MEDICOBIOLOGICAL EVALUATION OF DIETARY MEAT PRODUCTS

M.POPIVANOVA, K.WASSILEV, S.DANCHEV

Higher Institute of Food and Flavour Technologies, Plovdiv, Bulgaria

INTRODUCTION

The production of dietary foods is a problem of social importance in view of the unfavourable changes in the nourishment of people, and the necessity to provide adequate food for those who are or have suffered from certain diseases.

In this respect, the production of dietary meat products is of special importance because meat and meat products constitute a main component of contemporary man's diet.

Unlike previously available general dietary meat products, today's production must orientate itself towards meat products that, depending on their composition and processing technology, can be differentiated for specific diseases or group of diseases.

In relation to the above considerations, two new varieties of dietary sausage have been developed of the cooked sausage type, intended for people who suffer from obesity, hyper lipoproteinemia, diabetes, cardiovascular and liver diseases.

Since the newly developed sausages will be used by a specific social group, it was imperative to subject them to a medicobiological evaluation that would to a certain extent be indicative as to their expedience.

The most common method of medicoboilogical evaluation is to determine the protein effectiveness factor introduced by Osborn, Mendel (5). Today this factor is known as PER and reflects the weight growth in g per 1 g consumed protein for the period of study.

The aim of the present work was to define the factors that largely characterize the nutritive and biological value of the studied products, and to carry out a medicobiological evaluation.

MATERIALS AND METHODS

The investigations were carried out on texturized dietary sausage "Hissar", intended for cardiovascular and liver diseases, and on untexturized dietary sausage "Zdrave" for metabolic diseases (2). Test and control samples were analysed for basic chemical structure, establishing the dry substance, fat (by Soxhlet's method), and protein (by Kjeldahl's method) contents. As control sample was used the cooked sausage "Vladaya".

The biological value of the studied sausages was determined using test animals - Wistar breed male white rats with body weights of 54,5 $\pm$ 1,5 g. These animals are very suitable for nutrition-related experiments because the factors estimated for them are analogous to those for man. The animals were weaned a few days before the experiment began, and were fed on standard food for 4 days. On the fourth day they were divided into 3 groups of 12 animals each, and each animal was penned into a separate metabolic cell. Three days before and during the experiment the animals were fed in the following way: the investigated sausages were administered ad libitum for 2 hours daily being the only source of proteins and fats. During the remaining 22 hours the

animals received standard food where proteins and fats were substituted by starch. Water was administered ad libitum.

Under these conditions, the experiment, in fact, started on day 8. After weighing, the number of the animals was reduced to 10 within a group. The average weight difference was ± 1 g between groups, and ± 2 g between animals.

The animals' weight and the amount of consumed sausages were recorded once a day. An ambient temperature of 25°C was maintained. The experiment duration was 14 days.

The following parameters were followed during the experiment: animal weight, weight growth and protein consumption. These parameters were used to calculate the protein effectiveness factor (PER).

RESULTS AND DISCUSSION

The experimental data are given in the respective tables. Table 1 contains the basic chemical compositions of test and control samples which indicate that the test sausages are with high protein and low fat content, while the control sausage is a low protein and high fat product.

Table 1

Chemical composition of examined sausages

Variety	Dry substance content (%)	Proteins		Fats	
		% of total weight	%in d.s	% of total weight	%in d.s
HISSAR	29,36	23,40	79,70	3,86	13,15
ZDRAVE	26,33	19,60	74,43	3,88	14,74
CONTROL	39,40	14,73	37,38	12,92	32,79

The animals' viability and weight growth during the experiment necessiated protein, fat carbohydrates and energy consumptions that are given in Table 2.

Table 2

Protein, fats, carbohydrates and energy consumption by the test animals

Product variety		Daily consumption (g)	Daily energy consumption (kJ)	% of total energy
HISSAR	Proteins	1,27 ± 0,41 p = 0,05	21,76 ± 7,05 p = 0,05	13,94
	Fats	0,29 ± 0,035 p = 0,01	11,45 ± 1,36 p = 0,01	7,33
	Carbohyd.	7,16 ± 0,85 p = 0,01	122,9 ± 14,57 p = 0,01	78,73
	Total	5,42 ± 1,76 p = 0,01	156,11 ± 18,56 p = 0,01	
ZDRAVE	Proteins	1,11 ± 0,27 p = 0,01	19,05 ± 4,56 p = 0,01	12,77
	Fats	0,22 ± 0,053 p = 0,01	8,55 ± 2,05 p = 0,01	5,73
	Carbohyd.	7,09 ± 0,15 p = 0,01	121,6 ± 19,66 p = 0,01	81,50
	Total	5,66 ± 1,36 p = 0,01	149,2 ± 20,4 p = 0,01	
CONTROL	Proteins	0,75 ± 0,156 p = 0,01	13,00 ± 2,68 p = 0,01	8,85
	Fats	0,66 ± 0,137 p = 0,01	25,86 ± 5,33 p = 0,01	17,60
	Carbohyd.	6,30 ± 1,66 p = 0,01	108,1 ± 28,55 p = 0,01	73,55
	Total	5,14 ± 0,32 p = 0,01	146,96 ± 32,8 p = 0,01	

It is obvious from Table 2 that the lowest protein consumption is in the group which received the control sausage sample, and the difference with the remaining groups is significant. There are no significant differences in the protein consumptions between the groups that received test sausage samples. Due to the high fat content in the control sausage, the fat consumption in this group was significantly higher than the rest The consumption of "Zdrave" sausage was significantly higher than that of "Hissar" and control sausages. It can be seen from the results in Table 3 where the weight growth dynamics of the test animals is given.

Table 3

Weight growth dynamics of test animals fed on dietary sausages (g)

Sausage variety	Day 0	2	4	6	8	10	12	14
HISSAR	54,3	59,3	64,4	69,4	74,4	79,5	84,5	89,5
ZDRAVE	53,7	58,9	64,1	69,3	74,5	79,7	84,8	90,0

The animals fed on the experimental sausages increased their weight steadily. The correlation analysis shows that their weight growth is a straight line (the correlation coefficient of "Hissar" and "Zdrave" sausages are 0,9957 and 0,9862, respectively). The regression equations of the weight growth dynamics for the experimental sausages are the following:
"Hissar": $y=54,28+2,518x$
where x is day number, and
"Zdrave": $y=53,74+2,591x$
where x is day number.

"Hissar" dietary sausage gives greater daily growth ($2,61 \pm 0,58$ at $p=0,01$) as compared to "Zdrave" dietary sausage ($2,5 \pm 0,99$ at $p=0,05$), however, if the average and standard deviations are used, it is obvious that the differences are insignificant.

Because of the fact that within our experimental conditions the animals' diet was not isocalorific, it had to be recalculated for isocaloricity according

to the requirements for estimation of pure proteins (Herold and Hariel)(4). The protein effectiveness values are given in Table 4.

The data in Table 4 show that the PER and EPER values for the control sausage are significantly higher than those for the test samples. The PER values for the experimental sausages are high as proteins with PER value above 2 are generally considered to be very high.

Table 4

Protein effectiveness (PER) for the examined sausages

Factor	PER	EPER (PER:energy)	Theoretical PER (protein:weight
HISSAR	2,14 ± 0,45 p = 0,01	0,014 ± 0,0037 p = 0,01	y=54,06+1,82x S_y=1,29 rr=0,9919 p=0,01
ZDRAVE	2,20 ± 0,51 p = 0,01	0,015 ± 0,0043 p = 0,01	y=53,57+2,225x S_y=1,7 r=0,9868 p=0,01
CONTROL	2,97 ± 0,57 p = 0,01	0,0214 ± 0,0074 p = 0,05	y=53,59+2,628x S_y=1,54 r=0,9854 p=0,01

CONCLUSIONS

1. The experimental sausages give steady and satisfactory growth of body weight of test animals.

2. The consumption of experimental sausages entirely satisfies the animals' need of proteins and fats.

3. The protein effectiveness values are high for all sausages investigated.

4. The highest protein values were established with dietary sausage "Zdrave", and the difference from the remaining investigated sausages is insignificant.

REFERENCES

1. Djangirov A.P., G.V.Pavlov - Proizvodstvo produktov dlya dieticheskovo lechebnovo detskovo pitaniya na myasnoi osnove,OI Moskva,1989.

2. Kostov K., S.Danchev, M. Popivanova - "Hran.prom.",4, 1983,22-24.

3. Timoshtuk N.I. et al. - Novie vidi produktov dlya pitanie detei shkolnovo vozrasta, Myas. industr.SSSR,1983,12,19-20.

4. Herold G., K.K.Harigeb - Die Fleischwirtschaft,44,1964, 767-770.

5. Osborn T.N., T.Mendel - Biol.Chem.,37,223,1919 (cit.by 3).