Determination of the proximate composition in meat and meat products using one single sample unit

E. ZUKÁL, V. MIHÁLYI-KENGYEL, J. CZEGLÉDI-JANKÓ and L. KÖRMENDY

Hungarian Meat Research Institute, BUDAPEST (HUNGARY)

The analytical data provided by laboratories of quality control help in making decisions during meat processing on one hand, and qualify the final products on the other. Actually, the above mentioned two tasks determine the choice of analytical methods. Even simple, rapid and less accurate methods may fulfill the former requirements, so rapid-analysers (e.g. MH-2, Anyl-Ray etc.) can be adequately used for such purposes. Though they are relatively expensive, they provide suitable results for processing in a short period of time (approx. lo mins) /Rusz and Erdős, 198o; Young et al, 1976/. Concerning the analysis of final products rapidity and easy handling may not serve as primary aspects, highly precise results are often needed.

As a great amount of samples must be analyzed in laboratories for quality control, reduction of labour and working time achieved by a better organization of work and a modification in the system of analysis is eagerly needed /Selmeci et al. 198o/.

EXPERIMENTAL

Materials: samples from raw beef, poultry MDM, different meat products

Methods:

- determination of water content by drying at lo5 ^{o}C according to Hungarian Standard MSZ 5874-4;
- determination of fat content by extraction using petrolether according to Hungarian Standard MSZ 5874-2;
- determination of protein content by measuring the content of ammonia in the digested solution with spectrophotometry /Mihályi, 1975/;

- estimation of connective tissue content according to the modified hydroxiproline method /Csiba, 1983/;
- determination of chloride by Mohr /Hungarian Standard MSZ 5874-7/.

The new system performs the different analyses in a logical order using one single sample unit weighed previously. Fig. 1. shows the order of procedures needed for the determination of four components (water, fat, protein and connective tissue content). The individual methods used in the new system perfectly correspond to those of the previous one.

RESULTS AND DISCUSSION

Methodologically the new system differs from the previous one only in the determination of protein and connective tissue contents. A methodological comparison concerning only the protein content seemed to be necessary because the analysis of the solution deriving from the further digestion of a previously digested hydrolyzate causes an essential change at this point. Comparisons were carried out with samples of dry sausage, Bologna-type sausage (in Hungarian "párizsi") and raw beef. Results are shown in Fig. 2., the mathematical - statistical evaluation in Table 1. resp.

Table 1. A comparative mathematical-statistical evaluation of protein contents in meat and meat products (n = 3o)

	Classical regression	Regression by Deming /Zukál et al. 197o/
V_a	-	o,1129
V_b	-	o,o149
r	o,9971	o,9971
a	-o,2943	-o,3928
b	1,o211	1,o263
$E_{(y/x)}$		2,82

By the help of F-test /Mandel, 1964/ it has been proved that equation y = -o,29+1,o21x can be replaced by y = x; values "a" and "b" are not significantly different from 0 and 1

resp. According to sensitivity ratio the new system proved to be about three times more sensitive than the previous one.

Further, the standard deviation of the sum of the individual components (water+fat+protein content) was compared. Results are shown in Tables 2. and 3.

Table 2. Sum of the individual components in meat products.

S a m p l e	New system (analysis of one single s.)		Previous system	
	$\bar{x}$	s	$\bar{x}$	s
Bologna-type sausage 7 s. (in Hung. "párizsi")	99,09	±1,396	98,93	±1,435
Dry sausage 16 samples	100,00	±0,707	102,11	±2,146

$\bar{x}$ = mean value of the sum of fat, water, protein and salt contents

Table 2. shows that the standard deviation of the sum of the components is less with the new method and is nearer to 100 %.

Table 3. Sum of the individual components in raw meat.

S a m p l e	New system		Previous system	
	$\bar{x}$	s	$\bar{x}$	s
Raw beef (I. grade)	99,68	±1,055	97,43	±1,496
Raw beef (II. grade)	100,15	±1,344	98,36	±2,371
Raw beef (III. grade)	99,11	±1,179	96,76	±2,251

$\bar{x}$ = mean value of the sum of fat, water and protein contents

Results of Table 3. clearly show that the standard deviation of the sum of the components is less with the new system and it falls nearer to 100 % even in this case.

After having attained a proper routine in using the new analytical system 100 further samples were analyzed. Even with these latter analyses it was found that the standard deviation of the sum of the components is less, the mean being near to 100 %. (Table 4.) Ash content (calculated according to the protein content) was added to water, fat and protein contents in the case of raw meat, while in the case of meat products salt content

was also added to them.

Table 4. Analysis of loo different samples by the new analytical system.

S a m p l e	Mean value of the sum of components	Standard deviation of the sum of components
Beef (I. grade) n = 31	99,81	± o,331
Beef (II. grade) n = 32	99,59	± o,333
Beef (III. grade) n = 12	99,73	± o,328
Poultry meat n = 15	99,74	± o,323
Different meat products n = lo	99,66	± o,229

The methodological advantages of the new analytical method are as follows:

- instead of 4 weighings only one must be done. Besides economy of time and labor it reduces the possibility of errors deriving from the inaccuracy of weighing and the changes in moisture content during weighing,
- digestion of the sample after drying and defatting is easier than digesting the original material,
- determination of protein content from the solution of a previously hydrolyzed material can be carried out more rapidly and with less chemicals used,
- after attaining a certain practice in the new system the analysis of one sample needs less manual work that can lead to labour economy at serial determinations when accompanied by proper organization of work.

By further development of our system new analyses can be included into the scheme of procedure. Determinations are performed independent from one another, so some of them may be omitted, too.

Summarizing the results, it can be stated that after attaining a proper routine in the new analytical system results are more reliable than in the case of the previous one. So its use in laboratories for quality control can be considered highly rational for its methodological advantages mentioned above.

REFERENCES

CSIBA, A., Acta Alimentaria (in press)

MANDEL, J., Statistical analysis of experimental data. Interscience Publ. New York-London-Sydney, 1964.

MIHÁLYI, Györgyné, Élelmezési Ipar, 29, 1975, 2oo-2o4.

RUSZ, J., ERDŐS, Z., Die Fleischerei, 31, 198o. 7o9-712.

SELMECI, Gy., CSEH, F., NOVÉ, L., 26th European Meeting of Meat Research Workers, Colorado Springs, 198o.

YOUNG, E.P., KOTULA, A.W., TWIGG, G.G., J. of Animal Sci., 42, 1976, 67-71.

ZUKÁL, E., FÉNYES, T., KÖRMENDY, L., Kísérletügyi Közlemények, LXIII.E. Élelmiszeripar, 41, 197o, 1-3.

Fig.1. Scheme of analysis using one single sample

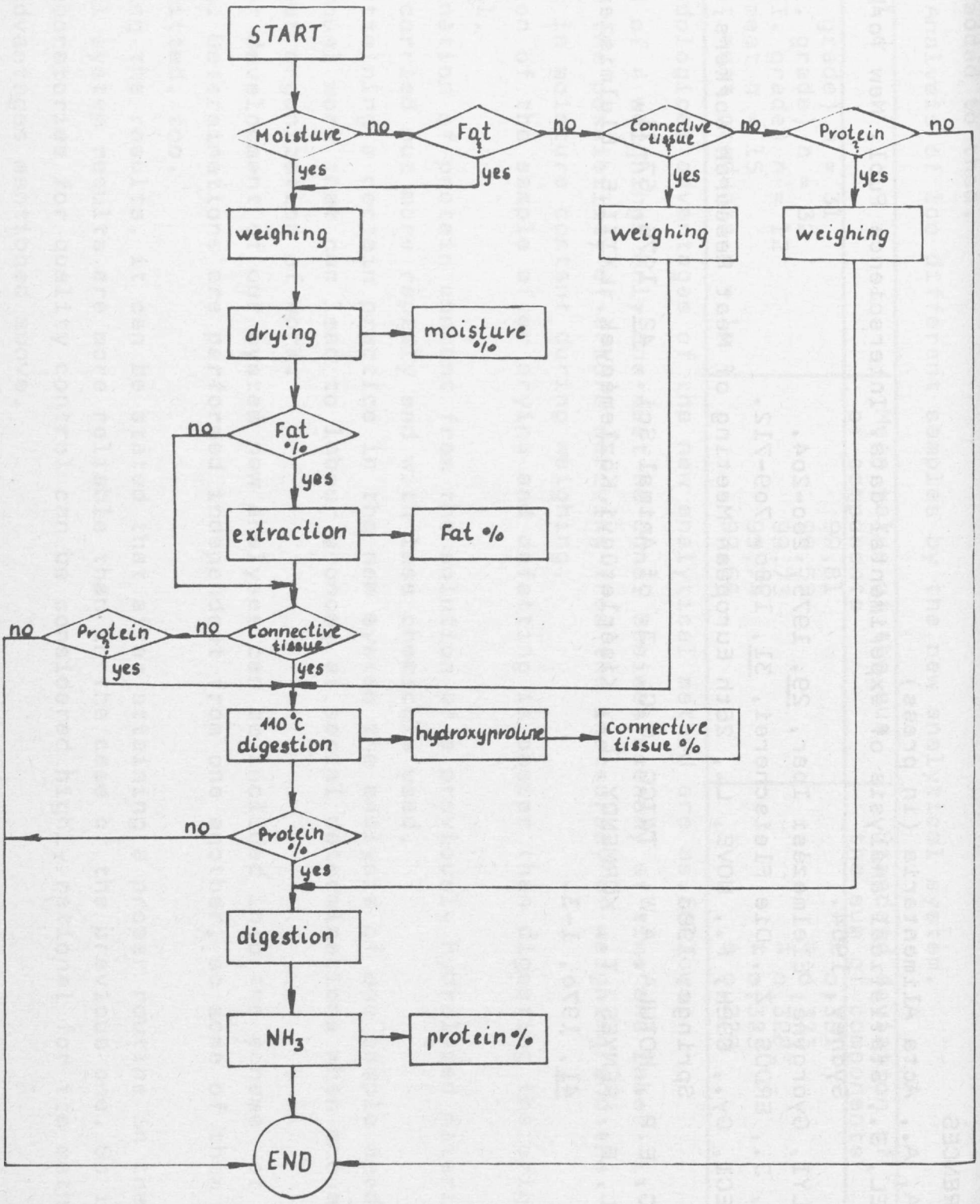

Fig. 2. Comparison of protein contents