QUALITY EVALUATION OF SPANISH COMERCIAL CATEGORIES OF OSTRICH MEAT

Sendra, E.; Fernández-López, J.; Aznar, A.; Navarro, C.; Sayas-Barberá, E.; Navarro, F. and Pérez-Alvarez, J.A.
Universidad Miguel Hernández. División de Tecnología de Alimentos. Escuela Politécnica Superior de Orihuela.
Ctra. Beniel, km. 3,2 – 03312 Orihuela, Alicante (Spain). E-mail: ja.perez@umh.es

Background.

Ostrich breeding has increased popularity in the recent years in Spain. Ostrich meat has a relatively high pH (*Sales, 1996*) and low intra-muscular fat content (1,6%) compared with beef (4,5%) and turkey (3,8%) (*Paleari et al., 1998*). Protein, moisture and ash content are similar for those species (*Paleari et al., 1998; Sales & Oliver-Lyons, 1996*). Ostrich has also a low sodium content, which is an advantage for special diets (43 mg each 100 g edible portion *vs* 77 in poultry and 63 mg in beef) (*Sales & Oliver-Lyons, 1996*). It has a low mono-unsaturated fatty acids content but it is rich in poli-unsaturated fatty acids (*Carbajo et al., 1997; Paleari et al., 1998*), its Ω-3 fatty acid content is 4 times higher than in poultry and beef (*Sales & Oliver-Lyons, 1996; Sales et al., 1996*). Ostrich meat is as red as beef, and its low collagen content provides it with a great tenderness when properly cooked (*Marks et al., 1998; Paleari et al., 1998*), it is well known that long cooking times have the opposite effect (*Sales, 1996*).

Objective.

The aim of this work was to evaluate physico-chemical and colour characteristics in the three Spanish commercial categories corresponding to three different muscles. Some other factors as breed, feeding and slaughtering could not be assessed as commercial samples were used for the sutdy.

Methods.

Vacuum packaged ostrich meat samples categorized as I, II y III, corresponding to: *Iliofibularis muscle, Gastrocnemius muscle* and tibia-metatarsial region, respectively. The samples were obtained from a retail store.

Twelve samples of each category were analyzed in triplicate for the following parameters: pH, moisture, ash, protein and fat (*AOAC, 1990*), water holding capacity (WHC) by a centrifuge method (*Pérez-Alvarez et al., 1995*), and colour using a Minolta CR-10 colorimeter (Minolta Camera Co. Osaka, Japan), the light reached the sample through a low reflectance glass Minolta CR-A51 1829-752 (Minolta Camera Co. Osaka, Japan) (*Hunt et al., 1991*) and colour was expressed as coordinates CIEL*a*b* (D_{65}, 10°), psycho-physical magnitudes Chroma (C*) and Hue (H*) were calculated (*UNE, 1983*).

Results were statistically analyzed by ANOVA test. Orthogonal contrasts were assessed by Tukey's test (*Affifi & Azen, 1979*) using Statgraphics Plus 2.0. (Statistical, Graphics Corp., Rockville, USA).

Results and discussions.

Colour parameters are shown in Table 1. Significant differences were found for lightness, yellowness (b)* and hue (H*), all these parameters were higher for the III category which differed from I and II categories that were similar. Luminosity and a* values are close to those of beef (*López-Noguera, 1999*) reinforcing the colour similarity between ostrich meat and beef. *Mellet & Sales (1997)* found that the higher the b* value showed the lower in tenderness, although this parameter has not been evaluated in the present study, in our results the III category, which is expected to be the toughest, presented the highest b* values. I and II categories samples were purple according to hue values described by Instituto de Racionalización (*Instituto de Racionalización, 1981*) and III category was red.

Chroma* value is usually related to moisture content (*Pérez-Alvarez et al., 1998*), in our study none of those parameters presented differences between commercial categories.

Table 1. Average values for colour parameters of three commercial categories of ostrich meat.

Category	I	II	III
CIE L*	22,48 a	29,04 a	36,13 b
CIE a*	12,69a	12,59a	12,47a
CIE b*	5,22 a	4,84 a	6,83 b
Hue (H*)	22,17 a	21,15 a	30,32 b
Chroma (C*)	13,74a	13,51a	14,58a

a,b Values with the same letter within the same row do not significantly differ ($P>0,05$).

Overall composition, pH and WHC of ostrich meat are presented in Table 2. According to *Sales & Horbanczuk (1998)* ostrich meat pH is 6,0, and in emus, *Berge et al., (1997)* observed the same final pH (6,1), these second authors evidenced that glycogen depletion *ante mortem* stress was the main cause of the high final pH in both species.

In order to achieve an appropriate tenderness in ostrich meat, optimum pH is slightly lower than 5,8 and in any case it never has to be over 6,2 as meat turns to be dark, firm and dry (*Salles & Mellet, 1996*).

Significantly differences were observed for pH, highest values were for III category, tibia-metatarsal region (Table 2). It can be related to high glycogen consumption *ante-mortem* due to exercise and consequently low lactic acid formation in *post-mortem* leading to high final pH and dry, firm and dark meat (*Girard, 1991*).

Table 2. Overall composition, pH and water holding capacity of three categories of ostrich meat.

Category	I	II	III
pH	5,93 b	5,88 a	6,04 c
WHC	7,85 a	12,61 b	19,53 c
Moisture (g/100g)	73,60	74,04	74,04
Fat (g/100g)	1,47 b	1,91 c	1,10 a
Ash (g/100g)	1,46	1,50	1,63
Proteins	21,13 b	21,25 b	20,69 a

a,b,c Values with the same letter within the same row do not significantly differ ($P>0,05$).

The highest pH and the highest WHC (*Honikel & Hamm, 1994*), have been observed in our experience for the III category, but its WHC is still lower than that of beef (*López-Noguera, 1999*) .

Moisture values are similar to those observed by *Paleari et al. (1998)*. Its moisture, ash and protein content is similar to those of other meats, but its intra-muscular fat content is definitively lower (1,2-9,5 g/100g in mammals and 1,9-4,7 g/100g in poultry) (*Forrest et al., 1975*).

Observed fat contents significantly differed between categories, and are similar to those observed by *Paleari et al, (1998)* but differ from those by *Sales & Horbanczuk (1998)* that in any case were over 0,5 g/100g. Lowest fat content was observed in III category, followed by I and II categories.

Ash content did not significantly differed among categories as was expected according to *Sales (1996)*.

Protein content was lowest for III category, with lower values than those observed by *Paleari et al. (1998)*, but similar to those by *Sales & Horbanczuk (1998)*.

Conclusions.

I and II categories do not differ in colour, moisture, ash and protein content, and significantly differs in pH, WHC and fat content, although pH (0,05 u.) and fat (0,44 g/100g) differences are not relevant. III category meat presents the highest pH, WHC and b* value, its colour is red, so different from the purple of I and II categories.

Pertinent literature

AOAC. (1990). Official Methods of Analysis (15th Ed) Association of Official Analytical Chemists, Arlington, VA, USA.

Affi A y Azen S.P. (1979). Statistical analysis. A computer oriented approach. Academic Press Inc. Londres.

Berge P., Lepetit J., Renerre M. y Touraille C. (1997). Meat quality traits in the emu (*Dromaius novahollandiae*) as affected by muscle type and animal age. *Meat Sci.* 45, 209-221.

Carbajo E., Gurri A., Mesiá J. y Castelló F. (1997). Cría de Avestruces. Real Escuela de Avicultura. Barcelona.

Forrest J.C., Aberle E.D., Hedrick H.B., Hudge M.D. y Merkel R.A. (1975). Principles of Meat Sciencie. W.H. Freeman and Company, San Francisco.

Girard J.P. (1991). Tecnología de la carne y de los productos cárnicos. Ed. Acribia. Zaragoza

Instituto de Racionalización. (1981). Nomenclatura Cromática Española. IRANOR. Madrid.

Honikel K.O y Hamm R. (1994). Measurement of water holding capacity and juiciness. En: Quality attributes and their measurement in meat poultry and fish products. Eds: A.M. Pearson y T.R. Durston. Blackie Academic and Professional. London.

Hunt M.C., Acton J.C., Benedict R.C., Calkins C.R., Cornforth D.P., Jeremiah L.E., Olson D.P., Salm C.P., Savell J.W y Shivas S.D. (1991). American Meat Science Assoc. Committee on Guidelines for Meat Colour Evaluation. En: Proceedings of 44th Annual Recip. Meat Conf. Kansas State University. Manhattan, K.S.. American Meat Sci. Assoc. National Live Stock and Meat Board. Chicago.

López Noguera, S. (1999). Efecto de las sales sobre las propiedades de colour en sistemas modelo embutidos crudo-curados. Trabajo Fin de Carrera Ingeniería Técnica Agrícola. Escuela Politécnica Superior de Orihuela, Universidad Miguel Hernández, Orihuela.

Marks, J., Stadelman W., Linton R., Schmieder H. y Adams R. (1998). Tenderness analysis and consumer sensory evaluation of ostrich meat from different muscles and different aging times. *J. Food Qual.* .21, 369-381.

Mellet F.D. y Sales J. (1997). Tenderness of ostrich meat. *Meat Sci.* 9, 27-29.

Paleari M.A., Camisasca S., Beretta G., Renon P., Corsico P., Bertolo G. y Crivelli G. (1998). Ostrich meat: physico-chemical characteristics and comparison with turkey and bovine meat. *Meat Sci*, 48(3/4), 205-210.

Pérez- Alvarez J.A., Pagan-Moreno M.J., Gago-Gago M.A., Perlo F., Rosmini M.R., Sayas-Barberá M.E. y Aranda-Catalá V. (1995). Manual de prácticas de industrias cárnicas. SPUPV. Valencia.

Pérez-Alvarez J.A., Fernández-López J, Sayas-Barberá M.E. y Cartagena R. (1998). Caracterización de los parámetros de colour de diferentes materias primas usadas en la industria cárnica. *Eurocarne* 63, 115-122.

Sales J. (1996). Histological, Biophysical, Physical and Chemical Characteristics of Different Ostrih Muscles. *J Sci Food Agric*, 76, 109-114.

Sales J. y Horbanczuck J. (1998). Ratite meat. *World's Poultry Sci. J.*, 54(3).

Sales J. y Mellet F.D. (1996). Post-mortem pH decline in different ostrich muscles. *Meat Sci*, 42 (2), 235-238.

Sales J., Marais D. y Kruger M. (1996). Fat content, caloric value, cholesterol content and fatty acid composition of raw and cooked ostrich meat. *J. Food Comp. and Anal.* 9, 85-89.

Sales J. y Oliver-Lyons B. (1996). Ostrich meat: a review. *Food Australia* 48, 504-511.

UNE. (1983). 72-031. Magnitudes colorimétricas. Norma Española. Instituto español de normalización. Madrid.