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Kaposvári Egyetem, Állattudományi Kar, Kaposvár
University of Kaposvár, Faculty of Animal Science, Kaposvár

Comparison of oven drying with permeable film in substitution to freeze-drying in rabbit meat submitted to chemical analysis

A. Dalle Zotte, P. Berzaghi, L. Serva, R. Verdiglione
Dipartimento di Scienze Animali, Università degli Studi di Padova, Agripolis, Viale dell'Università, 16, PD 35020 Legnaro, Italy

ABSTRACT

The study compared two meat drying methods, the classical freeze-drying and the oven drying with the introduction of the minced meat into bags made of permeable film of polyetherblockamide (Osmolux). Fourteen hindlegs from rabbits slaughtered at an age of 11 weeks, were deboned, minced and samples were either freeze-dried or oven-dried with Osmolux film. All of the samples were analysed for chemical composition, cholesterol content, and fatty acids (FA) profile. No statistical differences on the studied variables were found between the 2 drying methods. Determination coefficient R^2 *between the 2 drying methods was high for ash (0.95), dry matter (0.93), ether extract (0.90) contents, while for cholesterol content the* R^2 *was lower (0.74). Relationship between methods were weak for FA with* R^2 *values ranging from 0.57 for polyunsaturated FA, to 0.59 for saturated FA, to 0.69 for monounsaturated FA.*
(Keywords: rabbit, meat, chemical analysis, oven drying, permeable film)

INTRODUCTION

Freeze-drying technique is currently used to prepare meat samples prior to their chemical analysis, in order to reduce their water content, spoilage and the hydrolytic reactions. The limit of the freeze-drying is its high cost and the limited number of samples that can be prepared with each batch. The oven drying method is susceptible to waste minerals, vitamins and other meat constituents. Osmolux is a gas and vapour permeable film which is proposed for the storage and packaging of some vegetable products (*Moras* and *Lambert*, 1997). Its use for drying purpose could be economically advantageous, but no information are available on the chemical constituents preservation of the meat.

The aim of this study was to verify the effectiveness of oven drying with gas and vapour permeable films OSMOLUX (polyetherblockamide) in preparation of rabbit meat submitted for chemical analysis.

MATERIALS AND METHODS

Fourteen hindlegs from rabbits of 11 weeks of age were deboned. The meat was minced (Retsch grinder, 4000 r.p.m. per 12 sec) and split into two samples that were either freeze-dried (Control) or oven-dried with Osmolux (Permeable film). Osmolux is a gas and vapour permeable film of polyetherblockamide produced by P.A.T.I. S.p.A. A layer of meat about 0.7 cm thick was made using a roll bar up, and then placed into Osmolux

bags, sealed and oven-dried at 60 °C until constant weight after 2 consecutive weightings.

After drying, all of the samples were ground (Girmi type FR 51 grinder, 20 sec) and stored at room temperature until analysis. Samples were analysed for chemical composition (DM, ether extract, ash) and protein was calculated by difference according to the standards of the *A.O.A.C.* (1984). Cholesterol content was also determined (*Casiraghi et al.*, 1994). Fatty acids (FA) profile was determined using a gas-chromatography, after Folch extraction, according to *A.O.A.C.* methods (1984). The chemical analyses were completed within a month from the drying.

Variance analysis was performed using the GLM procedure of the SAS program (*SAS Institute*, 1990) by including drying method as fixed effect. Determination coefficients R^2 , and regression equations between drying methods were calculated for all variables using Excel spreadsheet.

RESULTS AND DISCUSSION

The average chemical composition of rabbit's hindleg meat (*Table 1*) were not influenced by the drying method, except for the protein content on the as is basis ($P<0.05$). The protein content was calculated by difference, so all of the small differences emerged on the other analysed variables relapsed into the protein content.

Table 1

Chemical composition of hindleg meat

Samples, n.	Control	Permeable film	RSD	Probability
	14	14		
DM, %	25.9	26.1	1.5	ns
Protein, %DM	83.3	84.4	4.4	ns
Ash, %DM	4.5	4.5	0.4	ns
Ether Extract, %DM	12.2	11.1	4.7	ns
Cholesterol, mg/100g DM	239	250	33	ns
Moisture	74.1	73.9	1.5	ns
Protein, %	21.5	22.0	0.5	P<0.05
Ash, %	1.15	1.16	0.04	ns
Ether Extract, %	3.2	3.0	1.4	ns
Cholesterol, mg/100 g	61.3	64.8	6.1	ns

Comparing the fatty acid (FA) profile of the two groups (*Table 2*), it appeared that oven-drying with Osmolux permeable film, doesn't affected the compositions of fat. Differences were reported only for some of the less representatives FA, such as the C24:0, C24:1 n-9, C20:5 n-3 ($P<0.01$) and CLA (Conjugated Linoleic Acid, $P<0.05$). Saturated Fatty Acids (SFA) and Monounsaturated Fatty Acids (MUFA) values increased for permeable film group, while Polyunsaturated Fatty Acids (PUFA) decreased, but reported differences were not statistically significant. These small differences could be partly ascribed to the variability of the FA analysis and also to the FA hydrolysis which may have occurred on Osmolux samples during storage.

Table 2

Fatty Acid profile of hindleg meat

Samples	Control	Permeable film	RSD	Probability
	14	14		
SFA	37.5	40.5	6.4	ns
C6:0	0.16	0.38	0.32	ns
C10:0	0.12	0.13	0.07	ns
C12:0	0.14	0.16	0.05	ns
C14:0	1.93	2.11	0.55	ns
C16:0	25.0	27.1	4.5	ns
C18:0	7.8	8.1	1.2	ns
MUFA	26.0	27.7	4.0	ns
C14:1	0.10	0.11	0.09	ns
C16:1	2.02	2.17	1.16	ns
C17:1	0.45	0.46	0.04	ns
C18:1	22.4	24.0	2.8	ns
PUFA	32.6	28.8	10.7	ns
C18:2 n-6	27.8	24.9	9.4	ns
C18:3 n-3	1.67	1.27	0.77	ns
C20:4 n-6	1.67	1.17	0.98	ns

Determination coefficient R^2 between the 2 drying methods was high for ash (0.95, *Figure 3*), dry matter, DM (0.93, *Figure 1*), ether extract (0.90, *Figure 2*) contents, while for cholesterol content (*Figure 4*) the R^2 was lower (0.74).

Figure 1

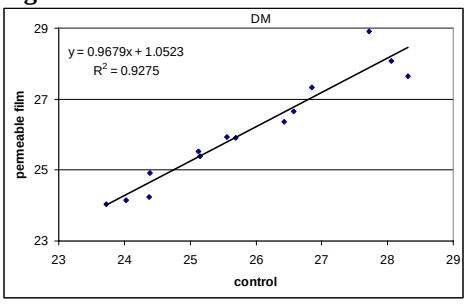


Figure 2

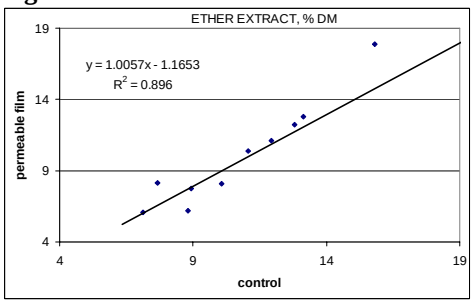


Figure 3

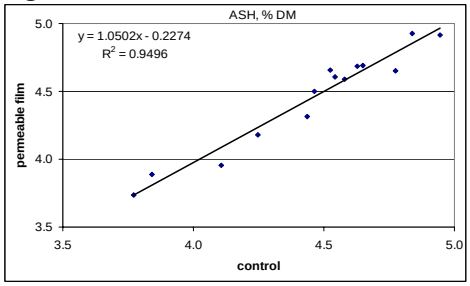
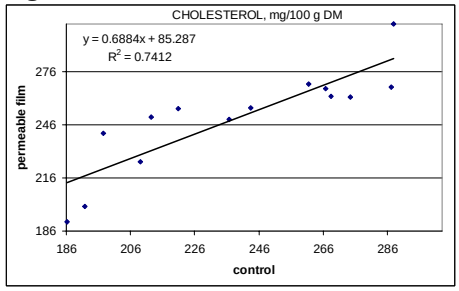


Figure 4



The R^2 values found on FA were worse than chemical analysis, ranging from 0.57 of PUFA (*Figure 7*), to 0.59 of SFA (*Figure 5*), to 0.69 of MUFA (*Figure 6*). Higher R^2 values were obtained for C10:0 (0.80), C12:0 (0.81), C14:0 (0.84), C16:1 (0.97) and C20:1 n-9 (0.80).

The present work aimed to approach the use of economical drying system, i.e. the oven drying with permeable films, and no particular attention was paid to the grinding methods and to the storage conditions. It is likely that the relationship between methods values could be improved by optimizing the grinding, before and after drying, and the storage conditions (time and temperature) of permeable film drying system.

Figure 5

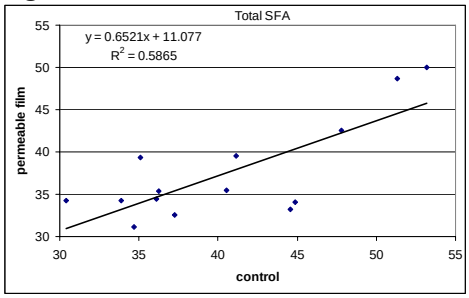


Figure 6

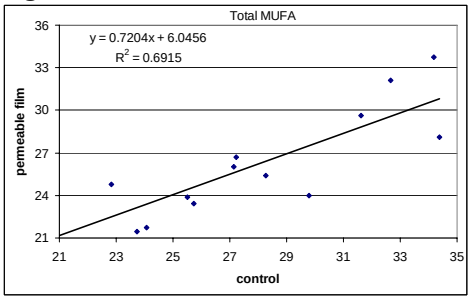
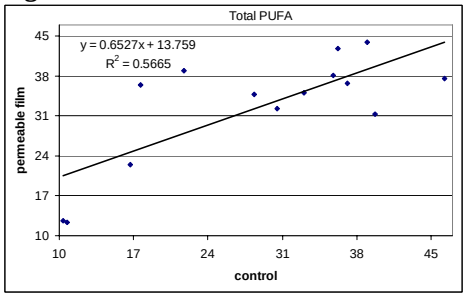


Figure 7



CONCLUSIONS

In conclusion, the oven drying with gas and vapour permeable films Osmolux did not affect the content of meat macro-constituents and its use could be suitable for screening purposes in rabbit meat. Further studies should aim at the improvement of this new method of water removal by testing the effects of grinding methods and storage conditions of the samples prior chemical analyses.

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Corresponding author:

Antonella Dalle Zotte
Dipartimento di Scienze Animali, Università degli Studi di Padova, Agripolis PD 35020 Legnaro, Viale dell'Università 16, Italy
Tel.: +39 0498272640, fax: +39 0498272669
e-mail: antonella.dallezotte@unipd.it