SLOVENSKI STANDARD
SIST EN 16967:2017

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Krma: metode vzorčenja in analize - Napovedne enačbe za presnovno energijo v krmilih in krmnih mešanicah (hrane za hišne živali) za mačke in pse, vključno z dietično hrano

Animal feeding stuffs: Methods of sampling and analysis - Predictive equations for metabolizable energy in feed materials and compound feed (pet food) for cats and dogs including dietetic food

Futtermittel - Probenahme- und Untersuchungsverfahren - Schätzgleichungen für umsetzbare Energie in Futtermittel-Ausgangserzeugnissen und Mischfuttermitteln (Heimtierfutter) für Katzen und Hunde, einschließlich Diätfuttermittel

Aliments pour animaux : Méthodes d'échantillonnage et d'analyse - Équations prédictives de l'énergie métabolisable dans les matières premières pour aliments et les aliments composés (aliments pour animaux de compagnie) pour chats et chiens, y compris les aliments diététiques

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SIST EN 16967:2017

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EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
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Contents

European foreword

This document (EN 16967:2017) has been prepared by Technical Committee CEN/TC 327 “Animal feeding stuffs - Methods of sampling and analysis”, the secretariat of which is held by NEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2018, and conflicting national standards shall be withdrawn at the latest by January 2018.

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Introduction

Balanced nutrition enabling adequate intake of energy, protein, minerals and vitamins is essential for cats and dogs to allow health and longevity. In order to realize the recommended intake of energy and nutrients, products need to be formulated accordingly. In other words: all essential nutrients need to be provided in the amount of diet which is needed to fulfil the daily energy requirements. The approach to provide nutrient recommendations expressed as units per MJ recognizes the close relationship between energy and nutrient intake. Hence the accurate determination of energy content in pet food is crucial for formulating appropriate diets for cats and dogs as well as the corresponding instructions for proper use.

Feeding trials are the most accurate way to measure the energy density of a pet food. Since animal studies are labour and cost intensive, several predictive formulae for calculating metabolizable energy (ME) content in dog and cat foods have been developed during the years. The use of predictive formulae is a well-established method within control authorities in Member States and within the pet food industry. However, there is currently no uniformity as to their use. Considering the labelling declarations required for certain pet food products listed in Annex I to Directive 2008/38/EC it is clear that there is a need for a harmonization at EU level by means of a European Standard laying down the predictive formulae to be used.

The predictive formulae in this standard will constitute simple tools to be used by control authorities and manufacturers to calculate ME by using values of dietary components determined by validated official methods (Commission regulation (EC) No 152/2009). This represents a good and robust compromise between accuracy and practicability to overcome the difficulties of feeding trials, which would be otherwise required to obtain the most accurate value of ME.

1 Scope

This European Standard specifies predictive formulae for the determination of metabolizable energy (ME) in

— products of vegetable or animal origin, in their natural state, fresh or preserved, such as meat, offal, milk products, cooked starch sources; highly digestible special products such as milk substitutes or diets for enteral nutrition;

— complete or complementary products derived from the industrial processing for cats and dogs.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
crude fibre
CF
substances which are insoluble and combustible under the operating conditions specified in this standard

3.2
digestible energy
DE
gross energy minus energy loss in faeces

Note 1 to entry: DE provides an estimate of the energy the animal is able to use.

Note 2 to entry: DE does not take into account energy losses via urine (and combustible gases).

3.3
dry matter
DM
measurement of mass when completely dried

3.4
gross energy
GE
total chemical energy arising from complete combustion of a food in a bomb calorimeter

Note 1 to entry: The heat of combustion in feedstuffs can be predicted from the chemical analysis using standard values for the nutrients. For pet foods appropriate GE estimates for crude fat, crude protein and carbohydrates (nitrogen-free extract (NFE) plus crude fibre (CF)) are 39,3 kJ/g [1], 23,8 kJ/g [2] and 17,1 kJ/g [3].

3.5
metabolizable energy
ME
energy available to an animal after correction of the DE for losses via urine and combustible gases

3.6
nitrogen-free extract
NFE
carbohydrate fraction including starch, simple sugars and soluble parts of cellulose, hemicellulose, lignin and pectin

4 Principle

4.1 Determination of GE

The GE content of a food is defined as the total chemical energy arising from complete combustion of a food in a bomb calorimeter. The heat of combustion in feedstuffs can be predicted from the chemical analysis using standard values for the nutrients. For pet foods appropriate GE estimates for crude fat, crude protein and carbohydrates (NFE plus CF) are 39,3 kJ/g [1], 23,8 kJ/g [2] and 17,1 kJ/g [3].

4.2 Determination of DE

In animal experiments the difference between the GE intake with feedstuffs and the GE loss via faeces is used to determine the digestible energy of a food. For this, GE of food and faeces is determined by complete combustion in a bomb calorimeter. Alternatively, DE can be calculated by multiplication of GE with the percentage of apparent digestibility of energy divided by 100. Formulae to estimate energy digestibility as a function of fibre have been based mainly on CF analysis for practical reasons: CF is mostly used in labelling the pet food and the methodology is well established with the added benefit of being cheap and easy to perform. Consequently, there is much more data on CF and energy digestibility than on any other fibre analysis.

4.3 Determination of ME

The ME of a food is determined by subtracting energy losses via urine from the DE. In species with relevant extent of fermentation activity such as ruminants, energy losses through combustible gases are subtracted from the DE as well. Fermentation losses by gas can be neglected in dogs and cats, therefore only the separate collection of faeces and urine is required in digestion trials. In order to avoid the use of metabolic cages it is common practise to collect only faeces and to correct for energy losses via urine using a fixed value for urinary GE losses per g digested protein multiplied by the amount of digestible protein in the food. Therefore, 5,2 kJ per g digestible protein is subtracted for dogs and 3,6 kJ per g digestible protein for cats applying either the apparent protein digestibility measured in a digestion trial or a mean apparent protein digestibility of 83,5 % in dogs and 86 % in cats.

4.4 Mathematical prediction of ME in food for cats and dogs

The predictive formulae of ME are based on the results of feeding trials. Calculation of ME in accordance to these formulae employ contents of dietary components, determined by validated official methods (Commission regulation (EC) No 152/2009). The mathematical prediction ME in food for cats and dogs can be described in four steps.

1) Estimation of GE using appropriate GE estimates for crude fat, crude protein and carbohydrate (with CF);

2) Estimation of the percentage apparent energy digestibility using a linear regression formula based on CF content per dry matter (DM);

3) Calculation of DE;

4) Conversion into ME by subtracting urinary energy losses related to protein metabolism.

4.5 Conversion factors

Conversion factors kcal conversion to kJ: 1 kcal = 1 000 cal = 4,184 kJ; 1 MJ = 1 000 kJ = 239 kcal.

4.6 Nitrogen-free extract (NFE)

NFE comprises the carbohydrate fraction including starch, simple sugars and soluble parts of cellulose, hemicellulose, lignin and pectin. NFE is calculated according to Formula (1).

$$m_{NFE} = 100 - (m_M + m_{CP} + m_{CFA} + m_{CA} + m_{CFI}) \quad (1)$$

where

m_{NFE} is the mass nitrogen free extract, in g/100 g;

m_M is the mass moisture, in g/100 g;

m_{CP} is the mass crude protein, in g/100 g;

m_{CFA} is the mass crude fat, in g/100 g;

m_{CA} is the mass crude ash, in g/100 g;

m_{CFI} is the mass CF, in g/100 g.

5 Reagents and materials

All the reagents shall be of analytical grade.

All reagents used for determination of moisture, protein, fat, ash and fibre as described under Clause 9.

6 Apparatus

Usual laboratory equipment and, in particular, those for determination of moisture, protein, fat, ash and fibre.

7 Sampling

It is important that the laboratory receives a sample that is homogenous and truly representative and has not been altered or changed during transport and storage.

Sampling is not part of the method specified in this European Standard. A recommended sampling method for feed is given in Commission regulation (EC) No 152/2009 Annex I.

8 Sample preparation

A recommended sampling method is given in Commission regulation (EC) No 152/2009 Annex II point A or equivalent.

9 Measurements

9.1 Moisture

A recommended method is given in Commission regulation (EC) No 152/2009 Annex III, method A or equivalent.

9.2 Protein (crude)

A recommended method is given in Commission regulation (EC) No 152/2009 Annex III, method C or equivalent.

9.3 Fat (crude)

A recommended method is given in Commission regulation (EC) No 152/2009 Annex III, method H, Procedure B, with Hydrolysis compulsory for pet food or equivalent.

9.4 Ash (crude)

A recommended method is given in Commission regulation (EC) No 152/2009 Annex III, method M or equivalent.

9.5 Fibre (crude)

A recommended method is given in Commission regulation (EC) No 152/2009 Annex III, method I or equivalent.

10 Determination of energy by calculation

10.1 Complete or complementary compound feed for dogs and cats

The ME in complete or complementary compound feed for dogs and cats derived from the industrial processing can be predicted with the following steps and Formulae (2) to (7).

1) Calculate GE with Formula (2) for both dog and cat foods

$$E_{GE} = (f \times M_{CP}) + (g \times M_{CFA}) + [j \times (M_{NFE} + M_{CFI})] \quad (2)$$

where

E_{GE} is the GE, in MJ/kg;

f is the value of 0,02385 for the GE estimate of crude protein, in MJ/g;

g is the value of 0,03933 for the GE estimate of crude fat, in MJ/g;

j is the value of 0,01715 for the GE estimate of carbohydrate (with CF), in MJ/g;

M_{CP} is the mass crude protein, in g/kg;

M_{CFA} is the mass of crude fat, in g/kg;

M_{NFE} is the mass of NFE, in g/kg;

M_{CFI} is the mass of CF, in g/kg.

2) Calculate the apparent digestibility of gross energy with Formula (3) for dog food and Formula (4) for cat food.

$$E_{DIG,\,d} = k - (n \times M_{CFD}) \quad (3)$$

$$E_{DIG,\,c} = p - (q \times M_{CFD}) \quad (4)$$

where

$E_{DIG,d}$ is the energy digestibility in dog food, in % ;

$E_{DIG,c}$ is the energy digestibility in cat food, in %;

k is the value of 91,2 for the $E_{DIG,d}$ estimate;

M_{CFD} is the mass CF in DM, in g/100 g;

n is the value of 1,43 for the impact estimate of CF on $E_{DIG,d}$;

p is the value of 87,9 for the $E_{DIG,c}$ estimate;

q is the value of 0,88 for the impact estimate of CF on $E_{DIG,c}$.

3) Calculate the digestible energy with Formula (5)

$$E_{DE} = (E_{GE} \times D_{GE}) \,/\, 100 \quad (5)$$

where

E_{DE} is the DE, in MJ/kg;

E_{GE} is the GE, in MJ/kg;

D_{GE} is the digestibility of GE, in %.

4) Convert into metabolizable energy with Formula (6) for dog food and Formula (7) for cat food.

$$E_{ME,d} = E_{DE} - (r \times M_{CP}) \quad (6)$$

$$E_{ME,c} = E_{DE} - (v \times M_{CP}) \quad (7)$$

where

$E_{ME,d}$ is the ME in dog food, in MJ/kg;

$E_{ME,c}$ is the ME in cat food, in MJ/kg;

E_{DE} is the DE, in MJ/kg;

M_{CP} is the mass crude protein, in g/kg;

r is the value of 0,00434 for the ME estimate of crude protein in dog food, in MJ/g;

v is the value of 0,00322 for the ME estimate of crude protein in cat food, in MJ/g.

10.2 Examples

10.2.1 Dog food

Composition of the pet food (g/kg):

$M_M = 800$

$M_{CP} = 70$

$M_{CFA} = 40$

$M_{CA} = 30$

$M_{CFI} = 10$

$M_{NFE} = 50$

Calculation of ME in dog food:

1) Formula (2):

$E_{GE} = (0{,}02385 \times 70) + (0{,}03933 \times 40) + [0{,}01715 \times (50 + 10)] = 4{,}27$

2) Formula (3):

$E_{DIG,d} = 91{,}2 - (0{,}143 \times 50) = 84{,}05$

3) Formula (5):

$E_{DE} = 4{,}27 \times 84{,}05/100 = 3{,}59$

4) Formula (6):

$E_{ME,\,d} = 3{,}59 - (0{,}00434 \times 70) = 3{,}28$

10.2.2 Cat food

Composition of the pet food (g/kg):

$M_M = 800$

$M_{CP} = 70$

$M_{CFA} = 40$

$M_{CA} = 30$

$M_{CFI} = 10$

$M_{NFE} = 50$

Calculation of ME in cat food:

1) Formula (2):

$E_{GE} = (0{,}02385 \times 70) + (0{,}03933 \times 40) + (0{,}01715 \times (50 + 10)) = 4{,}27$

2) Formula (4):

$E_{DIG,c} = 87{,}9 - (0{,}088 \times 50) = 83{,}5$