EVALUATION OF DIETS FOR LABORATORY RODENTS*

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The diets for laboratory rodents were collected from different sources of the Czech origin. The eight feeding diets were analysed to find out the basic nutritional parameters (dry matter, crude protein, ether extract, fibre, ash and also brutto energy) by the usual chemical analytical method. The target of our study was to define quality of the feeding used for nutrition of laboratory rodents in biomedicine experiments. We also wanted to indicate the imbalance between the diets and overvalue of the granulated mixtures also used to feed adult rodents. There is a danger of overweight in this category of laboratory animals as well as the possibility of animal welfare disruption and preciseness of biomedicine studies. Every tested diet has shown a high level of crude protein. The average content in the analysed feed was 228.2 g $P.kg^{-1}$ and average content of gross energy was 19.2 $MJ.kg^{-1}$ diet. The crude protein amounts in the diets is suitable for growing rodents but not for adult rodents. On the other hand, the contents of gross energy met the energy requirement of most rodent species used in biomedicine.

laboratory rodents; biomedicine; welfare; harmonization of diets; nutrition requirements

INTRODUCTION

Laboratory rodents are at present the most frequently used in biomedicine as laboratory animals. They make about 60% from the total amount of used laboratory animals (Ministry of Agriculture CR, 2002).

On the basis of feeding by quality and uniform laboratory rodent feed we can suppose a satisfactory standard of laboratory animals. The definition of breeding conditions for laboratory animals is useful for the objectification of the system environment of biomedicine studies and to decrease the impact on experimental results. This is in the interest of the research and animal protection (Burda et al., 1999). At the 30th symposium of the Scandinavian Society for Laboratory Animal Science which took place in Stockholm – Sweden in 2000, the necessity of increasing knowledge and understanding of laboratory animal feeding (Lang et al., 2000) was pointed out.

The National Research Council (1995) laboratory animal nutritional status influences its ability to reach its genetic potential for growth, reproduction, longevity and to respond to pathogens and other environmental stresses. A nutritionally balanced diet is important both for the welfare of laboratory animals and to ensure that those experimental results are not biased by unintended nutritional factors. Also Richmond (2000) and Bondy et al. (1989) point out the important influence of conditions as well as nutrition on laboratory animal welfare.

Ritskes-Hoitinga (2001) says that standardization and exact definition of synthetic or purified diet makes safe control and comparison of experimental results. Bartošek et al. (1982) state that the biggest problem of reproducibility and validity of tests is the harmonization of laboratory rodent diets as an instrument for an increase and validity of experimental results.

In our study we wanted to recognize the qualitative level of laboratory diet which is usually available on the Czech market and which is recommended to feed laboratory rodents in biomedicine. It is known that the laboratory diet can have an impact on the welfare and health of laboratory rodents and on the evaluation of the results of a study. We wanted mainly to compare the content of protein and energy, as major nutrients in rodent nutrition, to the nutritional recommendation of the National Research Council – the Subcommittee of Laboratory Animal Nutrition.

MATERIAL AND METHODS

Eight different types of laboratory rodent diets of Czech origin were chosen. The granulated diets KMK-20 (EYPY, s.r.o.), KMK (EYPY, s.r.o.), TM2-CH (Kocanda, s.r.o.), TM-MaK1 (Kocanda, s.r.o.), St-1 (Kocanda, s.r.o.), LzŽ (KrmiMo, s.r.o.), NOE H1 (RACIO, s.r.o.), St-1 (VELAZ, a.s.) were used for our screening study. The average samples of the diets were gained according to the method of Kacerovský et al. (1990).

The tested feeds were analysed by Weenden's chemical analysis i.e. the content of crude matter was found out (by weight difference, exiccation, T = 105 °C), crude protein (Kjeltec auto 1030 analyzer), ether extract (extraction by Soxhlet), fibre (fibertec system 1020 hot extracter), ash (burning the sample in furnace, T = 550 °C) and by calculation NFEM, organic matter. We also detected the amount of brutto energy in the feed mixtures

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by the adiabatic calorimeter (LAGET MS-10A). The diets were every time analysed by two samples of parallel assessment.

RESULTS AND DISCUSSION

All of the tested diets showed (Table 1) wealthy substitution of crude protein. The average content was 228.2 g CP.kg^{-1}. We determined a minimum value of crude protein by feed LzŽ i.e. 200.0 g CP.kg^{-1} diet. By KMK-20 was presented the highest substitution there was the amount equal 253.1 g CP.kg^{-1}. It is possible to think that feeding by diet with nutritive overvalued feed by adult rodents is inadequate and also is in contradiction with their real nutrition requirements. The second thing is that the nutrition requirements of young rodents where substitution of protein like building nutrients corresponds to their intensive growth. Nutrition requirements of crude protein were established by NRC (1995) e.g. an adult laboratory rat needs 50.0 g.kg^{-1} and a guinea pig 180.0 g.kg^{-1} diet.

Average content of gross energy in the diets corresponded to the level 19.2 MJ.kg^{-1} diet. Feed TM-MaK1 had the lowest content of brutto energy i.e. 16.2 MJ.kg^{-1}. On the other hand, the maximum achieved the rodent diet TM2-CH with level 22.4 MJ BE.kg^{-1} diet. The difference among diets was demonstrated by almost 20% or 3.8 MJ.kg^{-1} mixture. In comparison the recommended of digestible energy is in rodent nutrition 16.0–17.0 MJ.kg^{-1} diet (NRC, 1995). In the case of the diets TM2-CH and KMK-20 we recognized relatively high-level content of brutto energy. We have noticed that digestibility by rodents achieve the value 0.8–0.9. So the digestible energy created 80–90% of the total diet brutto energy. Many other things from a diet influence the ratio ME/BE, e.g. fibre content (NRC, 1995). This fact impacts digestibility of energy for an activity of the organism (maintenance requirement, growth, pregnancy, milk production, etc.), too.

We were also interested in uncover fibre content in the diets and we can state that all of the rodent mixtures from this aspect corresponded to the rodent requirements. At the present time there is not any standard or regulation for this nutrient by laboratory rodents but normally is recommended the content 50.0 g fibre.kg^{-1} diet. Only by the feed TM-MaK1 was detected higher substitution of fibre i.e. 144.7 g.kg^{-1} because is destined for guinea pig nutrition. In this case NRC (1995) proposes content of 150.0 g fibre.kg^{-1} diet for guinea pig.

From the literature it is known that feeding by nutrition with high substitution of nutrients ad libitum is probably the source of some degenerative diseases and tumours by laboratory rodents. Overweight has as well a negative relation to the life span of animals, what takes status by generation, reproductive studies and by long-term experiments e.g. chronic influence of toxicological and aging process of eucaryot organism (NRC, 1995). The disharmony of nutrition composition of the diet can also have an unfavourable effect in the breeding of rats like pet. Harmonic nutrition including optimal feeding technique have a great relation to the increase of the welfare of laboratory animals.

CONCLUSION

The problem of nutrition of laboratory rodents is still topical and it is very suitable to follow this branch. At present the nutrition composition of the rodent diets and the way of laboratory rodents feeding in the future is not absolutely defined.

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Table 1. Overview of nutrition composition of tested laboratory rodent diets

Diet	Crude matter	Crude protein	Fiber	Ether extract	Ash	N-free extract	Organic matter	Brutto energy
	g.kg^{-1}	g.kg^{-1}	g.kg^{-1}	g.kg^{-1}	g.kg^{-1}	g.kg^{-1}	g.kg^{-1}	MJ.kg^{-1}
KMK-20	908.3	253.1	59.1	37.2	85.3	473.6	823.0	19.98
KMK	907.9	202.0	55.5	37.4	76.4	536.6	831.5	18.19
TM2-CH	907.7	213.4	76.5	52.3	48.4	517.1	859.3	22.44
TM-MaK1	909.4	234.4	144.7	33.6	61.1	435.6	840.3	16.24
St-1 (Kocanda)	913.9	258.9	68.1	51.9	62.9	472.1	851.0	17.78
LzŽ	912.7	200.0	45.5	33.9	60.4	572.9	852.3	18.24
NOE H1	898.1	236.4	44.4	36.6	56.5	524.2	841.6	21.74
St-1 (Velaz)	865.7	227.6	44.8	36.9	79.9	476.5	785.8	18.67

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Zhodnocení krmných diet určených laboratorním hlodavcům.

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Celkem osm diet určených laboratorním hlodavcům (českého původu) bylo chemicky analyzováno a podrobeno hodnocení. Detekovali jsme tyto nutriční ukazatele: množství sušiny, proteinu, hrubého tuku, vlákniny, popelovin a brutto energie. Cílem testace bylo určit kvalitu běžně dostupných diet určených ke krmení laboratorních hlodavců v biomedicíně. Také jsme chtěli poukázat na určitou živinovou nevyváženost těchto granulovaných směsí používaných ke krmení rostoucích jedinců i dospělých hlodavců. Zjistili jsme, že v podstatě všechny diety obsahovaly vysoké množství proteinu, které odpovídá spíše potřebám mladých potkanů. Průměrný obsah proteinu činil 228,2 $g.kg^{-1}$ diety. Průměrný obsah brutto energie byl stanoven na úrovni 19.2 $MJ.kg^{-1}$ diety, což hodnotíme jako optimální zastoupení BE v dietě určené pro nejběžněji používané druhy laboratorních hlodavců v biomedicínském výzkumu. Tato hodnota rovněž odpovídá doporučení National Research Council.

laboratorní hlodavci; biomedicína; proteiny; brutto energie; živinové doporučení

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