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Short communication

The Rabbit as an Experimental, Model Animal

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The rabbit as a model

The rabbit is widely used in the classical genetic, immunological, physiological, reproduction biology (see Friedman test), as well as in the embryological researches. This species was used in studying both the spontaneous and the induced malformations.

Despite the fact that it is the classical model of the digestive physiology, the digestibility data cannot be used in the digestibility calculation for the horse. The reason for that is, that the rabbit is a caecum and the horse a caecum plus colon fermenting herbivore.

From the metabolism models, atherosclerosis has an outstanding rabbit model Watanabe hereditable hyperlipemic rabbit (WHHL). Although reference values for lipid metabolism in the rabbit resemble those of the rat, and the principal component is high density lipoprotein (HDL), hypercholesterolemia is more readily induced by dietary manipulations and it is the low density lipoprotein (LDL) fraction which increases. This is in contrast with the rat, that is quite resistant to the induction of hyperlipidemia and atherosclerosis, except the Zucker Fatty Rat strain. Even the conventional rabbit develops atherosclerosis very readily, so it has been widely used as a model to study this disease. Hypercholesterolemia and atherosclerosis in the rabbit can easily be produced by cholesterol, as well as casein feeding. Cholesterol and casein induced hypercholesterolemia in rabbit develop in a similar manner, first the cholesterol concentration increases in the LDL fraction and subsequently in the very low density lipoprotein (VLDL) fraction.

The Watanabe hereditable hyperlipemic rabbit (WHHL) is a very good model of familial hypercholesterolemia. Homozygotes have a mean serum cholesterol level of 500 mg/dl, and may reach 1000 mg/dl, too. The principal fraction in these animals is LDL cholesterol with only small quantities of HDL. Affected animals develop atherosclerosis by 5 months of age.

Some constituent of dietary fibre can reduce the blood cholesterol level in the rabbit. It was reported about hypocholesterolemic effect of pectin and that of the NDF. The fibre reduces the blood cholesterol level by the following ways; by binding of bile and bile acids in the lumen of the intestine and regulating the cholesterol metabolism through the released volatile fatty acids. The latter means that the propionate inhibits β-Hydroxy β-methylglutaryl-CoA (HMG-CoA) synthetase activity in tissues; the short-chain fatty acids, in general, tend to decrease HMG-CoA reductase, both indispensable in the cholesterol synthesis.

The nature of dietary protein also affects cholesterol metabolism. For instance, the feeding of rabbits with a ration containing casein, results in elevated serum cholesterol; whereas diets containing soybean protein maintain low serum cholesterol level. The cholesterolemic effect of the mentioned proteins is attributed either to the lysine:arginine ratio or to the influence on the enterohepatic circulation of bile acids and cholesterol. The type of fibre can erase or enhance the cholesterolemic effect of the dietary protein. The rabbit is very suitable for the investigation of the mentioned questions because one can change the protein and fibre level between large limits.

The rabbit is used also as a model for Alzheimer disease. Given the body measures and anatomy, the rabbit is a good subject of bone and tooth researches and experimental surgery. The main ophthalmologic fields are the development of the techniques of cataract operation, laser treatments, implantation of shunts, intravitreal drug application and improvement of surgery techniques. In the biotechnology, the rabbit serves as a bioreactor to produce mono and polyclonal antibodies, as well as recombinant proteins for human usage. Infectious diseases like tuberculosis and many parasitosis can be modelled in rabbits. Using artificially immun-impaired rabbits, the study of prion diseases and important human opportunistic pathogens (e.g. Pneumocystis) is possible.

Being a caecotroph animal, the rabbit is extremely sensitive to the ingested mycotoxins for instance Fusariotoxin T2 (T-2 toxin), both in female and male genders, making it an excellent research subject in this direction.

Feeding and nutrition of laboratory rabbit

The average daily feed intake of the weaned rabbit during the subsequent 4 - 12 weeks is 50 to 150 grams, which assures 5 to 20 gram average daily gain. The energy, nutrients and mineral requirements of the adult laboratory rabbit on air-dry matter basis is 11 - 12 MJ ME/kg, 16 - 17% crude protein, 2.5 - 3.0% ether extract, 15 - 17% crude fibre, 1.15% calcium, 0.60% phosphorus and 0.3% sodium (in form of common salt). It needs 7.5 g/kg lysin, 5 g/kg methionine+cysteine, 18 - 20 g/kg tryptophan and 6.3 - 6.5 g/kg threonine. The National Institutes of Health (NIH) meeting these requirements through NIH-09 Open Formula Rabbit Diet, as well as the NIH-32 Open Formula Rabbit Diet Autoclavable. The later has higher vitamin concentrations. The natural ingredients are: 28% alfalfa meal (17% of crude protein), 22.50% ground oat hulls, 13% extracted soybean meal (49% of crude protein), 14.75% ground barley, 6 % wheat bran, 2% dried whey, 1.5% dried molasses, 1% brewer's dried yeast, 0.5% salt, 1.25% dicalcium-phosphate, 1.5% ground limestone and 0.5% vitamin and mineral premixes [1-4].

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