

Effects of sample preparation on the water/protein ratio of poultry cuts in relation to the identification of extraneous water

Gisela Hahn*, Michael Judas, Wolfgang Branscheid

Max Rubner-Institut, Federal Research Institute of Nutrition and Food, Location Kulmbach, E.-C.-Baumann-Str. 20, D-95326 Kulmbach, Germany

* Corresponding author: gisela.hahn@mri.bund.de

Abbreviated title: W/P of poultry cuts

Summary

The water/protein ratio (W/P) is commonly used to identify critical rates of extraneous water in poultry cuts, defined for the European Community by a regulation based on an international study from 1993. Most cuts are to be prepared including bones, which is analytically disadvantageous because samples are difficult to homogenize compared to deboned samples. Therefore, we investigated the effects of deboning poultry cuts, in particular chicken legs and turkey thighs, prior to the determination of W/P according to ISO standards. A sample of 280 chickens and 240 turkeys was collected from different slaughterhouses, representative for Germany in 2007. Physiological W/P was determined for half the sample by dry-plucking. From each specimen, one leg or thigh was analyzed after de-boning, the other according to the EC standard method.

Overall, the applied slaughter techniques did not increase W/P compared to the respective physiological W/P. On average, deboning increased W/P from 3.86 to 3.98 for broiler legs, and from 3.46 to 3.53 for turkey thighs. A change of method would frequently exceed the EC limit of 4.05 for broiler legs, but not for turkey thighs (3.80). A simplification of the analytical procedure would have to be accompanied by a re-evaluation of the threshold W/P, at least for broilers.

Keywords: water/protein ratio, chicken, turkey, cuts, physiological water content, extraneous water

Introduction

Extraneous water uptake is a key concern of the EC marketing standards for poultry. Excess water content is to be kept to a minimum in the interest of both the common market and the consumers. In this context, COMMISSION REGULATION (EC) No 543/2008 details the determination of the water/protein ratio (W/P) as an indicator of extraneous water uptake of poultry and poultry cuts during the slaughter process. The basis of the assessment is that the physiological water content of the cuts has a rather constant relation to the protein content of the cuts. Thus, excess water uptake can be identified by a critical exceeding of the physiological W/P. For some poultry cuts, the chemical analysis is prescribed to include the bones.

Upper limiting values for W/P are defined for chicken and turkey cuts based on an EC-wide study in 1993 that analyzed data from Germany and several other member states (COMMISSION OF THE EUROPEAN COMMUNITIES, 1993). Recurring claims of too high W/P values, detected during current controls in Germany, gave rise to the present study. It was suspected that the physiological W/P from the current German production had changed compared to the situation in 1993.

An additional objective of the investigation was to quantify the potential impact of sample preparation, i.e. to evaluate if the official analysis of poultry cuts including bones may be replaced by a simplified analysis without bones.

Materials and methods

The investigation comprised anatomical legs of 280 broiler carcasses (n=560) and thighs of 240 turkeys (n=480). The trial included representative slaughterhouses and slaughter methods as well as major breeds. One half of the carcasses were dry-plucked by hand to determine the physiological W/P, the other half were processed with common slaughter techniques (water scalding or steam scalding, air spray chilling or maturation chilling). From each specimen, one leg (broiler) or thigh (turkey) was analyzed after deboning, the other leg or thigh inclusive of bones according to the EC standard method. This was to determine if a simplified analytical method affects W/P.

The chemical analyses were carried out as described in Annex VIII of COMMISSION REGULATION No 543/2008 and in accordance with ISO 1442 (water content) and ISO 937 (nitrogen, protein). The data were analyzed with Generalized Linear Models (SAS 9.1) for the effect of deboning or slaughter techniques. Results from control inspections were simulated by bootstrapping: the official composite samples (n=5) were calculated from the separate samples analyzed, with 1000 random runs to estimate the probability of objections.

Results and Discussion

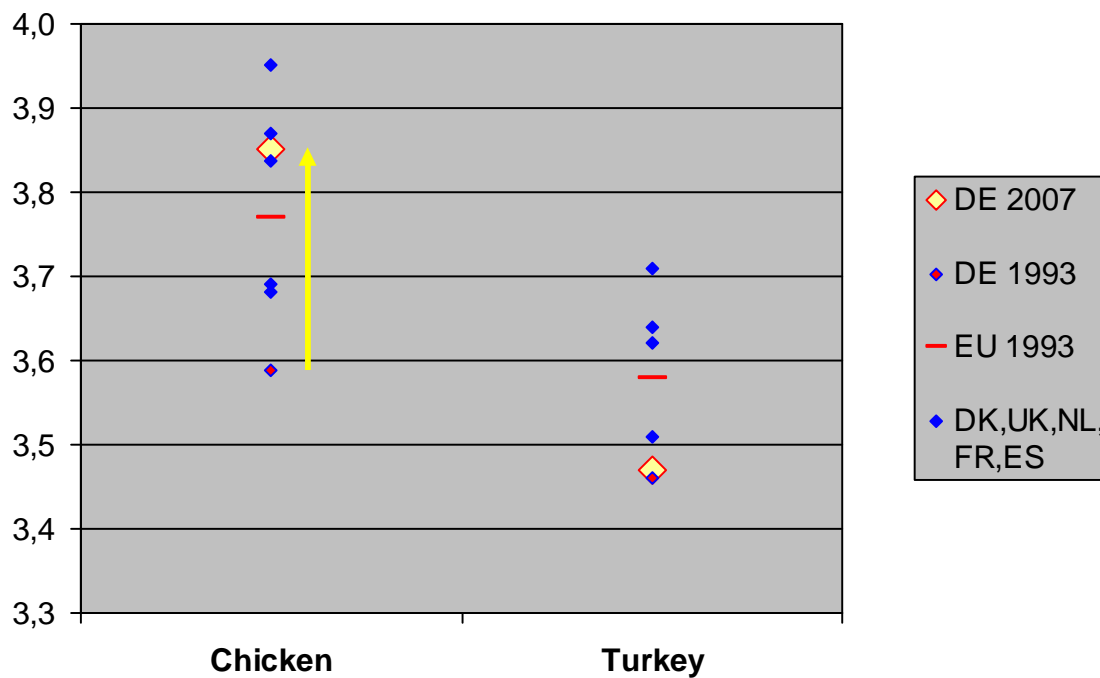
For German broiler legs, the average physiological W/P in 2007 had increased by 0.26 compared to the study of 1993 (Figure 1). In contrast, the physiological W/P of turkey thighs had not changed in this period. The results also indicate that the applied slaughter techniques do not significantly affect the W/P compared to the physiological W/P.

Deboning of cuts before chemical analysis increased W/P, for broiler legs on average from 3.86 to 3.98. Also for turkey thighs, the W/P was significantly higher in case of deboning before homogenization (3.53 compared to 3.46). The increase following the removal of bones from the sample is due to the fact that W/P for bones is lower than for the entire cut.

The increase of physiological W/P in broiler legs may partially be induced by developments in broiler production systems with respect to breed, age, and weight at slaughter. Such a development is to be assumed for other EC member states as well. Consequently, the Commission of the European Communities presently considers the possibilities for an update of the data base.

In analytical practice, sample processing for the determination of W/P inclusive of bones appears to be insufficiently specified and standardized, especially with respect to the grade of homogenization of samples. A methodological simplification in terms of an analysis without bones could not only facilitate the preparation of homogeneous mixtures but also improve the comparability of measurements.

Figure 1: Physiological W/P values from the EC study 1993, and from the German study 2007, for chicken legs and turkey thighs, respectively. The arrow indicates the strong increase for chicken legs in Germany between 1993 and 2007.



For chicken legs, a simulation of composite official control samples and the application of the valid thresholds for W/P showed that, with the official EC method, the probability of objections was not increased above the implicit 2.5% probability for any slaughter technique (Table 1). In contrast, a simplification of sample preparation by deboning would frequently exceed the EC limit of 4.05, even for dry-plucking with a probability of 14%. Only for air spray chilling, for which the limit is 4.15, deboning would not be problematic.

Table 1: Probability (%) that composite samples of chicken legs exceed the W/P limit for extraneous water uptake if samples are analyzed after deboning or according to the official EC method (i.e. no deboning). The probabilities are based on 1000 simulated randomized composite samples from separate analyses of 280 chickens. The definition of the W/P limit allows for 2.5 % false-positive indications of excess water.

Practical W/P	Physiological W/P	Practical W/P		
		steam scalding maturation chilling	water scalding maturation chilling	water scalding air spray chilling
EC method	0.1	3	0.3	0
Deboning	14	13	18	0

Based on the results of this study, the following conclusions are drawn: The alteration of physiological W/P in chicken legs do not generally elevate the probability for exceeding limits at regular checks. The practice of deboning significantly affects the W/P ratio and would require an adjustment of limits for chicken legs as well as for turkey thighs.

References

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