2500 kcal DE with 12 per cent CP when compared to that of ration D containing 2500 kcal DE with 20 per cent CP and ration I containing 2000 kcal DE with 12 per cent CP when compared to that of ration G with 20 per cent CP and 2000 kcal DE respectively indicating that as the level of CP in the ration decreases, the percentage retention of nitrogen also decreases ($P<0.01$). Similar trend of results can be observed in second and third stage of experiment.

On examining the data on percentage retention of nitrogen in animals maintained on varying levels of DE, it can be seen that the percentage retention is decreased with a decrease in DE content of the ration, as can be seen from a retention of 28.23 per cent registered for SC and 29.37 per cent for CB rabbits

Fig. 21

NITROGEN RETENTION OF SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT STAGES OF EXPERIMENT



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maintained on ration G containing 20 per cent CP and 2000 kcal DE as against a retention of 50.43 per cent recorded for SC and 50.62 per cent for CB animals maintained on ration A containing 20 per cent CP and 3000 kcal DE. Statistical analysis of data reveal that a significant decrease ($P<0.01$) in retention of nitrogen in animals maintained on ration G when compared to that of ration A, ration H when compared to that of ration B and ration I when compared to ration C, indicating that DE content in the ration influences the nitrogen retention in animals ($P<0.01$). Similar trend of result can be seen in the second and third stage of experiment also.

As between the periods the percentage retention of nitrogen decreases as age of the animal advances which can be noticed from a significantly ($P<0.01$) better percentage retention of nitrogen in animals during the 8th week of experiment than that of 24th week of experiment irrespective of ration treatments.

The observations on nitrogen retention reported by various authors with different ration treatments and breeds of rabbits are different.

Lall et al. (1984) reported an average nitrogen intake of 3.7, 3.2, 3.5, 2.5 and 1.7 g/head/day in Angora rabbits fed on rations containing different protein levels of 25.38, 21.18, 19.32, 13.83 and 10.18 per cent respectively and the corresponding nitrogen retention ($P < 0.01$) were 1.0, 0.5, 1.5, 0.0 and -4.9 g/head/day for five groups respectively. Adegbola et al. (1985) reported a nitrogen balance of -1.8, -1.7, -1.8, -0.3 and + 0.7 g respectively in 16-18 weeks old rabbits of 1.5 - 1.7 kg body weight, maintained on all forage, forage plus concentrate and all concentrate diets.

An average nitrogen balance (g/head/day) of 1.4, 1.8, 2.1 and 1.8 were recorded by Lall et al. (1985) in four groups of adult Angora rabbits maintained on complete rabbit feed (control) fed ad lib. (group I) and 25 and 50 per cent of concentrate moiety was replaced by berseem hay meal in group two and three respectively (group II and III) and 50 per cent concentrate moiety was replaced by nutritious Grewia optiva leaf meal (group IV) respectively.

On feeding NZW rabbits weighing about two kg, wheat bran in ground and unground form with and without grass hay for a three day adjustment period and seven day collection period recorded a nitrogen retention ranging from 0.6 - 1.11g/day (Robinson et al. 1986 b).

Robinson et al. (1986 a) in a study on effect of age and cecotrophy on urea utilization recorded an average nitrogen retention (g/day) of 1.37 in fryers and 0.98 in adult on a basal diet, 1.39 g and 1.12 g respectively on a basal diet + soybean meal, 1.26 and 0.75 respectively on basal diet + urea. The CP per cent of the three diets were 13.56, 15.63 and 16.94 respectively and this supports the findings of reduction in percentage retention of nitrogen as age advances observed in the present study with maximum percentage retention during the first stage of experiment. Singh and Negi (1987) from their study on evaluation of peanut, mustard, linseed and cotton seed meals for wool production in Angora rabbits reported an average daily nitrogen retention of 1.81, 1.54, 2.06 and 2.15 g/head/day with nitrogen retained as percentage of intake as 66.03, 55.98, 60.93 and 64.86 per cent in four isonitrogenous rations containing different oil meals as protein sources. Ahmed and Abou-Ashour (1987) from a study on protein quality and essential amino acid requirements for growing Baladi rabbits of five weeks old maintained for 10 weeks on diets containing 16.1 - 17.1 per cent CP supplied by ground clover hay, maize grain, soybean meal, cotton seed meal and urea in different proportions recorded an average daily nitrogen retention of 0.64, 0.52, 0.46 and 0.33 g respectively. Sankhyan et al. (1990) from their study on effect of different levels of protein and energy on growth performance of rabbits observed nitrogen balance (g/head/day) of 1.57, 0.8 and 2.34 and the calculated corresponding percentage of intake was 45 per cent, 25 per cent and 53.67 per cent in growing cross bred rabbits maintained on NPNE (100 per cent NRC-1977), LPLE (15 per cent lower than NRC) and HPHE (15 per cent higher than NRC) respectively for 126 days from six weeks of age. Grigorov (1991) from his study on effect of the amount of crude fibre on digestibility of mixed feeds and nitrogen balance reported that utilization of nitrogen improved with decrease in crude fibre in the diet to the extent of 14.59, 12.51 and 10.4 per cent and the corresponding nitrogen retention as percentage of intake was 38.86, 36.29 and 31.8 per cent respectively. Gupta et al. (1993 c) from their evaluation of complete feeds in rabbits utilizing tropical grasses reported an average nitrogen balance (g/day) of 1.33, 1.12, 1.2 and 1.33 and nitrogen retention as percentage of intake as 56.85, 50.61, 49.65 and 49.28 respectively in four groups of adult SC rabbits.

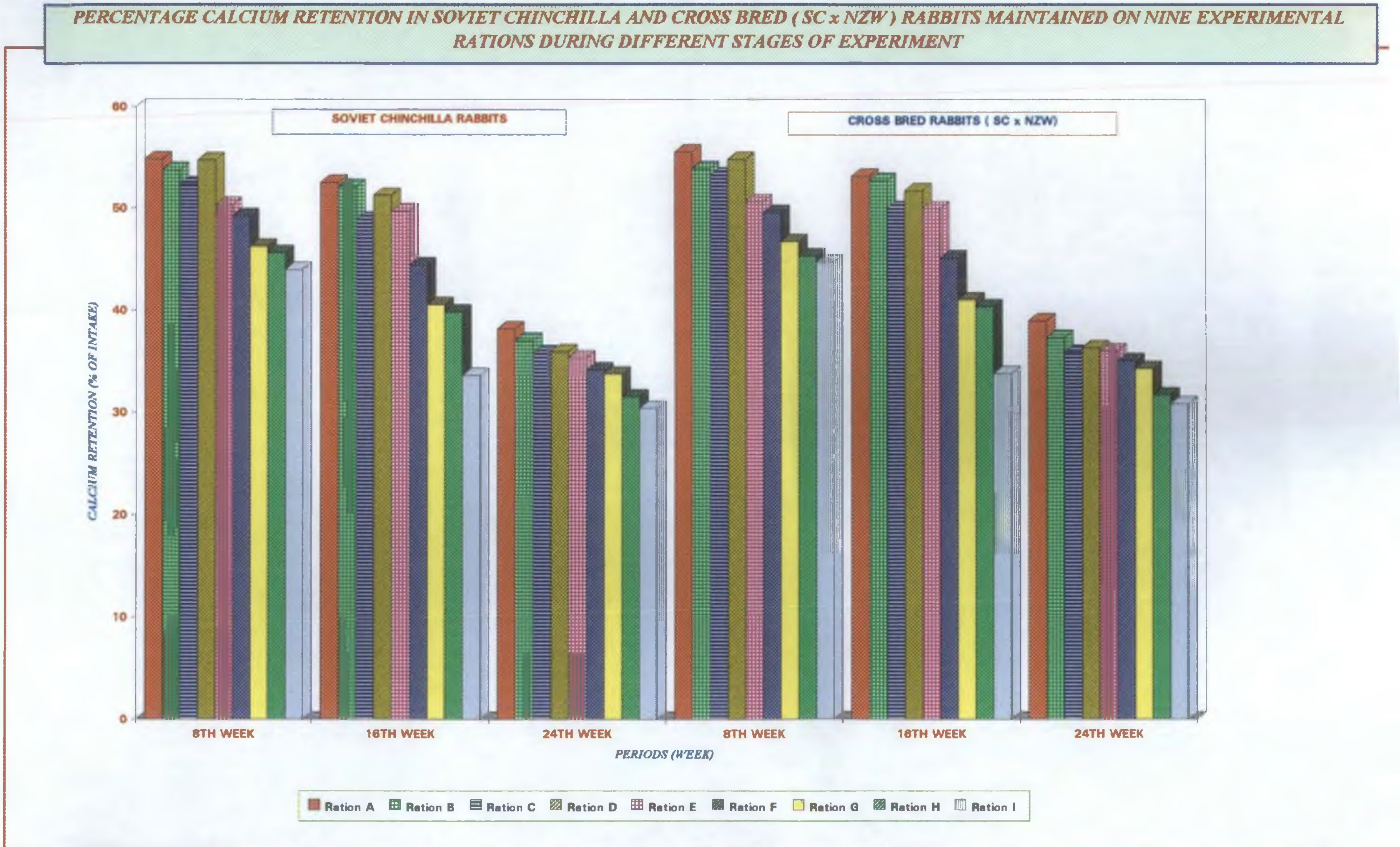
While the observations on nitrogen retention in the present study are in support of various workers (Lall et al. 1984 and 1985; Robinson et al. 1986; Singh and Negi, 1987; Grigorov, 1991 and Gupta et al. 1993 c), Adegbola et al. (1985) could find only negative or very low nitrogen retention in growing rabbits fed on forage, forage plus concentrate and all concentrate diets. Results on nitrogen balance obtained in the present investigation is essentially in agreement with Sankhyan et al. (1990) who could also observe significant influence of dietary energy and protein on nitrogen retention with maximum nitrogen retention in the HPHE group which may be attributed to the efficient utilization of nitrogen in the presence of adequate energy.

5.8.3.2. Calcium Balance

Consolidated data on Ca balance of SC and CB rabbits maintained under different ration treatments for the periods 8th, 16th and 24th week of experiments are presented in tables 22 and 23 represented by Fig. 22 with their statistical analysis in Appendix 25.11 and 25.12. Statistical analysis of the data reveal that there is significant decrease ($P<0.01$) in percentage retention of Ca in animals maintained on ration C when compared to that of ration A, ration F when compared to that of ration D and ration I when compared to that of ration G indicating that dietary level of CP influences the percentage retention of Ca ($P<0.01$). Essentially similar trend of observation has been made during the 16th and 24th week of experiment.

On examining the influence of DE content on percentage retention of Ca, a significant increase ($P<0.01$) in the rate of retention has been noticed in animals maintained on high DE ration as can be appreciated from a retention of Ca

Fig. 22



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to the extent of 55.85, 54.91 and 47.01 per cent for CB animals maintained on rations A, D and G (P<0.01) respectively and 54.82 and 46.26 per cent for SC rabbits maintained on rations A and G (P<0.01); 54.16, 50.70 and 45.49 per cent for CB rabbits (P<0.01) and 53.78, 50.35 and 45.63 per cent for SC rabbits (P<0.01) maintained on rations B, E and H respectively and 53.41, 49.66 and 44.61 per cent for CB rabbits and 52.34, 49.25 and 44.00 per cent for SC rabbits maintained on rations C, F and I respectively showing that variation of DE, from 2000 kcal to the extent of 3000 kcal significantly enhances (P < 0.01) the percentage retention of Ca. Similar trend of results have been noticed in animals during the 16th and 24th week of experiment.

Statistical analysis of the data further show that there is a significant increase in retention of Ca in animals maintained during 8th week of experiment when compared to that of 16th and 24th week of experiment irrespective of ration treatments.

Data on calcium retention and their apparent digestibility obtained in the present investigation are essentially in agreement with the observation made by Lall et al. (1985) who recorded an apparent digestibility of Calcium to the extent of 64.22, 60.09 and 64.92 per cent respectively from their studies on effect of partial replacement of concentrate by roughages in the diet of Angora rabbits on wool production.

The results on Calcium retention in the present study indicate higher percentage retention with the increase in dietary energy and protein and this observation is essentially in agreement with Baghel and Pradhan (1990) who reported that higher retention of Ca, P, Mn and Zn occurred in broilers receiving highest levels of dietary protein and energy in different phases of growth. They could also find that increasing level of energy and protein has increasing effect on the retention of minerals. Higher levels of energy and protein favouring increased mineral retention observed in the present investigation is also in accordance with the findings of Edwards et al. (1960), Peeler et al. (1960) and Saxena (1985) in poultry.

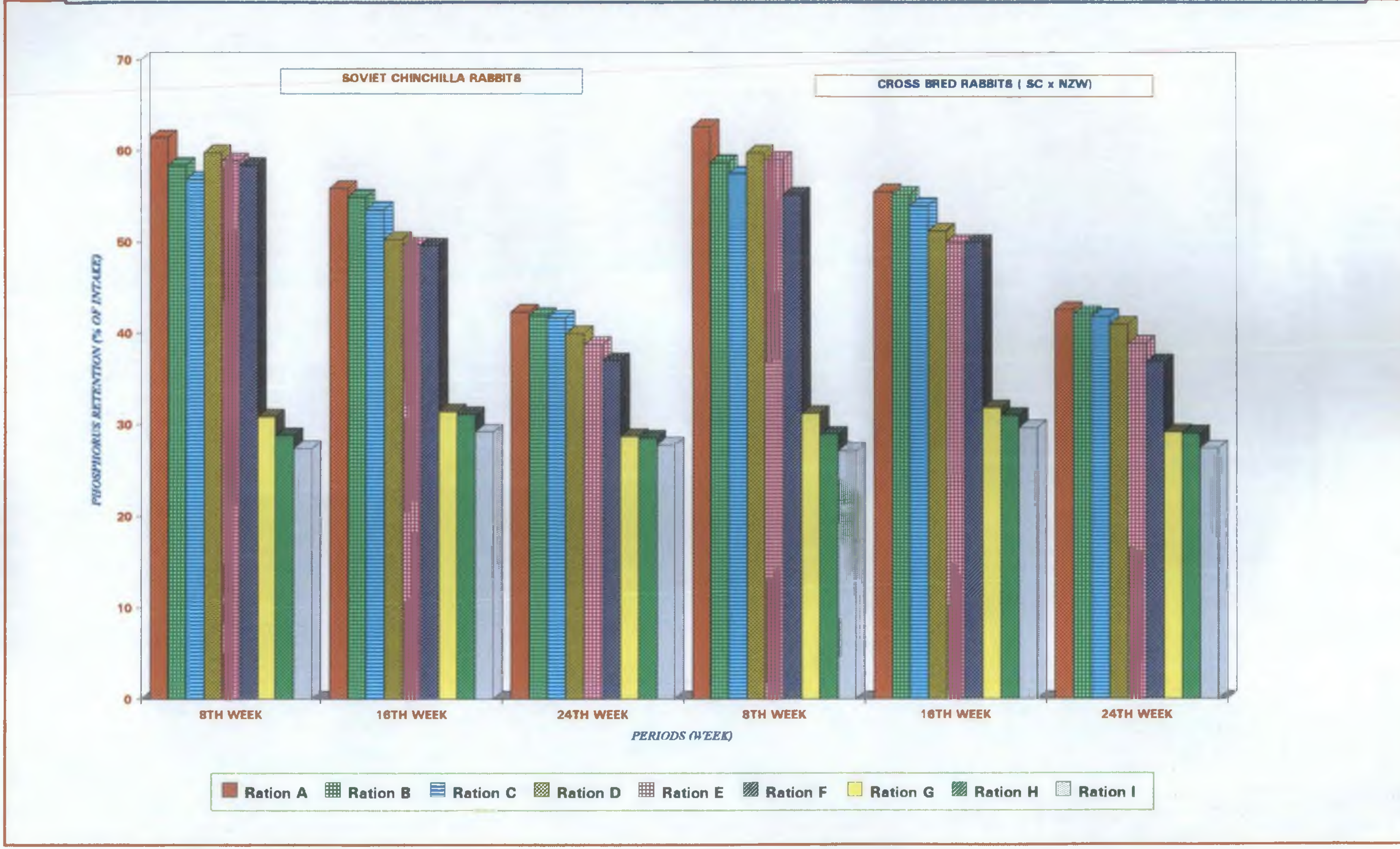
5.8.3.3. Phosphorus Balances

From the consolidated data on P balance for SC and CB rabbits presented in table 24 and 25 represented by Fig. 23 with the statistical analysis in Appendix 25.11 and 25.12 for the animals under different ration treatments for the period 8^{th}, 16^{th} and 24^{th} week of experiment we can observe that there is an increasing trend in percentage retention of phosphorus registered for animals maintained on high levels of CP as can be observed from an increased percentage retention of P in ration A when compared to that in ration C ($P<0.01$), ration D when compared to that in ration F ($P<0.01$) and ration G when compared to ration I ($P<0.01$) indicating that increase in CP from 12 per cent - 20 per cent significantly enhances the phosphorus retention. Essentially similar trend of results have been observed in the 2nd and 3rd metabolism trial also in SC and CB rabbits for the respective groups. It can also be noticed from the data that a better percentage retention of P has been registered in animals maintained on ration containing increased levels of DE as can be substantiated from the fact that, animals maintained on ration A registered a higher percentage retention of 62.72 as against 59.96 in ration D and still lower retention of 31.36 in ration G; likewise ration B registered a percentage retention of 59.18 as against 59.05 in ration E and still lower retention of 29.04 per cent in ration H and ration C registered a percentage retention of 57.36 as against 55.27 in ration F and still lower retention of 27.26 per cent in ration I in the case of CB rabbits during the 8^{th} week of experiment, indicating that on increasing DE content in the ration from 2000 - 3000 kcal significantly enhances ($P<0.01$) the percentage retention of P. Essentially, similar trend of result has been observed during the three stages of experiment in both SC and CB rabbits.

From an overall assessment of data during the various periods, it can be appreciated that the percentage retention of P significantly decreases ($P < 0.01$) as the age of the animal advances from 8^{th} - 24^{th} week of experiment.

Fig. 23

PERCENTAGE PHOSPHORUS RETENTION IN SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT STAGES OF EXPERIMENT



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Comparable work on phosphorus retention in rabbits as influenced by dietary energy and protein levels is rather scanty in the literature. Lall et al. (1985) reported comparable Phosphorus retention and percentage digestibility in Angora rabbits. Though comparable data on phosphorus balance in growing rabbits are not available the results on phosphorus retention as influenced by dietary energy and protein levels obtained during the present in investigation are essentially in agreement with the observation of Edwards et al. (1960) Peeler et al. (1960) Saxena (1985) and Baghel and Pradan (1990) in poultry.

5.9. **Carcass characteristics**

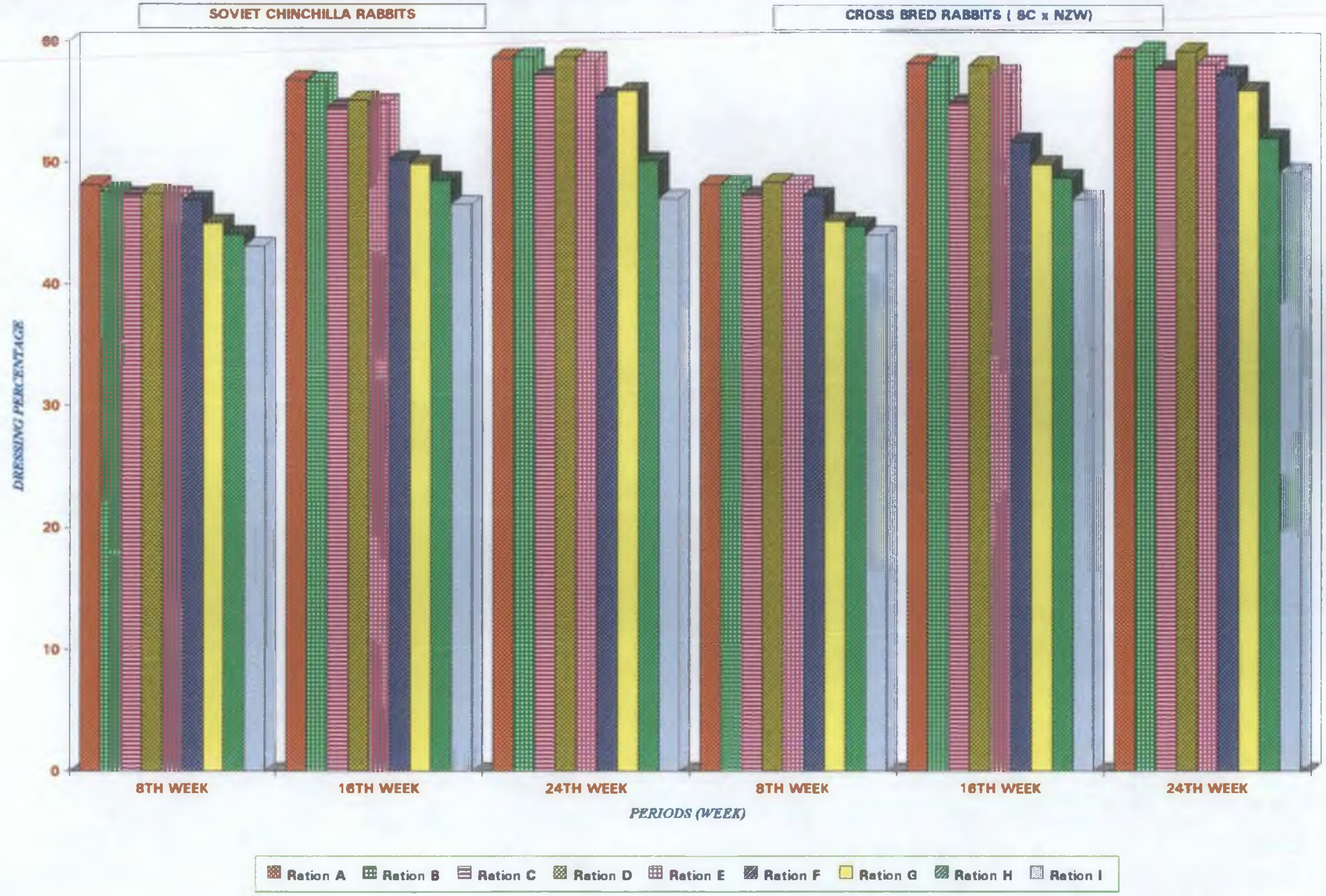
Carcass characteristics of SC and CB rabbits observed from rabbits slaughtered at 8th, 16th and 24th week of experiment involving dressing percentage, chemical composition of muscle, liver and fat constants of the animals maintained under the nine ration treatments are presented in tables 27-33 and the results are discussed under separate heads.

5.9.1 Dressing Percentage

Dressing percentage of SC and CB rabbits maintained under nine ration treatments during the 8th, 16th and 24th week of experiment as arrived from pre slaughter weight (g) and dressed weight (g) are presented in tables 26 and 27 respectively and represented by Fig. 24 with statistical analysis in Appendix 25.13. It can be noticed that maximum dressing percentage is obtained in animals maintained on ration A containing 20 per cent CP and 3000 kcal DE while lower dressing percentage is obtained with animals maintained on ration I containing 12 per cent CP and 2000 kcal DE in SC rabbits. In the case of cross bred rabbits maximum dressing percentage is obtained in animals maintained on ration D containing 20 per cent CP and 2500 kcal DE while lower dressing percentage is obtained in animals maintained on ration I containing 12 per cent CP and 2000 kcal DE. It can also be noticed that the dressing percentage is also proportional to the preslaughter weight of the animals since maximum dressing percentage is registered with animals having maximum

Fig. 24

DRESSING PERCENTAGE OF SOVIET CHINCHILLA AND CROSS BRED (SC x NZW) RABBITS MAINTAINED ON NINE EXPERIMENTAL RATIONS DURING DIFFERENT STAGES OF EXPERIMENT



preslaughter weight and vice versa. During the 16^{th} week of experiment the dressing percentage is comparatively increased in animals maintained under all ration treatments and during the 24^{th} week of experiment also in general a still more increase in dressing percentage could be noticed in all the animals slaughtered under different ration treatments. From an overall assessment of slaughter data it is discernible that the dressing percentage is directly proportional to the pre- slaughter weight of animals as can be noticed from a significant increase in dressing percentage (P<0.01) of animals slaughtered during the 24^{th} week of experiment, when compared to that of animals slaughtered at 8^{th} week of experiment irrespective of the ration treatments.

From a critical overall assessment of the statistical analysis of data it can be noticed that rabbits maintained on ration A registered a significant increase (P<0.01) in dressing percentage when compared to ration C, both containing 3000 kcal DE with 20 per cent and 12 per cent CP respectively, ration D compared to ration F and ration G when compared to ration I containing DE to the extent of 2500 kcal with 20 and 12 per cent CP and 2000 kcal DE with 20 and 12 per cent CP respectively, indicating that dietary CP influences the dressing percentage of animals slaughtered during the 8^{th}, 16^{th} and 24^{th} week of experiment. A significantly better (P<0.01) dressing percentage could be noticed in ration A when compared to that of ration G, ration B when compared to that of ration H and ration C when compared to that of ration I indicating a significantly better dressing percentage commensurate with an increase in dietary DE to the extent of 2000 kcal/kg to 3000 kcal/kg respectively in animals slaughtered during 8^{th}, 16^{th} and 24^{th} week of experiment.

Maximum dressing percentage is obtained during 24^{th} week of experiment, the values for the SC and CB rabbits being 58.64 and 58.72; 58.71 and 59.23; 57.20 and 57.71; 58.66 and 59.17; 58.4 and 58.12; 55.46 and 57.28; 55.89 and 55.96; 50.15 and 52.05 and 47.05 and 49.24 for rabbits maintained on rations A, B, C, D, E, F, G, H and I respectively.

Data on dressing percentage gathered the present study indicate that dressing percentage increases progressively with linear increase in age as well as body weight. This can be substantiated by the findings of various authors.

Dilella and Zicarelli (1971) observed an average dressing percentage of 52.6, 54.1, 55.7 and 56.6 in NZW rabbits slaughtered at 9^{th}, 11^{th}, 13^{th} and 15^{th} weeks of age respectively. Parillo (1977) reported an average dressing percentage of 47.4, 51.3 and 54.3 for three groups of SC rabbits slaughtered at 60 days, 52.8, 52.9 and 54.9 for those slaughtered at 135 days. On slaughtering growing NZW rabbits at various ages, Rao et al. (1978) reported that the carcass yield were higher ($P < 0.01$) at 12 and 16 weeks than the yield at eight weeks of age. The average dressed carcass ranged from 45.6 percent - 50.3 per cent of live weight. Mahajan and Sastry (1982) obtained an average dressing percentage age of 39.12, 41.39 and 45.95 in growing NZW rabbits slaughtered at 12 weeks of age and 42.17, 47.17 and 48.59 per cent at 20^{th} week of age for three groups maintained on roughage, roughage+concentrate and or concentrate alone respectively. Rudolph and Fisher (1982) reported an average carcass weight of 1383 g and 1542 g at 86 and 100 days of age with a dressing percentage 56.89 and 57.34 per cent on a pre slaughter weight of 2431 g and 2689 respectively in NZW rabbits. Butcher et al. (1983) reported that killing out proportions increased progressively for rabbits slaughtered from 1.5 - 3.0 kg, the dressing percentage were 52.3, 57.3 and 61.4 for high energy fed rabbits at 1.5, 2.25 and three kg body weight. Increase in dressing percentage with advancement in age and weight were also reported by Petrov et al. (1984), who observed that NZW rabbits slaughtered at first day and at 3, 4, 5, 12 and 24 months of age had a dressing percentage of 19.7, 43.2, 46.0, 49.8, 53.9 and 60.4 respectively. Diwyanto et al. (1986) from their study on carcass evaluation of the offspring of Flemish Giant rabbits at different slaughter weights of 1.75, 2, 2.25 and 2.5 kg recorded a dressing percentage of 39.7, 41.5, 45.8 and 49.1 per cent respectively. Effect of age on carcass traits of SC rabbits have been studied by Salroo et al. (1989) and observed that the carcass yield increases significantly with age, the dressing percentage reported were 45.09 per cent for fryer SC rabbits (< 12 weeks old), 45.31 per cent in young growers ($>12 \leq 16$ weeks old) 49.79 per cent of old growers (>16 - $\leq$ 24 weeks old) and 52.93 in Adult SC rabbits (>24 weeks old) with a pre-slaughter weight of 1.72, 1.6, 1.92 and 2.98 kg and the corresponding ages in days were 85, 90, 124 and 247 respectively. Osman (1992) also reported that dressing percentage was influenced by slaughter age. On slaughtering NZW rabbits at 14 or 18 weeks of age, he observed that dressing percentage and percentage of forequarter and loin increased (P <0.01) while hind quarter percentage decreased.

Results on slaughter data of the present study further reveals a better carcass yield on higher plane of nutrition, which is essentially in agreement with the observations of several authors. Omole (1977) obtained heavier liver and kidney in NZW rabbits by increasing dietary protein levels from 14 - 18 per cent. Colin and Allain (1979) also observed a reduction in carcass yield by 1.5 per cent when the crude fibre in the semi-purified diets was increased from 10 to 17 per cent. Mahajan and Sastry (1982) on studying the carcass characteristics of NZW rabbits fed diets containing different concentrate roughage ratio revealed that the concentrate diet and concentrate+roughage diet resulted in higher dressing percentages at both stages (12^{th} and 20^{th} weeks of age) of slaughter, when compared to diet containing roughage alone and with increase in concentrate in the diet, the proportion of edibles also increased. Increased carcass yield on concentrate diet than roughage based diet is also reported by Sastry and Mahajan (1982) on supplementation of white clover hay with tree leaves, barley grains or bengal gram in NZW rabbits from 10 - 20 weeks of age and obtained an average dressing percentage of 41.92, 46.09 and 47.03 with the pre slaughter weight of 2062.5, 2506.25 and 2775 g respectively. Butcher et al. (1983) reported higher killing out proportions for high energy fed rabbits than low energy fed rabbits (P <0.01 and P < 0.05). The dressing percentage were 53.6, 53.6 and 60.6 for LE group at 1.5, 2.25 and three kg body weight and 52.3, 57.3 and 61.4 for high energy fed rabbits at 1.5 kg, 2.25 kg and three kg body weight. Maertens et al. (1990) reported a dressing percentage of 59.6 and 58.7 for high energy diets and 58.1 and 58.4 on low energy diets with DE 8.6 - 9.1 or 10.3 - 10.8 MJ/kg and DCP 12 or 14 g/MJ DE from five weeks - 11 weeks of age in a factorial experiment. Maertens et al. (1991) also reported that carcass yield was greater in rabbits fed diets with a higher energy content, but was not affected by the protein to energy ratio.

Contrary to the present findings supported by the above authors, there are studies that revealed higher dressing percentage even on lower planes of nutrition. Sankhyan et al. (1991) on feeding cross bred male rabbits of six weeks of age, with diets containing 16.21, 13.42 or 18.73 per cent CP and gross energy 4.76, 4.56 and 4.98 kcal/g diets LPLE, NPNE and HPHE respectively observed that the dressing percentage, weight of various physical cuts, heart, liver and kidney were not affected by the treatment. Centoducati et al. (1991) obtained best carcass yield with 16.05 per cent CP level in their study on the effect of environmental temperature on carcass characteristics of NZW rabbits given pelleted diets with different levels of CP to the extent of 16.05, 18.05 or 21.05 per cent maintained up to 60 days of age from weaning at 30 days. On feeding weaned californian, NZW and cross bred rabbits with diets containing 15 or 17.5 per cent CP and DE 2500 or 2800 kcal/kg until two kg body weight Hemid et al. (1991 a) observed the best carcass dressing percentage with 15 per cent protein and 2500 kcal of DE.

Comparable values of dressing percentage as observed in the present study are also reported by various workers (Zelnik and Granat, 1971; Titarev, 1971 a; Arrington and Kelly, 1976; Shqueir et al., 1985, Rudloph and Fisher, 1982; Joy et al., 1985; Abdella et al., 1988; Baumier and Retailer, 1988; Coan et al., 1988; Salroo et al. ,1989 Kuttynarayanan and Nandakumar, 1989 and Prasad and Sahu, 1989). While the dressing percentage reported by various authors are higher when compared to the results of the present study; (Templeton, 1968; Bednarz and Frindt, 1977; Butcher et al., 1983; Parillo and Vasenina, 1984; Beynen et al., 1990; Lambertini et al., 1990 and Zoccarato et al., 1990), comparatively lower values on dressing percentage have also been reported by certain authors (Sastry and Mahajan, 1982; Caklovia et al., 1987 and Fennell et al., 1991)

5.9.2 Chemical composition of Muscle.

Chemical composition of muscle from animals slaughtered during the 8th, 16th and 24th week of experiment maintained under different ration treatments are presented in table 28 and 29 with statistical analysis in Appendix 25.14 and 25.15. and discussed under separate heads.

5.9.2.1 Moisture content

Data presented in table 28 and 29 with statistical analysis in Appendix 25.14 and 25.15 reveal no significant difference between the groups with regard to moisture contents in different ration treatments during the three periods of experiment suggesting that neither the crude protein nor DE content in the ration influences the moisture content of the muscle. As between the periods statistical analysis of the data reveal that there is a significant decrease ($P<0.01$) in moisture content during the 24th week of experiment when compared to that of 8th week of experiment irrespective of protein and DE content in the ration showing that age of the animal influences the moisture content in the muscle.

Rao et al. (1978) studied the carcass quality and composition of rabbit meat at 8, 12 and 16 weeks of age in NZW rabbits and reported that the moisture content tended to go down as the slaughter age increased. Moisture content obtained in the present study are similar to values reported by Rao et al. (1978) and Lukefahr et al. (1982) for Flemish giant, NZW, and Terminal cross-breds and Holmes et al. (1984) in NZW rabbits.

On carcass analysis Butcher et al. (1983) also reported that moisture content decreases as the age advances, the moisture content for rabbits slaughtered at three kg was lower than for rabbits slaughtered at 1.5 and 2.25 kg.

Similar values on moisture content of rabbit meat has also been reported by EL-Gammal et al. (1984) and could observe a decrease in moisture content as the age advances, in Bouscat rabbit maintained upto nine months of age. Values on muscle moisture content at 12 weeks of age (8^{th} week of experiment) obtained in the present study is higher when compared to that of Prasad and Sahu (1989) who reported a moisture content of 67.6, 66.3, 66.0, 64.7 and 65.5 per cent on studying the meat composition of SC fryers at 12 weeks of age maintained on different concentrate mixtures.

5.9.2.2 Dry matter

Data on muscle DM presented in table 28 and 29 with their statistical analysis in Appendix 25.14 and 25.15 for SC and CB rabbits reveal no significant difference in animals maintained on different ration treatments showing that dietary CP and DE does not seem to influence the muscle DM. As between the periods, the dry matter content of the muscle increases ($P<0.01$) to the extent of 34.17 per cent at 24^{th} week of experiment as against 28.40 per cent during the 8^{th} week of experiment for SC rabbits, and 34.2 per cent as against 28.5 per cent for CB rabbits on high energy high protein ration (ration A) while the DM content increase to the extent of 32.85 per cent during the 24^{th} week of experiment in low energy low protein group as against 26.50 per cent during 8^{th} week of experiment for SC and 32.90 per cent as against 26.70 per cent in CB rabbits ($P<0.01$), tending to suggest that, as the age of the animal advances the DM content in the muscle significantly ($P<0.01$) increase irrespective of the ration treatments.

Increase in DM content of the muscle on advancement of age as seen in the present study is also reported by De blas et al. (1977) and El-Gammal et al. (1984) who also reported an increase in DM content as the age of the animal advances from a study on Bouscat Rabbit maintained upto nine months of age.

5.9.2.3. Crude protein

Data presented in table 28 and 29 with statistical analysis in Appendix 25.14 and 25.15 on muscle CP content of SC and CB rabbits reveal no significant difference between the groups indicating that neither the dietary CP nor the energy content influences the CP content of the muscle and the values during the three period range from 69.04 - 71.77 per cent on DMB for SC and 68.80 - 71.70 per cent for CB rabbits. As between the periods the CP content significantly decreases ($P<0.01$) on dry matter basis as the age of the animal advances, irrespective of ration treatments.

Non-significant effect of diet on CP content of the muscle observed in the present study is also supported by Butcher et al. (1983) who found no differences in protein content of muscle between treatments in their study on effect of slaughter weight upon the growth and carcass characteristics of rabbits fed diets of different metabolizable energy concentration. Reduction in protein content on advancement of age, as observed in the present study is also reported by El-Gammal et al. (1984) from the studies on the chemical composition of muscle in Bouscat rabbit maintained upto nine months of age. Muscle CP content observed in the present study agree with those reported by Lukefahr et al. (1982); El-Gammal et al. (1984) and Holmes et al. (1984) for NZW rabbits Boccingnone et al. (1987) reported the meat-composition of Burgundy Fawn, Californian and NZW rabbits fed ad lib. and slaughtered at 90-95 days of age wherein the CP content averaged 21.75, 20.7 and 21.6 per cent respectively while Rao et al. (1978) reported slightly lower values on muscle CP.

5.9.2.4. Ether Extract

Data presented in table 28 and 29 with statistical analysis in Appendix 25.14 and 25.15 on crude fat in muscle of SC and CB rabbits show a significant decrease ($P<0.01$) in crude fat content when the CP content in the ration decreases as can be seen from an appreciable decrease in ether extract content in animals maintained on ration C when compared to that of Ration A and a significant decrease ($P<0.01$) in fat content in animals maintained on ration F when compared to that of ration D and ration I when compared to that of ration G, during the 8th, 16th and 24th week of experiment, showing that dietary CP significantly ($P<0.01$) influences the muscle crude fat content. Statistical analysis of the data further show that DE content of the ration also influences the fat content in the muscle as can be appreciated from a significantly higher ($P<0.01$) fat content registered in animals maintained on high DE content in the ration, which was confirmed by a significantly higher muscle fat content in animals maintained on ration A when compared to that of ration G, ration B when compared to that of ration H and ration C when compared to that of ration I during the 8th, 16th and 24th week of experiment. Further scrutiny of the data also reveal a progressive increase in muscle fat content as the age of the animal advances as can be noticed from a significantly higher muscle fat content ($P<0.01$) recorded in animals during the 24th week of experiment when compared to that of 8th week of experiment irrespective of ration treatments.

Increase in fat content as the age advances as observed in the present study is essentially in agreement with De blas et al. (1977), Rao et al. (1978) and Butcher et al. (1983). Butcher et al. (1983) could also find that diet has a significant effect on fat content ($P<0.05$), the high energy diet resulting in a higher carcass fat content and essentially similar trend of result has been obtained in the present study also.

Fat content of muscle obtained in the present study is comparable with that reported by El-Gammal et al. (1984) for Bouscat rabbit from one to nine months of age, Holmes et al. (1984) for NZW rabbits, Boccingnone et al. (1987) for californian rabbits and Prasad and Sahu (1989) in SC fryers, while Rao et al. (1978) and Lukefahr et al. (1982) reported higher fat per cent for NZW, Flemish giant and Terminal cross rabbit meat.

5.9.2.5 Total Ash

Not much of variation in values could be noticed with regard to total ash content in muscle (Table 28 and 29). From the statistical analysis of the data (Appendix 25.14 and 25.15) it can be noticed that there is no significant difference between the muscle ash values of animals maintained on varying levels of CP to the extent of 20, 16 and 12 per cent respectively for ration A, B and C with 3000 kcal DE; rations D, E and F containing 2500 kcal DE with CP level 20, 16 and 12 per cent respectively and ration G, H and I containing 2000 kcal DE with CP levels of 20, 16 and 12 per cent respectively indicating that level of CP in the ration is not seem to influence the total ash content of muscle.

It can be further probed from the statistical analysis of the data that a significantly (P<0.01) higher muscle ash content could be noticed in animals maintained on ration G when compared to that of ration A during the 8^{th}, 16^{th} and 24^{th} week of experiment in SC and 16^{th} and 24^{th} week of experiment in CB rabbits, ration H when compared to that of ration B during the 8^{th} and 24^{th} week of experiment and ration I when compared to that of ration C during the 8^{th} and 24^{th} week of experiment while an apparent increase could be noticed during the 16^{th} week of experiment in both SC and CB rabbits, indicating that DE content in the ration seems to influence the total ash content of muscle. As between the periods, the muscle ash content show a significant decrease (P<0.01) as the age of the animal advances.

Total muscle Ash content obtained for SC and CB rabbits in the present study are comparable to that reported by El- Gammal et al. (1984) while Lukefahr et al. (1982) and Prasad and Sahu (1989) reported slightly lower ash values. Reduction in Ash content in the 24^{th} week of experiment observed in the present study is further supported by Butcher et al. (1983) who reported that the ash content is found decreasing with age, as the carcasses of rabbits slaughtered at three kg has a lower ash content than those slaughtered at 1.5 kg. El-Gammal et al. (1984) also recorded a decrease in ash content of rabbit meat as the age advances in Bouscat rabbit from one to nine months of age.

Effect of dietary energy level on muscle ash content is reported by Butcher et al. (1983) who could notice that total ash values of rabbits fed LE group was higher than that of HE group fed rabbits, which concur the results of the present investigation.

5.9.3 Liver Protein

Data on liver protein presented in table 30 and 31 with statistical analysis in Appendix 25.16 for SC and CB rabbits show a significant decrease in liver protein content, in those animals maintained on low CP content in the ration as can be substantiated from a significant decrease ($P<0.01$) in liver protein observed in animals maintained on ration C when compared to that of ration A, ration F when compared to that of ration D and ration I when compared to that of ration G, during the 8th, 16th and 24th week of experiment showing that dietary CP in the ration significantly ($P<0.01$) influences the liver protein content.

Statistical analysis of the data further show an appreciable decrease of liver protein in animals maintained on ration G when compared to that of ration A ration H when compared to that of ration B ($P<0.01$) and in ration I when compared to that of ration C during the 8th, 16th and 24th week of experiment showing that DE level in the ration seems to influence the liver protein content of the animals. Age of the animals does not seem to influence the liver protein content as no significant difference could be noticed between the periods on statistical analysis of the parameter.

Comparable work on liver protein content of rabbits maintained on varying levels of CP and DE could not be traced in the literature. However, similar work on liver protein was reported by Jalaludeen and Ramakrishnan (1991) in caged layers. On maintaining the white Leghorn strain- cross pullets on four levels energy (2400, 2500, 2600 and 2700 kcal ME/kg) and four levels of protein (14,16,18 and 20 per cent CP) they observed that as the dietary protein level increased, liver protein content also increased linearly and the liver protein content was significantly influenced by the dietary protein and energy levels. But Peethambaran (1991) could not find any significant influence of dietary energy or protein on liver protein in White Pekin ducks on maintaining them with three levels of protein (17,20 and 23 per cent CP) and three levels energy (2400, 2600 and 2800 kcal ME/kg) from day old to 10 weeks of age.

5.9.4 Liver Fat

Data on liver fat presented in table 30 and 31 with statistical analysis in Appendix 25.16 for SC and CB rabbits show a progressive increase in fat content in animals maintained on lower CP levels while a progressive decrease in liver fat content in animals maintained on ration containing low digestible energy. Statistical analysis of the data reveals no significant difference between groups or the periods. Though not statistically significant, a trend showing better fat content can be noticed in animals during the 24^{th} week of experiment when compared to that on 8^{th} week of experiment irrespective of animals maintained on high or low plane of CP or DE.

No published data on liver lipid content of rabbit as influenced by dietary energy or protein are available at present. But Jalaludeen and Ramakrishnan (1991) performed similar work on White Leghorn strain cross pullets and obtained similar trend of increase in liver lipid with the increase in dietary energy level. Ivy and Nesheim (1971) and Hart field and Tuller (1975) also reported that higher energy in the diet resulted in increase in liver fat content in poultry. But non-significant influence of dietary energy and protein on crude fat content of liver has been reported by Peethambaran (1991) in White Pekin ducks, but he could observe a slight increase in liver ether extract as age advanced, which supports the result of the present study.

5.9.5 Fat constants

Abdominal fat was collected during the slaughter studies and estimated the iodine number and saponification values for SC and CB rabbits and are presented in table 32 and 33. During the 8th week of experiment appreciable quantity of abdominal fat could not be collected for the estimation of iodine value and saponfication value. It was also noticed that animals maintained on rations G, H and I did not contribute sufficient quantity of abdominal fat for estimation during the three periods and hence their iodine number and saponification value for 8th, 16th and 24th week of experiment could not be registered but in animals maintained on high energy rations (A,B,C,D,E and F), the fat deposited was appreciably higher when compared to that of animals maintained on rations G, H and I.

Low percentage of abdominal fat in low energy ration was reported in 74 per cent alfalfa diet fed group when compared to 28 per cent and 54 per cent in NZW rabbits slaughtered at nine weeks of age by Holmes et al. (1984) Maertens et al. (1990) also obtained similar results on feeding growing rabbits with high and low energy diets with DCP 12 or 14 g/1000 MJ, from five to 11 weeks of age and observed that depot fat and total fat were greater in rabbits given high energy diet.

Shrivastava and Panda (1991) from their study on distribution of fat at different locations as influenced by dietary calorie-protein ratio in Quail broilers at five weeks of age observed that increase in dietary energy and decrease in Caloric-protein ratio significantly increased fat content of whole carcass, abdomen, leg and breast meat and liver.

5.9.5.1 Iodine Number

Iodine number of the abdominal fat estimated for different ration treatments presented in table 32 with statistical analysis in Appendix 25.17 for SC and CB rabbits vary from 63.30 - 74.70 during 16th week and 66.27 - 73.74 during 24th week for SC and 64.23 - 76.26 during 16th week and 67.31 - 75.14 during the 24th week of experiment for CB rabbits; the values being not statistically significant, indicating that neither dietary protein nor DE influences iodine value of abdominal fat. No significant difference could be noticed between the period also. Though not statistically significant, comparatively lower value for iodine number can be seen in animals maintained on rations A, B and C containing 3000 kcal DE as against rations D, E and F containing 2500 kcal DE. No definite trend could be seen regarding the influence of dietary CP levels on iodine number.

The estimated values of iodine number as influenced by dietary protein and energy levels indicated that fat contained more of UFA. Non-significant influence of dietary energy and protein on iodine number of abdominal fat has been reported by Peethambaran (1991) in White Pekin ducks with three protein and energy levels (17, 20 and 23 per cent CP and 2400, 2600 and 2800 kcal ME/kg) and Amritha Viswanath (1992) in a study on requirement of protein and energy for broilers. Reported values on iodine number of abdominal fat of rabbit is not available in the literature. However, the iodine values in the present study agrees with Anderson and Mendel (1928) who found that in non-ruminants iodine numbers of body fat deposited from various carbohydrates and proteins fell with in the range of 55 - 70.

5.9.5.2. Saponification value

Saponification value recorded for the different ration treatments presented in tables 33 with statistical analysis in Appendix 25.17 for SC and CB rabbits ranges from 152.88 - 162.80 for SC and 151.63 - 162 for CB rabbits during the 16th week of experiment, while 152.20 - 172.32 in SC and 151.95 - 171.04 in CB rabbits during the 24th week of experiment and on statistical analysis of the data it can be noticed that dietary crude protein does not seem to influence the saponification value as can be substantiated from a non-significant difference between the animals maintained on rations A, B and C containing 20, 16 and 12 per cent CP respectively with 3000 kcal

DE and rations D, E and F containing 20, 16 and 12 per cent CP respectively with 2500 kcal DE during 16^{th} and 24^{th} week of experiment.

It can be further noticed from the statistical analysis of the data that, while a non-significant difference exist between the animals maintained on rations A and D, B and E & C and F respectively in SC and A and D, B and E in CB rabbits during the 16^{th} week of experiment, a significant decrease in both SC ($P<0.05$) and CB ($P<0.01$) rabbits could be observed in animals maintained on ration D containing 20 per cent CP with 2500 kcal DE when compared to ration A containing 20 per cent CP with 3000 kcal DE, ration E containing 16 per cent CP with 2500 kcal DE when compared to ration B containing 16 per cent CP with 3000 kcal DE during 24^{th} week of experiment showing that DE content in the ration seems to influence the saponifcation values.

Published data on saponification values of abdominal fat from broiler rabbit are less. The values obtained in the present study indicate that abdominal fat contain more of long chain fatty acids. Similar saponification value have been reported (Amritha Viswanath, 1992) in broilers fed with 22, 24 and 26 per cent CP with 2900 kcal ME/kg and 19 per cent CP with 3000 and 2900 kcal/kg. Peethambaran (1991) has reported the saponification value of abdominal fat in White Pekin ducks maintained on three level of energy and protein but neither the protein nor the energy level influenced the saponification value.

5.10 **Slaughter age**

The influence of diet on economic slaughter has been evaluated in depth by taken into consideration the cumulative weight gain, feed consumption, feed efficiency and economics of gain during the period 0 - 56 days, 0 - 112 days and 0 - 168 days of experiment, involving pre- slaughter weight, dressed weight, dressing percentage, profit and loss statement of animals maintained on nine treatment combinations as presented in the consolidated table 34 and 35. It can be noticed that the dressing percentage is directly proportional to the body weight of the animals in that the higher dressing percentage is seen recorded in animals having higher body weight and vice versa. But on further consideration of market value of meat and feeding cost during the period under evaluation, it can be perceived that animals maintained upto 56 days and slaughtered from different ration treatments, ration E and D containing 2500 kcal DE with 16 and 20 per cent CP respectively emerged out with maximum net profit of Rs. 19.09 and Rs. 22.43 for the SC and CB rabbits respectively on ration E and Rs. 18.56 and Rs. 22.31 for SC and CB rabbits on ration D. But when animals maintained upto 112 days and slaughtered from different ration treatments, though the margin of profit is less when compared to animals slaughtered on 56th day of experiment ration D containing 2500 kcal DE with 20 per cent CP came out with a maximum net profit of Rs. 3.96 as against Rs. 1.99 for animals maintained on ration E, in the case by SC and Rs. 14.63 for ration D as against Rs. 11.36 for animals maintained on ration E in the case of CB and beyond 112 days of age after weaning, there is no profit on slaughter.

Rapid growth rate and early marketing or slaughter age of eight - 12 weeks were reported in rabbits by various authors (Rao et al. 1977; Cheeke, 1980 b; Lukefahr et al. 1982; Butcher et al. 1983; Ozimba and Lukefahr, 1991). Owen (1978) indicated that rabbits should be slaughtered at a fixed live weight rather than at a fixed age and for NZW rabbits the approximate weight is 2.15 kg after which feed conversion efficiency declines rapidly. Sundaram and Bhattacharya (1991) reported a marketing age of 16 weeks, when the growth rate was maximum, for exotic meat rabbits in tropical climate. However, comparable works for the present study related to the slaughter age in broiler rabbits based on economics of slaughter are rather scanty in literature. Diminishing returns over the feed cost as the age of the rabbit advances as observed in the present study was also reported by Chen et al. (1978) who observed maximum growth rate and feed efficiency during the eight weeks of age and considering the feeding economics they reported that slaughtering rabbits at eight weeks of age is more profitable than slaughter at later ages.

From a critical evaluation of the data on economic slaughter it can be reasonably concluded that broiler rabbits (SC and CB) maintained on a ration containing DE at a level of 2500 kcal/kg with 20 per cent CP, when slaughtered during 56th - 112th day after weaning, yield maximum profit, the profit comparatively being more in cross bred and the profit accrued is seen inversely proportional to the advancing age of animals to be slaughtered.

Maximum economy on slaughter derived out of the profit and loss statement of animals maintained on nine treatment combinations clearly support the animals maintained on ration D which converges the optimum DE and CP requirement for broiler rabbits as 2500 kcal/kg and 20 per cent respectively for profitable growth.

While recapitulating the over all results of the feeding trial carried out during the course of the present study, the discrepancies and limitations involved in the empirical application of present standards (NRC, 1977 and Lebas, 1983) for the economic production of broiler rabbits has become clearly perceptible. It is evident from the above illustrations that from the points of view of feed efficiency and economics of feeding, the need to make a reappraisal of the requirements in terms of DE and CP for growth in broiler rabbits set out in the standards (Lebas 1983 or NRC, 1987) is also brought out by the result of the present study.

SUMMARY

SUMMARY

An investigation was undertaken using weanling Soviet Chinchilla and Cross bred rabbits (four weeks old) to establish dietary energy and protein requirements for growth and to assess optimum age for slaughter in broiler rabbits.

The present investigation consisted of two sets of growth studies for a period of 24 weeks using 108 weanling Soviet Chinchilla rabbits and 108 Cross bred rabbits in each set. Nine experimental diets containing three levels of crude protein viz., 12, 16 and 20 per cent and three levels of digestible energy viz., 2000, 2500 and 3000 kcal/kg in a 3 x 3 factorial design were assigned to nine experimental groups each consisting of 12 animals homogeneous with respect to sex, age and weight.

Records of daily dry matter consumption, weekly body weights and fortnightly body measurements were kept throughout the experimental period. Haematological studies were carried out at monthly intervals. During the 8th, 16th and 24th week of feeding trial a digestion cum metabolism trial involving a collection period of five consecutive days was carried out.

Four animals from each group were slaughtered at 8th, 16th and 24th week of experiment to investigate the dressing percentage, chemical composition of meat, liver protein and liver fat and fat constants viz., iodine number and saponification value of the abdominal fat. The parameters covered under this investigation were the average daily gain, feed conversion efficiency, protein efficiency, feed cost per kg weight gain, body measurements, data on haematological values, digestibility of nutrients, nitrogen, calcium and phosphorus balance, dressing percentage on slaughter, chemical composition of meat, liver

protein and liver fat and fat constants viz., saponification and iodine values. The result of the present investigation can be summarised as follows.

Rabbits maintained on different energy protein combinations showed significant difference in growth rate ($P<0.01$). Both dietary energy and crude protein were found to influence the average daily gain. The highest rate of gain was achieved in animals maintained on ration containing comparatively higher DE and CP while lowest rate of gain was noticed in animals maintained on low energy, low protein diet. On further scrutiny of the data an appreciably better growth response was observed in animals maintained on ration containing 3000 kcal DE/kg with 16 per cent CP and ration containing 2500 kcal DE/kg with 20 per cent CP in both pure bred and cross bred rabbits. It is also noticed that for maximum growth rate a ration containing 2500 kcal DE/kg need be sufficient as further increase in DE have not evinced any better response on ADG, which supports the view that for optimum biological response, a ration containing 2500 kcal DE/kg is sufficient for both pure bred and cross bred rabbits. As between the period it was observed that the animals attained maximum ADG during the first 56 days of experiment and there after ADG gradually declines irrespective of the level of CP or DE in the ration.

On comparing the DM consumption of animals expressed on percentage body weight, the dietary level of CP and DE influences DM consumption. A significantly higher rate of DM consumption could be observed in animals maintained on low levels of CP and DE and vice versa. Average DM intake as percentage of body weight ranged from 7.43 (Ration A) to 10.23 (Ration I) in SC and 6.97 to 9.65 in CB rabbits maintained on ration A and I respectively suggesting that DM intake is minimum with ration having highest energy-protein combination (3000 kcal DE/kg and 20 per cent CP) and maximum with ration having lowest energy-protein level (2000 kcal DE/kg and 12 per cent CP). As the animal advances in age the dry matter consumption decreases irrespective of treatment combinations.

Both dietary energy and crude protein influenced significantly ($P<0.01$) the feed conversion efficiency of animals. A general trend noticed is that the feed efficiency is found increasing with increase in dietary energy as well as crude protein. Highest efficiency of feed conversion was noticed in rabbits maintained on Ration D containing 2500 kcal DE/kg and 20 per cent CP, the values being 9.27 in SC and 8.85 in CB rabbits indicating that further increase in DE from 2500 kcal/kg to the extent of 3000 kcal/kg would not contribute better feed efficiency. Data on feed efficiency further revealed that maximum efficiency was observed during the first eight weeks after weaning and there after there is a linear reduction in feed efficiency as the age advances in all the nine dietary treatments.

A general trend noticed with regard to protein utilization in animals maintained on the experimental rations is that as the CP level in the feed decreases the efficiency of protein utilization is increased and on keeping the dietary protein level constant efficiency of protein utilization was enhanced on increasing the DE level. On statistical analysis significant influence ($P<0.01$) of dietary energy and protein was noticed on the protein efficiency of experimental animals. Rabbits maintained on Ration C containing 3000 kcal/kg and 12 per cent CP registered the highest protein efficiency of 0.75 and 0.81 in SC and CB rabbits respectively.

With regard to cost of production the overall biological and economical efficiency could be observed maximum in animals maintained on ration containing 2500 kcal DE/kg with 20 per cent CP with a cost per kg.gain of Rs.43.85 in SC and 41.86 in CB rabbits respectively, but when the cost of production was evaluated in between the periods viz., 0-56 days, 56-112 days and 112-168 days, the cost efficiency is seen maximum during 0-56 days of experiment and out of the nine treatments the animals maintained on ration containing 2500 kcal DE with 16 and 20 per cent CP emerged out as the lowest cost per unit gain.

On the whole a linear increase was seen in all body measurements with increase in body weight. Both dietary protein and energy significantly influenced ($P<0.01$) the body length, height and chest girth of experimental animals. A greater gain in body measurements was observed with higher energy protein levels.

Data with respect to levels of haemoglobin serum protein, serum calcium, inorganic phosphorus and serum magnesium were well within the normal range reported for the species. Neither dietary energy nor protein had significant influence on the various haematological values.

With regard to the digestibility of nutrients, there is a decrease in dry matter digestibility as the level of CP and DE of the ration is decreased. The digestibility of dry matter is increased as the age of the animal advances.

An increase in the rate of CP digestibility could be noticed in animals maintained on high levels of CP, likewise CP digestibility is enhanced with an increase in DE content of the ration. CP digestibility significantly enhanced with advancement of age. A significantly lower rate of crude fibre digestibility could be noticed with a decrease in DE content of the feed, but no significant difference in crude fibre digestibility could be noticed on increasing or decreasing the level of CP in the ration. Crude fibre digestibility enhanced as the age of the animal advances.

Varying levels of DE in the ration influences the ether extract digestibility, while the level of CP in the ration seems to have no influence on digestibility of ether extract.

A significantly lower NFE digestibility could be noticed in animals maintained on low DE ration, but no appreciable difference could be noticed on varying levels of CP in the ration.

With regard to the digestibility of fibre fractions, there is a decreasing trend in ADF digestibility on decreasing the levels of DE and CP in the ration or dietary levels of both DE and CP influences ADF digestibility. Similar trend of observation has been made with regard to NDF digestibility. Hemicellulose digestibility is seen decreasing when the level of CP in the ration decreases, like wise a trend towards a decrease in digestibility could be noticed with a decrease in the dietary level of DE. Similarly, digestibility of cellulose decreases with a decrease in the levels of dietary protein and dietary DE.

A significant decrease in percentage retention of nitrogen could be noticed in animals maintained on lower levels of CP in the ration so also, percentage retention of nitrogen is decreased with a decrease in DE content of the ration. As between the periods, the retention of nitrogen decreases as the animal advances in age.

A significantly lower retention of calcium could be observed in animals maintained on low levels of dietary protein. A significantly higher retention could be noticed with higher levels of dietary DE.

There is an increasing trend in percentage retention of phosphorus for animals maintained on high levels of CP and vice versa. Similarly increasing DE content in the ration from 2000 to 3000 kcal/kg, significantly enhanced percentage retention of phosphorus. Both retention of calcium and phosphorus significantly decreased as the age of the animal advances.

From an overall assessment of the slaughter data it is discernible that the dressing percentage is directly proportional to the pre-slaughter weight of the animals since significant increase in dressing percentage could be noticed in animals slaughtered during the 24th week of experiment when compared to that of animals slaughtered during 8th week of experiment. It is also observed that both dietary CP and DE influences dressing percentage.

With regard to chemical composition of muscle, the moisture content is not influenced by a change in dietary CP or DE in the ration. But age of the animal influenced the moisture content of the muscle. Dietary CP and DE does not seem to influence the muscle dry matter, but the DM content increases with the advancement of age. It is also observed that neither dietary CP nor DE influences the CP content of the muscle, while dietary CP or DE significantly influences the ether extract content of the muscle. A progressive increase in muscle fat content could be noticed as the age of the animal advances. Muscle ash values is not influenced by the dietary level of CP while the same is influenced by the dietary level of DE.

There is a progressive increase in liver fat content in animals on lowering the dietary CP, while progressive decrease in liver fat content in animals maintained on ration containing low DE. A significant decrease is noticed in liver protein content in those animals maintained on low CP diet, likewise low dietary level of DE decreases liver protein content.

With regard to abdominal fat constants, no definite trend could be noticed with regard to the influence of dietary CP and DE on iodine number. Saponification value does not seem to be influenced by dietary crude protein and period of experiment but DE content of the ration seems to influence the saponification values.

Maximum economy on slaughter derived out of the profit and loss statement of animals maintained on nine ration treatment combinations clearly support the animals maintained on rations containing 2500 kcal DE with 20 per cent CP for maximum growth.

From an overall assessment of the data during the course of the present investigation, it can be reasonably concluded that broiler rabbits maintained on ration containing DE at a level of 2500 kcal/kg with 20 per cent CP when slaughtered during 56th to 112th day after weaning, yielded maximum profit, the profit comparatively being more in cross breds and the profit accrued is seen inversely proportional to the advancing age of animals to be slaughtered.

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APPENDICES

APPENDIX - 1

Growth Studies on **Soviet Chinchilla Rabbits** - 0 to 168 days on Ration **A**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	465.2						
7	588.5	17.6	40.0	7.59	2.27	2.18	12.28
14	716.9	18.3	44.5	6.82	2.43	2.04	13.15
21	862.9	20.9	52.3	6.62	2.50	1.98	13.53
28	1026.4	23.4	59.7	6.32	2.55	1.94	13.80
35	1201.9	25.1	80.3	7.20	3.2	1.55	17.31
42	1389.4	26.8	104.5	8.14	3.90	1.27	21.10
49	1597.0	29.9	133.1	8.95	4.50	1.10	24.35
56	1808.4	30.2	138.9	8.16	4.60	1.08	24.89
63	1999.9	27.4	153.3	8.05	5.61	0.88	30.35
70	2160.9	23.0	166.6	8.01	7.24	0.68	39.17
77	2296.0	19.3	176.0	7.90	9.12	0.54	49.34
84	2453.6	22.5	185.2	7.80	8.23	0.60	44.52
91	2558.6	15.0	191.7	7.65	12.78	0.39	69.14
98	2655.2	13.8	196.3	7.55	14.26	0.35	77.14
105	2726.6	10.2	200.5	7.45	19.66	0.25	106.36
112	2804.7	11.9	207.6	7.50	17.49	0.28	94.62
119	2874.8	9.3	204.6	7.20	22.00	0.23	119.02
126	2944.8	10.0	212.4	7.30	21.24	0.23	114.91
133	3007.8	9.0	218.8	7.35	24.31	0.20	131.52
140	3074.3	9.5	221.4	7.28	23.31	0.21	126.11
147	3133.1	8.4	226.6	7.30	26.98	0.18	145.96
154	3189.1	8.0	218.1	6.90	27.26	0.18	147.48
161	3248.6	8.5	209.2	6.50	24.61	0.20	133.14
168	3299.7	7.3	219.4	6.70	30.05	0.16	162.57

APPENDIX - 2

Growth Studies on **Soviet Chinchilla Rabbits** - 0 to 168 days on Ration **B**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	468.05						
7	583.7	16.5	40.3	7.66	2.44	2.54	12.62
14	698.9	16.5	42.1	6.57	2.55	2.43	13.19
21	838.2	19.9	60.3	7.85	3.03	2.05	15.17
28	955.5	22.5	68.5	7.47	3.04	2.03	15.46
35	1162.6	23.9	83.7	7.76	3.50	1.77	18.10
42	1343.9	25.9	108.0	8.62	4.17	1.49	21.57
49	1545.0	28.7	128.6	8.90	4.48	1.38	23.18
56	1753.6	29.8	143.9	8.73	4.83	1.28	24.98
63	1949.6	28.0	159.6	8.62	5.70	1.09	29.46
70	2117.6	24.0	171.0	8.41	7.13	0.87	36.86
77	2275.1	22.5	180.1	8.20	8.00	0.77	41.35
84	2408.1	19.0	186.2	7.95	9.80	0.63	50.66
91	2515.2	15.3	195.0	7.92	12.75	0.49	65.47
98	2624.0	15.5	196.3	7.64	12.63	0.49	65.28
105	2712.9	12.7	200.7	7.52	15.80	0.39	81.67
112	2792.7	11.4	199.3	7.24	17.48	0.35	90.35
119	2868.3	10.8	196.7	6.95	18.21	0.34	94.13
126	2945.3	11.0	207.0	7.12	18.82	0.33	97.28
133	3024.4	11.3	206.6	6.92	18.28	0.34	94.49
140	3097.2	10.4	207.8	6.79	19.98	0.31	103.28
147	3153.2	8.0	214.1	6.85	26.76	0.23	138.33
154	3221.1	9.7	208.8	6.55	21.52	0.29	111.24
161	3276.3	7.9	214.4	6.60	27.21	0.23	140.65
168	3336.5	8.6	214.9	6.50	24.99	0.25	129.18

APPENDIX - 3

Growth Studies on **Soviet Chinchilla Rabbits** - 0 to 168 days on Ration **C**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	460.8						
7	573.2	16.1	40.3	7.80	2.50	3.25	12.61
14	691.2	16.9	48.5	7.67	2.87	2.84	14.48
21	829.1	19.7	62.3	8.17	3.15	2.58	15.89
28	973.9	20.7	67.5	7.49	3.26	2.49	16.44
35	1130.8	22.4	87.6	8.32	3.91	2.08	19.72
42	1308.6	25.1	109.9	9.00	4.38	1.86	22.08
49	1498.2	27.1	136.6	9.73	5.04	1.61	25.42
56	1690.8	27.5	144.1	9.04	5.24	1.55	26.42
63	1854.6	23.4	161.3	9.10	6.89	1.18	34.75
70	1984.1	18.5	170.8	8.90	9.23	0.88	46.57
77	2128.1	20.6	179.9	8.75	8.75	0.93	44.15
84	2233.1	15.0	188.0	8.62	12.53	0.65	63.22
91	2312.2	11.3	197.9	8.71	17.51	0.46	88.34
98	2413.7	14.5	200.9	8.50	13.86	0.59	69.93
105	2480.2	9.5	200.6	8.20	21.12	0.39	106.55
112	2544.8	9.2	204.8	8.15	22.19	0.37	111.96
119	2601.5	8.1	203.3	7.90	25.10	0.32	126.64
126	2663.5	8.9	205.3	7.80	23.15	0.35	116.80
133	2723.0	8.5	206.0	7.65	24.24	0.34	122.30
140	2772.2	7.0	212.1	7.72	30.21	0.27	152.42
147	2806.2	4.9	207.0	7.42	42.59	0.19	214.88
154	2846.1	5.7	212.5	7.52	37.28	0.22	188.09
161	2889.4	6.2	206.5	7.20	33.86	0.24	168.31
168	2930.0	5.8	197.9	6.80	34.12	0.24	172.14

APPENDIX - 4

Growth Studies on **Soviet Chinchilla Rabbits** - 0 to 168 days on Ration **D**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	/ FCR	PER	Cost/kg. gain (Rs.)
0	462.3						
7	574.2	16.0	39.4	7.60	2.46	1.99	11.65
14	694.2	17.1	44.5	7.02	2.60	1.88	12.31
21	832.4	19.7	62.3	8.17	3.15	2.58	16.09
28	979.8	21.1	65.8	7.26	3.12	1.57	14.77
35	1139.9	22.9	81.1	7.65	3.54	1.38	16.75
42	1319.9	25.7	107.9	8.77	4.20	1.17	19.88
49	1515.0	27.9	128.3	9.05	4.60	1.06	21.77
56	1714.5	28.5	138.2	8.56	4.85	1.01	22.96
63	1874.1	22.8	154.3	8.60	6.77	0.72	32.02
70	2007.1	19.0	164.0	8.45	8.63	0.57	40.81
77	2168.1	23.0	174.9	8.38	7.60	0.64	35.94
84	2285.7	16.8	180.40	8.10	10.74	0.46	50.80
91	2384.4	14.1	186.8	8.00	13.25	0.37	62.66
98	2491.5	15.3	199.9	8.20	13.07	0.37	61.81
105	2592.9	14.5	200.8	7.90	13.87	0.35	65.69
112	2697.9	15.0	198.4	7.50	13.23	0.37	62.56
119	2787.5	12.8	198.8	7.25	15.53	0.32	73.45
126	2884.9	13.9	201.4	7.10	14.47	0.34	68.43
133	2968.2	11.9	203.4	6.93	17.09	0.29	80.83
140	3050.8	11.8	204.6	6.80	17.34	0.28	82.00
147	3127.8	11.0	200.8	6.50	18.25	0.27	86.31
154	3199.2	10.2	212.0	6.70	20.78	0.24	98.27
161	3260.1	8.7	214.8	6.65	24.69	0.20	116.76
168	3310.5	7.2	210.3	6.40	29.21	0.17	125.50

APPENDIX - 5

Growth Studies on **Soviet Chinchilla Rabbits** - 0 to 168 days on Ration **E**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg gain (Rs.)
0	458.9						
7	570.0	15.9	39.4	7.66	2.48	2.48	11.20
14	689.6	17.1	45.0	7.15	2.63	2.34	11.87
21	827.4	19.7	60.7	8.00	3.08	2.01	13.91
28	974.2	21.0	68.0	7.55	3.24	1.90	14.63
35	1131.7	22.5	80.3	7.63	3.57	1.72	16.12
42	1308.9	25.3	107.9	8.81	4.25	1.45	19.18
49	1500.9	27.4	126.6	9.01	4.62	1.33	20.85
56	1700.4	28.5	139.7	8.73	4.90	1.25	22.12
63	1864.9	23.5	155.3	8.71	6.61	0.93	29.84
70	1995.8	18.7	168.1	8.71	8.99	0.68	40.59
77	2114.1	16.9	178.6	8.69	10.57	0.58	47.73
84	2257.6	20.5	185.8	8.50	9.06	0.68	40.91
91	2364.0	15.2	194.1	8.40	12.77	0.48	57.66
98	2483.0	17.0	193.9	8.00	11.40	0.54	51.48
105	2571.2	12.6	199.6	7.90	15.84	0.39	71.52
112	2641.2	10.0	203.3	7.80	20.33	0.30	91.80
119	2721.0	11.4	201.1	7.50	17.64	0.35	79.65
126	2776.3	7.9	197.9	7.20	25.05	0.24	113.11
133	2842.1	9.4	199.5	7.10	21.22	0.29	95.82
140	2898.1	8.0	198.0	6.90	24.75	0.25	111.7[illegible]
147	2958.3	8.6	199.1	6.80	23.15	0.26	104.54
154	3009.4	7.3	194.0	6.50	26.58	0.23	120.02
161	3057.7	6.9	206.3	6.80	29.90	0.20	135.01
168	3115.0	8.2	206.8	6.70	25.25	0.24	114.02

APPENDIX - 6

Growth Studies on **Soviet Chinchilla Rabbits** - 0 to 168 days on Ration **F**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	458.2						
7	566.4	15.5	46.5	9.08	3.00	2.72	12.87
14	684.7	16.9	54.9	8.78	3.25	2.52	13.94
21	811.9	18.2	68.4	9.14	3.76	2.17	16.12
28	951.7	20.0	81.8	9.28	4.09	2.00	17.54
35	1104.7	21.9	107.8	10.48	4.92	1.50	21.10
42	1263.9	22.7	123.5	10.43	5.44	1.66	23.33
49	1426.3	23.2	130.2	9.68	5.61	1.46	24.06
56	1590.8	23.5	134.9	8.94	5.74	1.42	24.61
63	1704.2	16.2	143.3	8.70	8.85	0.92	37.98
70	1770.7	9.5	152.9	8.80	16.09	0.51	69.05
77	1841.4	10.1	155.3	8.60	15.38	0.53	66.00
84	1902.3	8.7	151.6	8.10	17.43	0.47	74.80
91	1946.4	6.3	155.9	8.10	24.74	0.33	106.17
98	1998.9	7.5	161.8	8.20	21.57	0.38	92.56
105	2036.0	5.3	166.4	8.25	31.40	0.26	134.75
112	2070.7	5.0	172.5	8.40	34.78	0.23	149.26
119	2123.2	7.5	174.0	8.30	23.20	0.35	99.56
126	2186.2	9.0	175.6	8.15	19.51	0.42	83.72
133	2230.3	6.3	176.7	8.00	28.05	0.29	120.38
140	2259.0	4.1	168.3	7.50	41.05	0.20	176.16
147	2298.9	5.7	164.1	7.20	28.79	0.28	123.66
154	2334.9	5.1	164.5	7.10	32.00	0.26	137.32
161	2365.7	4.4	165.0	7.02	37.50	0.22	160.93
168	2400.0	4.9	169.2	7.10	34.53	0.24	148.18

APPENDIX - 7

Growth Studies on **Soviet Chinchilla Rabbits** - 0 to 168 days on Ration **G**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	451.5						
7	567.8	15.2	54.4	10.67	3.58	1.37	14.27
14	677.2	15.6	62.4	10.02	4.00	1.23	15.94
21	801.8	17.8	73.9	9.99	4.15	1.18	16.55
28	927.4	17.9	76.8	8.88	4.29	1.14	17.11
35	1054.5	18.2	78.6	7.93	4.32	1.14	17.22
42	1187.2	19.0	84.2	7.51	4.43	1.11	17.66
49	1325.0	19.8	98.1	7.81	4.98	0.99	19.85
56	1468.5	20.5	107.8	7.72	5.36	0.93	20.97
63	1575.6	15.3	132.3	8.69	8.65	0.56	34.47
70	1652.6	11.0	143.5	8.89	13.05	0.38	52.00
77	1749.2	13.8	150.9	8.87	10.93	0.45	43.55
84	1836.7	12.5	152.6	8.51	12.21	0.40	48.65
91	1900.4	9.1	153.2	8.20	16.84	0.29	67.09
98	1975.3	10.7	158.5	8.18	14.81	0.33	59.01
105	2035.5	8.6	162.4	8.10	18.88	0.26	75.22
112	2090.1	7.8	166.7	8.08	21.37	0.23	85.15
119	2139.1	7.0	169.2	8.00	24.17	0.20	96.30
126	2190.9	7.4	171.0	7.90	23.11	0.21	92.08
133	2238.5	6.8	174.7	7.89	25.69	0.19	102.36
140	2291.0	7.5	175.3	7.74	23.37	0.21	93.11
147	2325.7	5.0	177.7	7.70	35.90	0.14	143.04
154	2372.9	6.8	178.5	7.60	26.44	0.19	105.35
161	2414.9	6.0	180.3	7.53	30.04	0.16	119.69
168	2460.3	6.5	182.6	7.49	28.18	0.18	112.28

APPENDIX - 8

Growth Studies on **Soviet Chinchilla Rabbits** - 0 to 168 days on Ration **H**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	456.8						
7	528.1	10.2	49.4	10.03	4.84	1.27	17.58
14	609.5	11.6	58.8	10.34	5.07	1.21	18.35
21	696.4	12.4	73.9	11.32	5.96	1.03	21.68
28	795.4	14.1	94.6	12.68	6.71	0.92	24.37
35	893.4	14.0	95.9	11.36	6.85	0.90	24.88
42	996.9	14.8	103.6	10.96	7.00	0.88	25.43
49	1100.5	14.8	106.4	10.15	7.19	0.86	26.12
56	1206.9	15.2	113.3	9.82	7.50	0.82	27.25
63	1297.9	13.0	122.5	9.78	9.41	0.65	34.21
70	1362.3	9.2	132.7	9.98	14.42	0.43	52.43
77	1439.3	11.0	137.6	9.82	12.51	0.49	45.49
84	1483.4	6.3	140.7	9.63	22.31	0.28	81.20
91	1535.2	7.4	132.7	8.79	17.93	0.34	65.20
98	1584.2	7.0	133.2	8.54	19.03	0.32	69.20
105	1629.7	6.5	134.8	8.39	20.74	0.30	75.42
112	1671.7	6.0	140.3	8.50	23.38	0.26	85.01
119	1719.3	6.8	140.7	8.30	20.69	0.36	75.24
126	1755.0	5.1	142.4	8.20	27.92	0.22	101.52
133	1785.1	4.3	141.4	7.99	32.88	0.19	119.56
140	1822.9	5.4	140.7	7.80	26.06	0.24	94.76
147	1864.2	5.9	137.0	7.43	23.22	0.27	84.44
154	1906.9	6.1	143.1	7.59	23.46	0.26	85.30
161	1941.9	5.0	144.3	7.50	28.86	0.21	104.94
168	1974.1	4.6	142.9	7.30	31.07	0.20	112.97

APPENDIX - 9

Growth Studies on **Soviet Chinchilla Rabbits** - 0 to 168 days on Ration I. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	458.9						
7	514.3	7.9	52.2	10.73	6.61	1.23	21.69
14	570.5	8.0	59.4	10.95	7.43	1.09	24.38
21	629.9	8.5	63.8	10.63	7.51	1.08	24.64
28	689.6	8.5	73.8	11.19	8.68	0.94	28.49
35	750.2	8.7	78.4	10.89	9.01	0.90	29.57
42	815.6	9.3	89.8	11.47	9.65	0.84	31.67
49	882.5	9.6	94.9	11.18	9.88	0.82	32.42
56	956.0	10.5	110.3	12.00	10.50	0.77	34.46
63	1006.4	7.2	100.9	11.20	15.26	0.53	50.06
70	1045.6	5.6	112.9	11.00	20.15	0.40	66.10
77	1101.6	8.0	114.9	10.70	14.36	0.51	47.11
84	1154.1	7.5	118.4	10.50	15.79	0.51	51.79
91	1198.9	6.4	120.0	10.20	18.75	0.43	61.50
98	1252.8	7.7	123.8	10.10	16.08	0.51	52.75
105	1311.2	8.3	132.1	10.30	15.83	0.51	51.92
112	1352.5	5.9	134.5	10.10	22.80	0.36	74.78
119	1389.6	5.3	134.4	9.80	25.35	0.32	83.17
126	1428.1	5.5	133.8	9.50	24.33	0.33	79.81
133	1454.7	3.8	134.1	9.30	35.27	0.23	115.70
140	1477.1	3.2	131.9	9.00	41.23	0.20	135.24
147	1507.2	4.3	132.8	8.40	30.88	0.26	101.29
154	1535.2	4.0	133.8	7.80	33.47	0.24	109.79
161	1561.1	3.7	131.6	7.50	35.56	0.23	116.64
168	1587.7	3.8	136.0	8.00	33.14	0.25	108.71

APPENDIX - 10

Growth Studies on **Cross bred Rabbits** - 0 to 168 days on Ration **A**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	508.6						
7	595.4	12.4	35.89	6.50	2.89	1.71	15.66
14	693.4	14.0	45.12	7.00	3.22	1.54	17.45
21	809.6	16.6	52.06	6.93	3.14	1.58	17.02
28	967.8	22.6	63.88	7.19	2.83	1.75	15.34
35	1148.4	25.8	79.75	7.54	3.09	1.60	16.75
42	1344.4	28.0	93.12	7.47	3.33	1.49	18.05
49	1556.5	30.3	114.63	7.90	3.78	1.31	20.49
56	1794.5	34.0	131.55	7.85	3.87	1.28	20.60
63	2048.6	36.3	160.21	8.34	4.41	1.12	23.90
70	2251.6	29.0	157.13	7.33	5.42	0.92	29.38
77	2436.4	26.4	172.30	7.35	6.53	0.76	35.39
84	2596.7	22.9	185.71	7.38	8.11	0.61	43.96
91	2719.9	17.6	198.61	7.45	11.28	0.44	61.14
98	2823.5	14.8	205.64	7.42	13.89	0.36	75.28
105	2900.5	11.0	208.91	7.30	18.99	0.26	102.93
112	2968.5	9.7	210.21	7.16	21.65	0.23	117.34
119	3026.5	8.3	187.20	6.25	22.55	0.22	122.22
126	3083.2	8.1	192.10	7.52	23.72	0.21	128.56
133	3134.3	7.3	193.40	6.22	26.49	0.19	143.58
140	3184.7	7.2	191.32	6.06	26.57	0.19	144.01
147	3233.0	6.9	190.16	5.93	27.56	0.18	149.38
154	3280.6	6.8	190.23	5.84	27.98	0.18	151.65
161	3326.8	6.6	189.24	5.73	28.67	0.17	155.39
168	3372.30	6.5	187.50	5.60	28.85	0.17	156.37

APPENDIX - 11

Growth Studies on **Cross bred Rabbits** - 0 to 168 days on Ration **B**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	508.4						
7	591.0	11.8	40.68	7.40	3.45	1.80	17.84
14	686.2	13.6	48.56	7.60	3.57	1.74	18.46
21	831.8	20.8	58.21	7.66	2.80	2.21	14.48
28	999.1	23.9	70.12	7.66	2.93	2.11	15.15
35	1183.9	26.4	85.41	7.83	3.24	1.92	16.75
42	1386.9	29.0	103.32	8.03	3.56	1.74	18.41
49	1603.2	30.9	123.41	8.25	3.99	1.55	20.63
56	1832.8	32.8	138.0	8.39	4.39	1.47	22.70
63	2077.1	34.9	155.42	7.95	4.45	1.39	23.01
70	2278.7	28.8	172.68	7.93	6.00	1.03	31.02
77	2449.5	24.4	190.25	8.05	7.80	0.79	40.33
84	2594.4	20.7	195.36	7.75	9.44	0.66	48.80
91	2726.0	18.8	198.14	7.45	10.54	0.59	54.49
98	2828.9	14.7	208.26	7.50	14.17	0.44	73.26
105	2920.6	13.1	216.83	7.54	16.55	0.37	85.56
112	2999.0	11.2	215.18	7.34	19.39	0.32	100.25
119	3062.0	9.0	197.45	6.52	21.94	0.28	113.43
126	3124.3	8.9	196.23	6.34	22.05	0.28	114.00
133	3176.8	7.5	198.13	6.29	26.42	0.23	136.59
140	3227.2	7.2	199.18	6.22	27.66	0.22	143.00
147	3276.2	7.0	196.28	6.04	28.04	0.22	144.97
154	3323.8	6.8	199.12	6.03	29.28	0.21	151.38
161	3370.0	6.6	200.15	5.98	30.33	0.20	156.81
168	3415.5	6.5	199.68	5.89	30.72	0.20	158.82

APPENDIX - 12

Growth Studies on **Cross bred Rabbits** - 0 to 168 days on Ration **C**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	509.2						
7	590.4	11.6	38.02	6.92	3.28	2.48	16.53
14	686.3	13.7	43.83	6.87	3.20	2.54	16.13
21	788.5	14.6	52.96	7.18	3.62	2.24	18.24
28	894.9	15.2	60.28	7.40	3.97	2.05	20.01
35	1017.4	17.5	74.37	7.78	4.25	1.91	21.42
42	1116.5	21.3	85.82	7.86	4.03	2.02	20.31
49	1342.9	25.2	101.18	8.22	4.02	2.03	20.26
56	1540.3	28.2	119.84	8.31	4.25	1.91	21.42
63	1747.5	29.6	139.21	8.47	4.70	1.73	23.69
70	1942.1	27.8	153.96	8.35	5.54	1.47	27.92
77	2101.7	22.8	168.32	8.32	7.38	1.10	37.20
84	2233.3	18.8	179.52	8.28	9.70	0.85	48.89
91	2348.8	16.5	182.13	7.95	11.04	0.74	55.64
98	2441.2	13.2	192.17	8.02	14.56	0.56	73.38
105	2528.7	12.5	197.91	7.96	15.83	0.51	79.78
112	2612.0	11.9	202.67	7.88	17.03	0.48	85.83
119	2683.4	10.2	200.51	7.57	19.66	0.41	99.09
126	2755.5	10.3	206.68	7.60	20.07	0.41	101.15
133	2824.1	9.8	212.20	7.61	21.65	0.38	109.12
140	2891.3	9.6	215.81	7.55	22.48	0.36	113.30
147	2948.7	8.2	220.56	7.55	26.90	0.30	135.58
154	3004.0	7.9	224.40	7.53	28.37	0.29	142.98
161	3055.8	7.4	226.38	7.47	30.59	0.27	154.17
168	3107.0	7.3	231.13	7.50	31.62	0.26	159.68

APPENDIX - 13

Growth Studies on **Cross bred Rabbits** - 0 to 168 days on Ration **D**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	512.3						
7	628.5	16.6	40.58	7.11	2.44	2.00	11.54
14	760.8	18.9	50.21	7.23	2.66	1.84	12.58
21	896.6	19.4	60.89	7.35	3.14	1.56	14.85
28	1049.2	21.8	74.12	7.62	3.40	1.44	16.08
35	1228.4	25.6	90.28	7.93	3.53	1.39	16.70
42	1425.1	28.1	104.32	7.86	3.71	1.32	17.55
49	1638.6	30.5	122.13	7.97	4.00	1.22	18.92
56	1861.2	31.8	144.18	8.23	4.53	1.08	21.43
63	2091.5	32.9	161.16	8.15	4.90	1.00	23.18
70	2284.7	27.6	172.62	7.89	6.25	0.78	29.56
77	2439.4	22.1	183.13	7.75	8.29	0.59	39.21
84	2569.6	18.6	191.16	7.63	10.28	0.48	48.62
91	2691.4	17.4	190.73	7.25	10.96	0.45	51.84
98	2797.8	15.2	194.82	7.10	12.82	0.38	60.64
105	2902.1	14.9	198.43	6.96	13.32	0.37	63.00
112	2992.5	12.9	200.11	6.79	15.50	0.32	73.32
119	3062.5	10.0	194.12	6.38	19.31	0.25	91.34
126	3126.2	9.1	192.18	6.18	21.01	0.23	99.38
133	3178.7	7.5	190.13	6.03	25.35	0.19	119.91
140	3229.1	7.2	188.14	5.87	26.13	0.19	123.59
147	3277.4	6.9	185.67	5.55	26.18	0.19	123.33
154	3320.1	6.1	175.18	5.31	28.72	0.17	135.85
161	3362.1	6.0	172.53	5.16	28.76	0.17	136.03
168	3397.4	5.0	172.13	5.06	34.23	0.14	161.91

APPENDIX - 14

Growth Studies on **Cross bred Rabbits** - 0 to 168 days on Ration E. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	506.8						
7	613.2	15.2	40.52	7.24	2.67	2.31	12.04
14	737.8	17.8	46.76	6.92	2.63	2.34	11.86
21	865.2	18.2	57.20	7.14	3.14	1.96	14.16
28	1005.9	20.1	68.00	7.27	3.38	1.82	15.24
35	1175.3	24.2	82.70	7.58	3.42	1.80	15.42
42	1359.4	26.3	98.81	7.80	3.78	1.64	17.03
49	1565.9	29.5	119.23	8.15	4.04	1.52	18.22
56	1784.3	31.2	138.25	8.25	4.43	1.39	19.98
63	2010.4	32.3	148.82	7.84	4.76	1.32	20.79
70	2196.6	26.6	176.89	8.41	6.65	0.92	29.99
77	2347.1	21.5	207.98	9.15	9.67	0.64	43.61
84	2482.9	19.4	213.68	8.85	11.01	0.56	49.66
91	2604.0	17.3	219.98	8.65	12.72	0.48	57.37
98	2711.1	15.3	219.13	8.25	14.32	0.43	64.58
105	2814.7	14.8	218.12	7.89	14.74	0.42	66.48
112	2914.8	14.3	224.63	7.84	15.71	0.39	70.85
119	2999.5	12.1	201.18	6.80	16.63	0.37	75.00
126	3063.9	9.2	201.10	6.63	21.86	0.28	98.59
133	3121.3	8.2	206.18	6.67	25.14	0.24	113.38
140	3170.3	7.0	207.56	6.60	29.65	0.21	133.72
147	3214.4	6.3	201.87	6.32	32.04	0.19	144.50
154	3250.1	5.1	199.53	6.17	39.12	0.16	176.43
161	3281.6	4.5	202.57	6.20	45.02	0.14	203.04
168	3309.6	4.0	202.61	6.15	50.65	0.12	228.43

APPENDIX - 15

Growth Studies on **Cross bred Rabbits** - 0 to 168 days on Ration **F**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	509.8						
7	604.3	13.5	41.67	7.48	3.09	2.65	13.23
14	719.8	16.5	50.19	7.58	3.04	2.69	13.01
21	846.5	18.1	62.52	7.98	3.45	2.37	14.77
28	981.6	19.3	73.98	8.09	3.83	2.13	16.39
35	1128.6	21.0	87.22	8.27	4.15	1.97	17.76
42	1288.2	22.8	97.46	8.07	4.27	1.91	18.28
49	1452.7	23.5	111.52	8.14	4.75	1.72	20.33
56	1625.6	24.7	128.26	8.33	5.19	1.58	22.21
63	1806.9	25.9	149.79	8.72	5.78	1.41	24.74
70	1952.5	20.8	168.43	8.96	8.10	1.01	34.67
77	2063.1	15.8	186.10	9.27	11.78	0.69	50.42
84	2150.6	12.5	200.52	9.52	16.04	0.51	68.65
91	2222.0	10.2	209.72	9.59	20.56	0.40	88.00
98	2287.0	9.4	211.88	9.40	22.54	0.36	96.47
105	2348.0	8.6	210.74	9.09	24.50	0.33	104.86
112	2404.0	8.0	210.49	8.86	26.31	0.31	112.61
119	2455.1	7.3	198.31	8.16	27.17	0.30	116.29
126	2502.0	6.7	188.18	7.59	28.09	0.29	120.23
133	2539.8	5.4	173.22	6.87	32.08	0.25	137.30
140	2576.2	5.2	162.44	6.37	31.24	0.26	133.71
147	2611.2	5.0	160.60	6.19	32.12	0.25	137.47
154	2644.8	4.8	158.78	6.04	33.08	0.25	141.58
161	2676.3	4.5	154.58	5.81	34.35	0.24	147.02
168	2705.0	4.1	152.13	5.65	37.10	0.22	158.79

APPENDIX - 16

Growth Studies on **Cross bred Rabbits** - 0 to 168 days on Ration **G**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	508.9						
7	592.2	11.9	40.46	7.35	3.40	1.44	13.57
14	683.2	13.0	47.14	7.37	3.63	1.35	14.48
21	780.5	13.9	54.52	7.45	3.92	1.25	15.64
28	887.6	15.3	64.56	7.74	4.22	1.16	16.84
35	997.5	15.7	78.23	8.30	4.98	0.99	19.87
42	1122.8	17.9	95.63	9.02	5.34	0.92	21.31
49	1264.2	20.2	111.23	9.32	5.51	0.89	21.98
56	1418.2	22.0	126.48	9.43	5.75	0.85	22.94
63	1570.1	21.7	134.89	9.03	6.22	0.79	24.82
70	1694.0	17.7	142.56	8.74	8.05	0.61	32.12
77	1774.5	11.5	153.38	8.84	13.34	0.37	53.23
84	1845.9	10.2	156.59	8.65	15.35	0.32	61.25
91	1914.5	9.8	158.63	8.44	16.19	0.30	64.60
98	1973.3	8.4	161.43	8.30	19.22	0.26	76.69
105	2028.6	7.9	166.48	8.32	21.07	0.23	84.07
112	2081.1	7.5	175.00	8.54	23.33	0.21	93.09
119	2131.5	7.2	162.32	7.71	22.54	0.22	89.93
126	2179.8	6.9	168.85	7.83	24.47	0.20	97.64
133	2227.4	6.8	174.53	7.92	25.67	0.19	102.43
140	2272.2	6.4	172.72	7.68	26.99	0.18	107.69
147	2315.6	6.2	161.31	7.03	26.02	0.19	103.82
154	2358.3	6.1	160.32	6.86	26.28	0.19	104.86
161	2401.7	6.2	161.63	6.79	26.07	0.19	104.02
168	2443.8	6.0	162.78	6.72	27.13	0.18	108.25

APPENDIX - 17

Growth Studies on **Cross bred Rabbits** - 0 to 168 days on Ration **H**. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	510.2						
7	565.9	7.9	37.60	6.99	4.76	1.29	17.29
14	634.1	9.8	52.00	8.67	5.31	1.16	19.28
21	709.0	10.7	58.24	8.67	5.44	1.13	19.75
28	792.3	11.9	67.69	9.02	5.69	1.08	20.65
35	880.5	12.6	79.40	9.49	6.30	0.98	22.87
42	979.2	14.1	95.84	10.31	6.80	0.91	24.68
49	1081.4	14.6	104.77	10.17	7.18	0.86	26.06
56	1185.0	14.8	118.46	10.45	8.00	0.77	29.04
63	1295.6	15.8	136.14	10.98	8.61	0.71	31.25
70	1399.2	14.8	154.0	11.43	10.41	0.59	37.79
77	1496.5	13.9	163.16	11.27	11.74	0.52	42.62
84	1584.7	12.6	162.18	10.53	12.87	0.48	46.72
91	1668.0	11.9	168.21	10.34	14.14	0.44	51.33
98	1742.9	10.7	172.1	10.09	16.08	0.38	58.37
105	1805.2	8.9	172.09	9.70	19.34	0.32	70.20
112	1857.0	7.4	176.55	9.64	23.86	0.26	86.61
119	1906.0	7.0	164.64	8.75	23.52	0.26	85.38
126	1951.5	6.5	161.31	8.36	24.82	0.25	90.10
133	1993.5	6.0	156.06	7.91	26.01	0.24	94.42
140	2034.1	5.8	157.13	7.80	27.09	0.23	98.34
147	2072.6	5.5	155.21	7.56	28.22	0.22	102.44
154	2109.7	5.3	153.98	7.36	29.05	0.21	105.45
161	2145.4	5.1	150.19	7.06	29.45	0.21	106.90
168	2180.5	5.0	155.64	7.20	31.07	0.20	112.78

APPENDIX - 18

Growth Studies on **Cross bred Rabbits** - 0 to 168 days on Ration I. Data showing Average Body Weight (g), Average Daily Gain (g), Dry matter intake (g/day), DM intake on percentage body weight, Feed efficiency (FCR), Protein efficiency (PER) and cost per kg weight gain (Rs.) recorded at weekly intervals.

Days	Average Body Weight (g)	ADG (g)	DMI (g/day)	DMI (% B.wt.)	FCR	PER	Cost/kg. gain (Rs.)
0	508.6						
7	548.5	5.7	41.00	7.76	7.19	1.13	23.58
14	594.0	6.5	48.82	8.55	7.51	1.08	24.63
21	650.7	8.1	55.05	8.85	6.80	1.20	22.30
28	710.9	8.6	59.51	8.74	6.92	1.17	22.70
35	776.7	9.4	65.51	8.81	6.97	1.17	22.86
42	846.7	10.0	76.24	9.39	7.62	1.07	24.99
49	918.8	10.3	90.88	10.30	8.82	0.92	28.93
56	993.0	10.6	105.97	11.09	10.0	0.81	32.80
63	1068.6	10.8	124.49	12.08	11.53	0.70	37.82
70	1137.9	9.9	132.82	12.04	13.42	0.61	44.02
77	1198.1	8.6	139.01	11.90	16.16	0.50	53.00
84	1253.4	7.9	143.95	11.74	18.22	0.45	59.76
91	1304.5	7.3	145.48	11.37	19.93	0.41	65.37
98	1353.5	7.0	146.44	11.02	20.92	0.39	68.62
105	1401.1	6.8	148.00	10.75	21.76	0.38	71.37
112	1446.6	6.5	149.18	10.48	22.95	0.35	75.28
119	1490.7	6.3	149.38	10.17	23.71	0.34	77.77
126	1532.7	6.0	150.43	9.95	25.03	0.32	82.23
133	1571.2	5.5	153.33	9.88	27.88	0.29	91.45
140	1607.6	5.2	156.58	9.85	30.11	0.27	98.76
147	1642.6	5.0	158.98	9.78	31.80	0.26	104.3
154	1675.5	4.7	159.37	9.61	33.91	0.24	111.22
161	1706.3	4.4	160.18	9.47	36.40	0.22	119.39
168	1735.0	4.1	160.19	9.31	39.02	0.21	127.99

APPENDIX - 19

Fortnightly body length (cm) of Soviet Chinchilla rabbits maintained on nine experimental rations

Ration	DE kcal/kg	CP per cent	Number of Fortnights												
			0	1	2	3	4	5	6	7	8	9	10	11	12
A	3000	20	**20.40** ± 0.39	**23.15** ± 0.45	**24.58** ± 0.28	**26.00** ± 0.46	**29.15** ± 0.51	**31.05** ± 0.55	**33.20** ± 0.46	**34.15** ± 0.51	**35.15** ± 0.60	**36.05** ± 0.55	**36.25** ± 0.43	**36.40** ± 0.50	**36.55** ± 0.58
B	3000	16	**21.10** ± 0.40	**22.50** ± 0.21	**23.03** ± 0.44	**25.98** ± 0.37	**28.20** ± 0.27	**31.40** ± 0.47	**33.25** ± 0.72	**34.30** ± 0.78	**35.20** ± 0.70	**35.35** ± 0.80	**36.05** ± 0.78	**36.30** ± 0.72	**36.60** ± 0.72
C	3000	12	**21.05** ± 0.36	**22.10** ± 0.33	**23.20** ± 0.27	**25.10** ± 0.42	**27.15** ± 0.30	**30.10** ± 0.37	**31.95** ± 0.33	**32.80** ± 0.37	**33.40** ± 0.56	**33.75** ± 0.52	**34.00** ± 0.71	**34.50** ± 0.40	**34.80** ± 0.69
D	2500	20	**21.20** ± 0.33	**22.05** ± 0.41	**23.20** ± 0.39	**25.10** ± 0.28	**27.15** ± 0.42	**30.15** ± 0.37	**32.25** ± 0.63	**34.10** ± 0.59	**34.68** ± 0.83	**35.35** ± 0.75	**36.15** ± 0.60	**36.45** ± 0.38	**37.10** ± 0.49
E	2500	16	**21.15** ± 0.52	**22.04** ± 0.41	**23.10** ± 0.39	**25.06** ± 0.25	**27.10** ± 0.33	**29.25** ± 0.32	**31.50** ± 0.65	**33.05** ± 0.37	**34.60** ± 0.83	**35.05** ± 0.76	**35.50** ± 0.42	**36.00** ± 0.39	**36.40** ± 0.29
F	2500	12	**20.10** ± 0.64	**22.15** ± 0.53	**23.05** ± 0.63	**25.05** ± 0.61	**27.20** ± 0.67	**29.10** ± 0.53	**30.05** ± 0.61	**30.30** ± 0.70	**31.10** ± 0.62	**31.60** ± 0.65	**32.00** ± 0.61	**32.80** ± 0.58	**33.25** ± 0.57
G	2000	20	**20.40** ± 0.74	**20.65** ± 0.41	**21.15** ± 0.37	**23.00** ± 0.51	**25.15** ± 0.87	**27.20** ± 0.76	**28.35** ± 0.74	**29.20** ± 0.67	**30.40** ± 0.86	**31.00** ± 0.96	**31.50** ± 1.03	**32.00** ± 0.90	**33.10** ± 0.92
H	2000	16	**20.05** ± 0.25	**20.15** ± 0.90	**21.10** ± 0.49	**22.05** ± 0.80	**24.40** ± 0.58	**26.05** ± 0.68	**26.30** ± 0.70	**26.45** ± 0.69	**26.80** ± 0.58	**27.00** ± 0.61	**27.50** ± 0.56	**28.60** ± 0.67	**29.20** ± 0.80
I	2000	12	**20.10** ± 0.33	**20.25** ± 0.32	**20.60** ± 0.36	**21.05** ± 0.32	**22.25** ± 0.36	**23.45** ± 0.50	**24.15** ± 0.38	**25.10** ± 0.33	**25.50** ± 0.51	**26.00** ± 0.35	**26.40** ± 0.41	**26.80** ± 0.58	**27.15** ± 0.54

APPENDIX - 20

Fortnightly body height (cm) of Soviet Chinchilla rabbits maintained on nine experimental rations

Ration	DE	CP	Number of Fortnights												
	kcal/kg	per cent	0	1	2	3	4	5	6	7	8	9	10	11	12
A	3000	20	15.05 ± 0.32	16.40 ± 0.41	17.45 ± 0.37	19.50 ± 0.42	21.20 ± 0.23	22.10 ± 0.36	23.20 ± 0.34	24.10 ± 0.43	24.60 ± 0.41	25.20 ± 0.37	25.60 ± 0.31	25.90 ± 0.37	26.20 ± 0.33
B	3000	16	15.10 ± 0.29	16.20 ± 0.44	17.30 ± 0.48	19.05 ± 0.36	20.10 ± 0.35	21.70 ± 0.39	22.80 ± 0.23	23.10 ± 0.36	23.50 ± 0.56	24.40 ± 0.58	25.10 ± 0.52	25.80 ± 0.62	26.60 ± 0.64
C	3000	12	15.20 ± 0.23	16.10 ± 0.32	17.25 ± 045	18.50 ± 0.34	20.10 ± 0.43	20.90 ± 0.46	21.50 ± 0.56	22.20 ± 0.55	23.10 ± 0.58	24.05 ± 0.59	24.50 ± 0.61	25.00 ± 0.60	25.20 ± 0.56
D	2500	20	15.20 ± 0.40	16.30 ± 0.36	17.25 ± 0.49	19.15 ± 0.58	20.20 ± 0.62	21.40 ± 0.55	22.30 ± 0.43	23.20 ± 0.62	23.60 ± 0.51	24.30 ± 0.5	23.20 ± 0.58	25.90 ± 0.24	26.40 ± 0.32
E	2500	16	15.10 ± 0.29	16.25 ± 0.36	17.30 ± 0.45	18.40 ± 0.42	19.50 ± 0.25	20.50 ± 0.35	21.20 ± 0.50	22.40 ±0.41	23.10 ± 0.33	23.70 ± 0.29	24.05 ± 0.32	24.90 ± 0.29	25.50 ± 0.25
F	2500	12	15.20 ± 0.25	15.50 ± 0.37	16.70 ± 0.31	18.30 ± 0.38	19.20 ± 0.50	20.10 ± 0.35	20.70 ± 0.35	21.20 ± 0.36	21.75 ± 0.38	22.20 ± 0.37	22.75 ± 0.29	23.00 ± 0.50	23.20 ± 0.45
G	2000	20	15.20 ± 0.42	15.70 ± 0.45	16.40 ± 0.40	17.20 ± 0.63	18.10 ± 0.55	19.25 ± 0.51	20.10 ± 0.46	20.75 ± 0.46	21.40 ± 0.43	22.10 ± 0.45	22.60 ± 0.43	22.90 ± 0.33	23.10 ± 0.44
H	2000	16	15.25 ± 0.45	15.45 ± 0.57	16.10 ± 0.55	16.55 ± 0.58	17.10 ± 0.55	17.80 ± 0.31	18.45 ± 0.39	19.20 ± 0.40	19.90 ± 0.46	20.35 ± 0.46	20.75 ± 0.38	21.15 ± 0.48	21.50 ± 0.45
I	2000	12	15.20 ± 0.27	15.35 ± 0.45	16.10 ± 0.29	16.55 ± 0.42	16.90 ± 0.43	17.15 ± 0.40	17.60 ± 0.43	17.95 ± 0.39	18.40 ± 0.40	18.75 ± 0.40	19.05 ± 0.41	19.70 ± 0.32	20.60 ± 0.55

APPENDIX - 21

Fortnightly chest girth (cm) of Soviet Chinchilla rabbits maintained on nine experimental rations

Ration	DE	CP	Number of Fortnights												
	kcal/kg	per cent	0	1	2	3	4	5	6	7	8	9	10	11	12
A	3000	20	**16.15** ± 0.43	**19.30** ± 0.44	**22.80** ± 0.53	**25.05** ± 0.48	**26.20** ± 0.62	**28.10** ± 0.46	**29.05** ± 0.48	**30.20** ± 0.45	**31.05** ± 0.48	**31.75** ± 0.50	**32.40** ± 0.45	**33.05** ± 0.48	**33.40** ± 0.40
B	3000	16	**16.05** ± 0.32	**19.40** ± 0.39	**22.05** ± 0.32	**25.10** ± 0.36	**26.00** ± 0.35	**27.50** ± 0.55	**29.40** ± 0.52	**30.10** ± 0.65	**30.80** ± 0.64	**31.20** ± 0.66	**32.80** ± 0.58	**33.25** ± 0.58	**33.80** ± 0.60
C	3000	12	**16.05** ± 0.48	**18.20** ± 0.47	**21.40** ± 0.45	**24.10** ± 0.42	**25.40** ± 0.57	**27.05** ± 0.48	**28.10** ± 0.47	**28.70** ± 0.33	**29.10** ± 0.49	**30.05** ± 0.48	**31.10** ± 0.41	**31.60** ± 0.40	**31.85** ± 0.45
D	2500	20	**16.20** ± 0.31	**18.50** ± 0.34	**22.10** ± 0.36	**24.20** ± 0.32	**25.30** ± 0.31	**27.40** ± 0.32	**28.30** ± 0.70	**29.20** ± 0.32	**30.30** ± 0.25	**31.10** ± 0.24	**32.70** ± 0.29	**33.10** ± 0.38	**33.80** ± 0.37
E	2500	16	**15.25** ± 0.43	**17.55** ± 0.53	**20.10** ± 0.51	**22.70** ± 0.47	**24.15** ± 0.55	**26.50** ± 0.56	**27.70** ± 0.58	**28.50** ± 0.66	**29.75** ± 0.60	**30.60** ± 0.60	**31.40** ± 0.34	**32.10** ± 0.35	**32.90** ± 0.14
F	2500	12	**16.05** ± 0.47	**17.40** ± 0.51	**19.85** ± 0.43	**20.20** ± 0.49	**21.40** ± 0.50	**22.30** ± 0.49	**23.15** ± 0.53	**24.30** ± 0.50	**25.20** ± 0.48	**26.15** ± 0.43	**26.80** ± 0.55	**27.50** ± 0.56	**28.10** ± 0.46
G	2000	20	**15.50** ± 0.46	**17.10** ± 0.33	**18.20** ± 0.33	**19.05** ± 0.49	**20.20** ± 0.44	**21.30** ± 0.35	**22.25** ± 0.21	**23.15** ± 0.32	**24.20** ± 0.31	**25.10** ± 0.40	**25.70** ± 0.45	**26.40** ± 0.25	**27.10** ± 0.53
H	2000	16	**16.20** ± 0.23	**16.80** ± 0.35	**17.75** ± 0.40	**18.35** ± 0.39	**19.25** ± 0.24	**20.40** ± 0.33	**20.80** ± 0.18	**21.10** ± 0.07	**21.85** ± 0.23	**22.40** ± 0.20	**23.15** ± 0.05	**23.80** ± 0.13	**24.60** ± 0.27
I	2000	12	**16.15** ± 0.43	**16.45** ± 0.29	**17.10** ± 0.40	**17.50** ± 0.43	**18.15** ± 0.60	**18.70** ± 0.67	**19.20** ± 0.61	**19.75** ± 0.58	**20.40** ± 0.64	**21.25** ± 0.21	**21.80** ± 0.29	**22.45** ± 0.28	**23.20** ± 0.16

APPENDIX - 22

Fortnightly body length (cm) of Cross bred rabbits maintained on nine experimental rations

Ration	DE kcal/kg	CP per cent	Number of Fortnights												
			0	1	2	3	4	5	6	7	8	9	10	11	12
A	3000	20	21.10 ± 0.53	22.20 ± 0.45	25.35 ± 0.55	26.75 ± 0.47	29.15 ± 0.38	31.25 ± 0.52	33.20 ± 0.74	34.05 ± 0.48	34.25 ± 0.40	35.35 ± 0.34	36.10 ± 0.36	36.50 ± 0.34	37.20 ± 0.51
B	3000	16	21.00 ± 0.35	22.45 ± 0.48	25.10 ± 0.29	26.25 ± 0.41	29.40 ± 0.63	32.15 ± 0.49	33.05 ± 0.57	34.15 ± 0.44	34.50 ± 0.52	35.20 ± 0.45	36.15 ± 0.49	36.35 ± 0.57	37.25 ± 0.66
C	3000	12	21.20 ± 0.87	22.15 ± 0.70	23.35 ± 0.85	25.20 ± 0.69	27.25 ± 0.72	30.35 ± 0.81	31.20 ± 0.70	33.10 ± 0.73	33.45 ± 0.65	34.00 ± 0.79	34.35 ± 0.67	34.50 ± 0.64	35.00 ± 0.79
D	2500	20	21.00 ± 0.87	22.25 ± 0.79	24.50 ± 0.87	26.25 ± 0.88	29.35 ± 0.91	31.25 ± 0.80	33.05 ± 0.82	34.50 ± 0.87	35.20 ± 0.64	36.15 ± 0.49	36.55 ± 0.51	37.00 ± 0.61	37.15 ± 0.68
E	2500	16	21.20 ± 0.64	22.10 ± 0.53	24.25 ± 0.48	25.30 ± 0.59	28.20 ± 0.45	31.25 ± 0.52	33.05 ± 0.57	33.85 ± 0.56	34.15 ± 0.49	34.70 ± 0.57	35.15 ± 0.49	35.80 ± 0.50	36.20 ± 0.63
F	2500	12	21.00 ± 0.50	22.30 ± 0.46	24.25 ± 0.43	26.50 ± 0.53	28.41 ± 0.42	30.25 ± 0.45	31.30 ± 0.50	32.25 ± 0.45	33.15 ± 0.51	33.25 ± 0.58	34.30 ± 0.45	34.45 ± 0.43	35.10 ± 0.55
G	2000	20	20.30 ± 0.45	21.55 ± 0.63	23.10 ± 0.53	25.20 ± 0.58	26.35 ± 0.63	28.20 ± 0.58	29.15 ± 0.63	30.05 ± 0.61	31.25 ± 0.54	32.15 ± 0.59	32.50 ± 0.58	33.05 ± 0.60	33.25 ± 0.61
H	2000	16	21.10 ± 0.55	21.25 ± 0.50	22.05 ± 0.48	23.15 ± 0.51	25.05 ± 0.48	25.75 ± 0.53	27.25 ± 0.52	28.05 ± 0.48	29.25 ± 0.45	30.30 ± 0.46	31.25 ± 0.38	31.50 ± 0.33	32.20 ± 0.71
I	2000	12	21.20 ± 0.71	21.60 ± 0.55	21.85 ± 0.40	22.50 ± 0.45	23.40 ± 0.52	24.50 ± 0.55	25.20 ± 0.45	25.75 ± 0.41	26.20 ± 0.47	27.15 ± 0.38	27.70 ± 0.37	28.50 ± 0.34	29.30 ± 0.58

APPENDIX - 23

Fortnightly body height (cm) of Cross bred rabbits maintained on nine experimental rations

Ration	DE kcal/kg	CP per cent	Number of Fortnights 0	1	2	3	4	5	6	7	8	9	10	11	12
A	3000	20	**15.01** ± 0.29	**15.80** ± 0.32	**17.10** ± 0.37	**18.70** ± 0.3	**20.10** ± 0.74	**21.80** ± 0.32	**22.70** ± 0.22	**23.10** ± 0.29	**24.20** ± 0.34	**24.80** ± 0.38	**25.30** ± 0.37	**25.90** ± 0.34	**26.40** ± 0.42
B	3000	16	**15.05** ± 0.28	**16.45** ± 0.59	**17.30** ± 0.66	**19.35** ± 0.64	**20.15** ± 0.73	**21.90** ± 0.68	**22.75** ± 0.63	**23.20** ± 0.64	**24.10** ± 0.71	**25.25** ± 0.70	**25.70** ± 0.73	**26.20** ± 0.67	**26.70** ± 0.73
C	3000	12	**15.10** ± 0.32	**16.25** ± 0.38	**17.05** ± 0.48	**17.95** ± 0.45	**19.25** ± 0.50	**20.90** ± 0.53	**21.75** ± 0.50	**22.90** ± 0.52	**23.30** ± 0.38	**23.70** ± 0.27	**24.20** ± 0.46	**24.80** ± 0.48	**25.50** ± 0.58
D	2500	20	**15.10** ± 0.38	**16.10** ± 0.36	**17.45** ± 0.30	**20.10** ± 0.29	**21.25** ± 0.37	**22.30** ± 0.34	**23.15** ± 0.25	**23.70** ± 0.27	**24.65** ± 0.27	**25.35** ± 0.32	**26.05** ± 0.33	**26.40** ± 0.28	**26.65** ± 0.41
E	2500	16	**15.05** ± 0.32	**16.15** ± 0.26	**17.30** ± 0.39	**19.05** ± 0.48	**20.85** ± 0.38	**22.05** ± 0.50	**23.10** ± 0.46	**23.90** ± 0.48	**24.45** ± 0.45	**25.05** ± 0.43	**25.50** ± 0.43	**25.80** ± 0.44	**26.20** ± 0.45
F	2500	12	**15.10** ± 0.31	**16.40** ± 0.48	**17.25** ± 0.50	**18.10** ± 0.55	**19.50** ± 0.53	**21.00** ± 0.50	**21.95** ± 0.48	**22.50** ± 0.44	**22.75** ± 0.48	**22.90** ± 0.48	**23.15** ± 0.53	**23.60** ± 0.57	**23.95** ± 0.38
G	2000	20	**15.05** ± 0.39	**16.50** ± 0.34	**17.05** ± 0.35	**17.90** ± 0.39	**19.25** ± 0.32	**20.25** ± 0.32	**20.75** ± 0.32	**21.45** ± 0.24	**21.70** ± 0.27	**22.05** ± 0.26	**22.55** ± 0.26	**22.90** ± 0.29	**23.30** ± 0.36
H	2000	16	**15.15** ± 0.40	**15.75** ± 0.32	**16.30** ± 0.34	**17.15** ± 0.26	**17.90** ± 0.31	**19.20** ± 0.51	**19.85** ± 0.34	**20.25** ± 0.30	**20.80** ± 0.26	**21.45** ± 0.26	**21.70** ± 0.22	**21.90** ± 0.25	**22.10** ± 0.32
I	2000	12	**15.25** ± 0.20	**15.80** ± 0.29	**16.25** ± 0.38	**16.65** ± 0.34	**17.05** ± 0.35	**17.35** ± 0.37	**18.05** ± 0.41	**18.50** ± 0.34	**19.00** ± 0.38	**20.15** ± 0.36	**20.55** ± 0.38	**20.80** ± 0.42	**21.10** ± 0.36

APPENDIX - 24

Fortnightly chest girth (cm) of Cross bred rabbits maintained on nine experimental rations

Ration	DE kcal/kg	CP per cent	Number of Fortnights												
			0	1	2	3	4	5	6	7	8	9	10	11	12
A	3000	20	16.20 ± 0.31	17.50 ± 0.32	19.60 ± 0.54	23.50 ± 0.57	25.10 ± 0.68	26.40 ± 0.60	28.20 ± 0.64	29.30 ± 0.74	30.10 ± 0.64	31.35 ± 0.74	32.40 ± 0.67	33.25 ± 0.65	34.10 ± 0.69
B	3000	16	16.20 ± 0.62	17.80 ± 0.60	19.15 ± 0.73	23.40 ± 0.61	25.10 ± 0.65	26.20 ± 0.71	28.75 ± 0.68	29.10 ± 0.71	30.25 ± 0.69	32.40 ± 0.73	33.15 ± 0.69	33.75 ± 0.68	34.50 ± 0.70
C	3000	12	16.25 ± 0.66	18.10 ± 0.78	19.25 ± 0.68	20.75 ± 0.72	23.10 ± 0.44	25.20 ± 0.22	26.15 ± 0.26	27.25 ± 0.11	28.35 ± 0.26	29.10 ± 0.14	30.25 ± 0.22	31.20 ± 0.16	32.10 ± 0.25
D	2500	20	16.35 ± 0.30	19.10 ± 0.64	20.35 ± 0.56	22.45 ± 0.62	25.05 ± 0.60	26.10 ± 0.58	27.25 ± 0.60	28.15 ± 0.49	29.20 ± 0.41	31.85 ± 0.43	32.70 ± 0.45	33.65 ± 0.58	34.40 ± 0.56
E	2500	16	16.10 ± 0.45	17.80 ± 0.42	20.60 ± 0.55	22.15 ± 0.53	24.30 ± 0.44	25.15 ± 0.61	27.05 ± 0.71	28.20 ± 0.69	29.15 ± 0.73	30.60 ± 0.71	32.05 ± 0.55	33.10 ± 0.64	34.05 ± 0.52
F	2500	12	16.10 ± 0.29	17.35 ± 0.39	19.05 ± 0.49	20.20 ± 0.65	21.75 ± 0.68	23.70 ± 0.66	24.90 ± 0.59	25.35 ± 0.63	26.15 ± 0.69	27.05 ± 0.75	27.25 ± 0.79	28.05 ± 0.79	28.60 ± 0.74
G	2000	20	16.05 ± 0.36	17.25 ± 0.31	18.20 ± 0.27	19.10 ± 0.25	20.75 ± 0.50	21.40 ± 0.47	22.50 ± 0.49	23.75 ± 0.46	24.65 ± 0.45	25.05 ± 0.42	25.75 ± 0.40	26.30 ± 0.42	27.05 ± 0.40
H	2000	16	16.30 ± 0.38	17.45 ± 0.39	18.30 ± 0.36	18.75 ± 0.34	19.40 ± 0.35	20.85 ± 0.25	21.25 ± 0.23	22.45 ± 0.25	23.30 ± 0.30	24.00 ± 0.34	24.35 ± 0.37	25.15 ± 0.41	25.70 ± 0.10
I	2000	12	16.25 ± 0.27	16.80 ± 0.27	17.25 ± 0.25	17.90 ± 0.27	18.20 ± 0.26	19.15 ± 0.28	19.75 ± 0.27	21.40 ± 0.31	21.85 ± 0.36	22.25 ± 0.38	22.95 ± 0.41	23.75 ± 0.32	24.10 ± 0.34

APPENDIX 25

1. **ANOVA** of growth rate and nutrient utilization in **Soviet Chinchilla rabbits** during 0 to 168 days of experiment.

Source	MSS of Characters					
	df	ADG	DMI	DMI% Body Wt.	FE	PE
Between treatment	8	57.403 **	1413.567**	3.344**	22.196 **	0.049**
Within treatment	27	0.005	0.456	0.001	0.006	0.001

2. **ANOVA** of growth rate and nutrient utilization in **Cross bred rabbits** during 0 to 168 days of experiment.

Source	MSS of Characters					
	df	ADG	DMI	DMI% Body Wt.	FE	PE
Between treatment	8	54.061 **	776.382**	3.609**	26.280 **	0.065**
Within treatment	27	0.028	2.242	0.012	0.024	0.001

3. **ANOVA** of gain in body measurements in **Soviet Chinchilla rabbits**

Source	MSS of Characters			
	df	Body length	Body height	Chest girth
Between treatment	8	40.34 **	20.67 **	72.33 **
Within treatment	27	0.75	1.14	0.23

4. **ANOVA** of gain in body measurements in **Cross bred rabbits**

Source	MSS of Characters			
	df	Body length	Body height	Chest girth
Between treatment	8	29.4 **	18.79 **	69.245 **
Within treatment	27	0.48	0.15	1.168

**** P< 0.01**

APPENDIX 25 (Cont'd..)

5. **ANOVA** of Haematological values of **Soviet Chinchilla rabbits**

Source	*MSS of Characters*					
	df	Haemo-globin	Serum protein	Serum calcium	Serum Phosphorus	Serum magnesium
Between period	5	0.315	0.056	0.855	0.006	0.003
Between group	8	2.242	0.128	2.811	0.239	0.004
Error	159	3.222	3.235	4.294	0.207	0.008

6. **ANOVA** of Haematological values of **Cross bred rabbits**

Source	*MSS of Characters*					
	df	Haemo-globin	Serum protein	Serum calcium	Serum Phosphorus	Serum magnesium
Between period	5	1.163	0.585	2.214	0.085	0.035
Between group	8	1.992	0.982	2.411	0.286	0.038
Error	159	1.414	1.028	0.352	0.254	0.059

7. **ANOVA** of Digestibility coefficient of nutrients during three metabolism trials in **Soviet Chinchilla rabbits**

Source	*MSS of Characters*					
	df	DM	CP	CF	EE	NFE
Between period	2	118.034 **	337.767 **	23.558	54.223	20.601
Between group	8	821.359 **	968.650 **	238.543 **	1789.136 **	1170.755 **
Error	78	18.794	10.025	13.220	36.134	35.610

8. **ANOVA** of Digestibility coefficient of fibre fraction in **Soviet Chinchilla rabbits**

Source	*MSS of Characters*				
	df	NDF	ADF	Cellulose	Hemicellulose
Between period	2	6.919	285.844 **	136.722 **	3.840
Between group	8	483.876 **	173.932 **	310.743 **	505.467 **
Error	78	12.739	13.051	13.504	10.108

** P < 0.01

<u>*APPENDIX 25 (Cont'd..)*</u>

9. **ANOVA** of Digestibility coefficient of nutrients during three metabolism trials in **Cross bred rabbits**

Source	*MSS of Characters*					
	df	**DM**	**CP**	**CF**	**EE**	**NFE**
Between period	2	36.682	286.55 **	29.993	17.04	0.897
Between group	8	667.496 **	702.447 **	208.397 **	1958.958 **	5088.830 **
Error	78	13.879	17.657	11.066	24.628	23.882

10. **ANOVA** of Digestibility coefficient of fibre fractions in **Cross bred rabbits**

Source	*MSS of Characters*				
	df	**NDF**	**ADF**	**Cellulose**	**Hemicellulose**
Between period	2	178.008 **	231.329 **	147.741 **	36.989 *
Between group	8	482.206 **	200.818 **	303.374 **	409.341 **
Error	78	8.455	20.047	18.279	11.846

11. **ANOVA** of Balance studies from metabolism trials in **Soviet Chinchilla** rabbits

Source	*MSS of Characters (Retention in % of intake)*			
	df	**Nirogen Balance**	**Calcium Balance**	**Phosphorus balance**
Between period	2	328.565 **	2290.232 **	1237.605 **
Between group	8	1143.45 **	228.791 **	1340.798 **
Error	78	1.381	2.707	33.364

12. **ANOVA** of Balance studies from metabolism trials in **Cross bred** rabbits

Source	*MSS of Characters (Retention in % of intake)*			
	df	**Nirogen Balance**	**Calcium Balance**	**Phosphorus balance**
Between period	2	334.959 **	2293.281 **	1490.522 **
Between group	8	1121.818 **	237.095 **	1400.262 **
Error	78	2.107	0.801	85.131

**** P <0.01**

APPENDIX 25 (Cont'd..)

13. **ANOVA** of Dressing percentage in **Soviet Chinchilla** and **Cross bred rabbits**

Source		*MSS of Characters*	
	df	**Soviet Chinchilla rabbits**	**Cross bred rabbits**
Between period	2	803.679 **	873.805 **
Between group	8	121.541 **	119.990 **
Error	78	0.191	0.214

14. **ANOVA** of Muscle composition in **Soviet Chinchilla rabbits** slaughtered during three stages of experiment

Source		*MSS of Characters*			
	df	**Moisture**	**DM**	**CP (Fresh)**	**CP (DMB)**
Between period	2	320.215 **	314.816 **	115.372 **	43.039 **
Between group	8	3.943	3.833	2.639	0.618
Error	78	3.419	3.337	1.662	4.405

Source		*Ether Extract*		*Total Ash*	
	df	**Fresh basis**	**DMB**	**Fresh basis**	**DMB**
Between period	2	43.682 **	92.694 **	0.446 **	1.875 **
Between group	8	7.084 **	56.966 **	0.069 **	1.145 **
Error	78	0.244	0.717	0.015	0.126

**** P <0.01**

APPENDIX 25 (Cont'd..)

15. **ANOVA** of Muscle composition in **Cross bred rabbits** slaughtered during three stages of experiment

Source	df	*MSS of Characters*			
		Moisture	DM	CP (Fresh)	CP (DMB)
Between period	2	329.493 **	326.808 **	120.613 **	39.921 **
Between group	8	3.919	4.150	2.587	0.425
Error	78	13.839	14.567	8.013	8.595

Source	df	*Ether Extract*		*Total Ash*	
		Fresh basis	DMB	Fresh basis	DMB
Between period	2	41.262 **	80.877 **	0.299 **	2.994 **
Between group	8	7.186 **	57.546 **	0.022	0.496 **
Error	78	0.770	1.125	0.042	0.145

16. **ANOVA** of Liver crude protein and ether extract content in **Soviet Chinchilla** and **Cross bred rabbits**

Source	df	*MSS of Characters*			
		Soviet Chinchilla rabbits		Cross bred rabbits	
		CP	EE	CP	EE
Between period	2	3.09	0.311	5.362	0.393
Between group	8	199.494 **	4.875	185.431 **	4.786
Error	78	5.37	3.630	12.558	1.609

17. **ANOVA** of Fat constants of abdominal fat in **Soviet Chinchilla** and **Cross bred rabbits**

Source	df	*MSS of Characters*			
		Soviet Chinchilla rabbits		Cross bred rabbits	
		Iodine No.	Saponification value	Iodine No.	Saponification value
Between period	1	21.227	47.840	5.307	41.888
Between group	5	107.687	315.836 *	128.652	317.34 **
Error	33	183.163	103.970	165.641	77.828

* P < 0.05

** P < 0.01

OPTIMUM ENERGY AND PROTEIN REQUIREMENTS OF BROILER RABBITS

By

P. GANGA DEVI

THESIS

Submitted in partial fulfilment of the requirement for the degree

DOCTOR OF PHILOSOPHY

Faculty of Veterinary and Animal Sciences
Kerala Agricultural University

Department of Animal Nutrition
College of Veterinary and Animal Sciences
Mannuthy, Thrissur

1995

ABSTRACT

A detailed investigation involving two series of growth studies spread over a period of 24 weeks in Soviet Chinchilla and Cross Bred rabbits was carried out to establish the optimum energy and protein requirements for growth and to ascertain the optimum age for economic slaughter. One hundred and eight weanling Soviet Chinchilla and 108 weanling cross bred (SC X NZW) rabbits formed the experimental subjects. Rabbits of each breed were divided into nine identical groups and maintained factorially on three levels of crude protein (CP) viz., 12, 16 and 20 per cent and digestible energy viz., 2000, 2500 and 3000 kcal/kg for over a period of 168 days involving metabolism and slaughter studies during 8th, 16th and 24th week of experiment and production traits along with associated characters were studied and the salient results are presented.

Rabbits maintained on different energy protein combinations showed significant difference in growth rate ($P < 0.01$). Both dietary energy and crude protein were found to influence the average daily gain. The highest rate of gain was achieved in animals maintained on ration containing comparatively higher DE and CP while lowest rate of gain was noticed in animals maintained on low energy, low protein diet. On further scrutiny of the data, an appreciably better and identical growth response was observed in animals maintained on ration containing 3000 kcal DE/kg with 16 per cent CP and ration containing 2500 kcal DE/kg with 20 per cent CP in both pure bred and cross bred rabbits. It is also noticed that for maximum growth rate a ration containing 2500 kcal. DE/kg need be sufficient as further increase in DE have not evinced any better response on ADG, which supports the view that for optimum biological response, a ration containing 2500 kcal DE/kg is sufficient for both pure bred and cross bred rabbits. As between the periods it was observed that the animals attained maximum ADG during the first 56 days of experiment and there after ADG gradually declines irrespective of the level of CP or DE in the ration.

Both dietary energy and crude protein significantly influenced ($P < 0.01$) the feed conversion efficiency of animals. Highest efficiency of feed conversion was noticed in rabbits maintained on Ration D containing 2500 kcal DE/kg and 20 per cent CP the values being 9.27 in SC and 8.85 in CB rabbits and further increase in DE from 2500 kcal/kg to the extent of 3000 kcal/kg did not contribute better feed efficiency. Data on feed efficiency further revealed that maximum efficiency was observed during the first eight weeks after weaning and there after there is a linear reduction in feed efficiency as the age advances, in all the nine dietary treatments.

With regard to cost of production the maximum biological and economical efficiency could be observed in animals maintained on ration containing 2500 kcal DE/kg with 20 per cent CP and when the cost of production was evaluated in between the periods viz., 0-56 days, 56-112 days and 112-168 days, the cost efficiency is seen maximum during 0-56 days of experiment.

Dry matter intake on percentage of body weight was found decreasing on increasing the dietary energy level. Haematological values were with in the normal range and were not significantly influenced by the dietary energy and protein levels. Digestibility of nutrients and percentage retention of nitrogen, calcium and phosphorus were significantly influenced by the dietary treatments with an increasing trend on increasing the dietary energy and protein level. From the metabolism studies carried out during 8th, 16th and 24th week of experiment, the percentage retention of nitrogen, calcium and phosphorus were found reduced on advancing the age of animals.

Slaughter studies conducted at 8th, 16th and 24th week of experiment revealed that dressing percentage is directly proportional to the pre-slaughter weight of the animals. Higher dressing percentage is recorded in animals having higher body weight and vice-versa. Carcass yield were higher at 16th and 24th week of experiment than that at eighth week of experiment.

Regarding the chemical composition of meat, the moisture and crude protein content on dry matter basis decreased on advancement of age, without any significant influence of dietary treatments, while the fat content progressively increased with increase in age and dietary energy content. Total ash content (dry basis) decreased with increase in age and dietary DE levels. An increase in liver protein percentage was observed with increase in dietary protein level. As the dietary energy level increased, liver fat content showed an increasing trend. Iodine number of the abdominal fat was not found influenced by the dietary energy-protein levels and age of the animal. Saponification value also was not influenced by the dietary CP and age of the animal.

Absence of appreciable quantities of abdominal fat during the 8th week indicates that for the production of lean meat, animals can be slaughtered during 8th week after weaning.

Evaluation of the data on slaughter studies indicate that broiler rabbits when slaughtered during 8 - 16 weeks after weaning yielded maximum profit, the profit accrued is seen inversely proportional to the increase in age of the animals with maximum profit obtained from slaughter during 8th week after weaning.

From a critical evaluation of the data gathered during the present investigation it can be reasonably concluded that broiler rabbits require a dietary level of 20 per cent crude protein and 2500 kcal DE/kg feed for evincing optimum growth and slaughtering rabbits during 8th week after weaning is ideal for maximum profit.