# CHANGES IN WATER, PROTEIN, FAT AND ASH CONTENT IN THE MEAT OF RABBITS BETWEEN 2.2-3.5 KG LIVE WEIGHT

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**Abstract** - 29 Pannon White rabbits were slaughtered between 2.2 and 3.5 kg live weight. The water, protein, fat and ash content of their meat were analysed in the m. longissimus dorsi (LD), hind leg (HL) and m. longissimus dorsi + belly (LD + B). Water content averaged 74.8, 73.8 and 71.0 % in LD, HL and LD + B, respectively, whereas protein, fat and ash content averaged 23.1, 22.1 and 21.7 %, 1.08, 3.24 and 6.39 %, 1.15, 1.09 and 1.04 %, respectively, in order of the meat parts mentioned above. Water content decreased and fat content increased with increasing weight ($r = -0.47$, -0.33 and -0.51, $r = 0.38$, 0.31 and 0.45 for water and fat contents of LD, HL and LD + B, respectively). Protein and ash content did not change significantly with weight.

## INTRODUCTION

One way in which meat can be characterised is by its chemical composition. From the point of view of healthy human nutrition it is protein, fat and cholesterin content of the meat that are of particular importance. Moisture is related to the tenderness of meat. Meat quality, and the chemical composition of meat have only been given emphasis in the past few years.

The water, protein, fat and ash content of hind leg and m. longissimus dorsi proved to be 72.6 and 74.6 %, 21.6 and 22.1 %, 4.5 and 2.1 %, 1.26 and 1.20 %, respectively from the 9th to 13th weeks of age (2.07 and 3.07 kg), water content and ash content increased, while protein content did not change (PARIGI-BINI et al., 1992). RUDOLPH and FISCHER (1979) and MÖSCH et al. (1984) report on changes of the fat and protein content in the m. longissimus dorsi and the m. biceps femoris between the ages of 86-100 and 56-98 days. MAERTENS and DE GROOTE (1992) revealed significant correlations of $r = 0.93$ and $r = 0.38$ between dry matter and fat content and between protein and fat content of carcass without fat deposits.

Previously we reported on changes in slaughter value, weight and ratios of different body parts with age (SZENDRÔ et al., 1993). The present experiment had the objective of evaluating changes in water, protein, fat and ash content of the meat of Pannon White growing rabbits within a range of 2.2 to 3.5 kg live weight.

## MATERIAL AND METHODS

In the experiment 129 Pannon White rabbits with live weight between 2.2 and 3.5 kg were slaughtered. The rabbits were dissected in the way suggested by BLASCO et al. (1993). The carcass was cut between the 7th and 8th dorsal vertebrae and ribs and between the 6th and 7th lumbar vertebrae. The right-hand m. longissimus dorsi (LD), the left-hand m. longissimus dorsi with belly (LD + B) and the meat removed from the hind leg (HL) were sent to the central laboratory of the university for laboratory analysis.

Chemical composition of the meat samples was determine by the following methods :
Water content of the meat samples was determined by HS 68-30/3-77 method drying to constant weight, the crude protein content by HS 68-30/4 method by Kjel-Foss fast nitrogen determiner, the crude fat content by HS 68-30/65 with soxhlet extraction after hydrochlorid acid digestion, and the crude ash content by ashing the samples at 550 °C for 3 hours (HS ISO 5984/92).

## RESULTS AND DISCUSSION

Data from the laboratory analyses were arranged according to body weight measured before slaughter of the rabbits. Based on the data of all the rabbits the averages for water, crude protein, crude fat and crude ash content of LD, LD + B and HL were calculated, and the averages and standard deviations for the parameters examined were calculated according to the weight categories established by 100 g between 2.2 and 3.5 kg (Table 1).

**Table 1 : Change in water, crude protein, crude fat and crude ash content of the meat (m. longissimus dorsi, hind legs and m. longissimus dorsi + belly of Pannon White between 2.2 and 3.5 kg (mean ± Standard devision)**

| | M. longissimus dorsi | | | | | Hind legs | | | | | M. longissimus dorsi + belly | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Live weight kg | n | Water % | Protein % | Fat % | Ash % | n | Water % | Protein % | Fat % | Ash % | n | Water % | Protein % | Fat % | Ash % |
| 2.20-2.29 | 6 | 75.3 | 23.0 | 0.73 | 1.15 | 7 | 74.6 | 22.24 | 2.50 | 1.16 | 7 | 71.8 | 21.6 | 5.76 | 1.06 |
| | | 0.73 | 0.67 | 0.21 | 0.06 | | 1.21 | 0.99 | 1.08 | 0.11 | | 2.54 | 0.60 | 2.93 | 0.06 |
| 2.30-2.39 | 6 | 75.6 | 22.6 | 0.92 | 1.30 | 12 | 74.2 | 22.1 | 2.93 | 1.04 | 12 | 72.7 | 21.7 | 4.78 | 1.04 |
| | | 0.33 | 0.35 | 0.35 | 0.00 | | 0.62 | 0.66 | 0.78 | 0.10 | | 1.23 | 0.67 | 1.54 | 0.10 |
| 2.40-2.49 | 8 | 74.8 | 23.2 | 1.10 | 1.14 | 9 | 74.3 | 22.4 | 2.41 | 1.12 | 9 | 72.3 | 22.0 | 4.77 | 1.09 |
| | | 0.35 | 0.35 | 0.21 | 0.09 | | 0.76 | 0.49 | 0.71 | 0.09 | | 1.71 | 0.65 | 2.16 | 0.06 |
| 2.50-2.59 | 6 | 75.0 | 23.1 | 0.67 | 1.20 | 13 | 73.8 | 22.3 | 3.28 | 1.02 | 13 | 72.0 | 21.9 | 5.15 | 1.00 |
| | | 0.44 | 0.56 | 0.21 | - | | 0.44 | 0.35 | 0.56 | 0.07 | | 0.93 | 0.67 | 1.25 | 0.04 |
| 2.60-2.69 | 2 | 74.9 | 23.3 | 0.90 | 1.10 | 10 | 73.8 | 22.5 | 2.93 | 1.10 | 10 | 71.5 | 22.0 | 5.69 | 0.99 |
| | | 0.71 | 0.35 | 0.42 | - | | 0.54 | 0.51 | 0.90 | 0.07 | | 1.42 | 0.73 | 1.84 | 0.00 |
| 2.70-2.79 | 9 | 74.9 | 23.0 | 0.99 | 1.13 | 10 | 73.9 | 21.9 | 3.57 | 1.06 | 10 | 70.9 | 21.5 | 6.80 | 1.02 |
| | | 0.47 | 0.42 | 0.45 | 0.10 | | 0.69 | 0.68 | 0.83 | 0.06 | | 1.31 | 0.64 | 1.95 4 | 0.05 |
| 2.80-2.89 | 11 | 74.7 | 23.4 | 1.15 | 1.18 | 11 | 73.6 | 22.1 | 3.74 | 1.12 | 11 | 70.4 | 21.7 | 6.63 | 1.06 |
| | | 0.59 | 0.49 | 0.65 | 0.08 | | 0.75 | 0.74 | 1.17 | 0.04 | | 0.71 | 0.75 | 2.23 | 0.05 |
| 2.90-2.99 | 9 | 74.8 | 23.2 | 0.89 | 1.16 | 9 | 74.0 | 22.1 | 2.91 | 1.12 | 9 | 71.1 | 21.8 | 6.14 | 1.06 |
| | | 0.39 | 0.45 | 0.27 | 0.10 | | 0.99 | 0.30 | 1.00 | 0.07 | | 0.59 | 0.59 | 0.79 | 0.05 |
| 3.00-3.09 | 10 | 75.0 | 23.0 | 0.95 | 1.17 | 10 | 74.5 | 21.9 | 2.61 | 1.15 | 10 | 70.8 | 21.5 | 6.74 | 1.06 |
| | | 0.60 | 0.47 | 0.51 | 0.07 | | 0.86 | 0.39 | 1.01 | 0.05 | | 2.04 | 0.64 | 2.47 | 0.07 |
| 3.10-3.19 | 9 | 74.1 | 23.5 | 1.32 | 1.17 | 9 | 73.4 | 22.0 | 3.68 | 1.11 | 9 | 69.8 | 21.6 | 7.66 | 1.06 |
| | | 0.56 | 0.39 | 0.30 | 0.05 | | 1.19 | 0.34 | 1.35 | 0.08 | | 1.93 | 0.55 | 2.29 | 0.07 |
| 3.20-3.29 | 10 | 74.7 | 23.0 | 1.26 | 1.14 | 10 | 73.7 | 22.1 | 3.28 | 1.08 | 10 | 70.1 | 21.7 | 7.33 | 1.04 |
| | | 0.67 | 0.53 | 0.35 | 0.07 | | 1.29 | 0.53 | 1.39 | 0.04 | | 2.54 | 0.71 | 3.12 | 0.11 |
| 3.30-3.39 | 8 | 74.5 | 23.3 | 1.30 | 1.16 | 8 | 73.1 | 22.1 | 4.11 | 1.08 | 8 | 69.6 | 21.4 | 8.05 | 1.04 |
| | | 0.57 | 0.39 | 0.19 | 0.11 | | 0.62 | 0.64 | 0.96 | 0.08 | | 1.78 | 0.86 | 2.60 | 0.09 |
| 3.40-3.49 | 11 | 74.2 | 23.5 | 1.32 | 1.11 | 11 | 73.2 | 22.0 | 3.93 | 1.08 | 11 | 69.41 | 21.5 | 8.21 | 1.01 |
| | | 0.58 | 0.62 | 0.33 | 0.03 | | 0.87 | 0.41 | 1.03 | 0.06 | | 2.09 | 0.62 | 2.60 | 0.09 |
| **2.84** | **105** | **74.8** | **23.2** | **1.08** | **1.15** | **129** | **73.8** | **22.1** | **3.24** | **1.09** | **129** | **71.0** | **21.7** | **6.39** | **1.04** |

### Water

Average water content was highest in LD (74.8 %) followed by that of HL (73.8%) and LD + B (71.0 %). These results are in agreement with the data published by HOLMES et al. (1984), PANIC et al. (1989) and PARIGI-BINI et al. (1992) for HL and LD.

The standard deviations of LD and HL were similar. On the contrary, the variance of LD + B exceeded the variance of the other two meat parts considerably. The reason for this could be that the water content of LD differed greatly from that of B as shown by the difference of 3.8 % found between LD and LD + B. Considering that the weight of LD is larger than that of B, it can be supposed that the water content of B alone was around 65 %.

Depending on body weight, there was 1-2 % difference between the two extreme groups of 2.2-2.3 and 3.4-3.5 kg; meat contained less water in the case of larger bodied rabbits. A similar change was observed in the carcass by MAERTENS and De GROOTE (1992), while a less significant change was reported by PARIGI-BINI et al. (1992) for HL + LD. The difference between the lowest and highest values appears similar (1.5 %) in the case of LD and HL, whereas the difference is approximately double in the case of LD + B, which suggests that body weight has the greatest influence on the water content of B.

**Table 2 : Correlations between live weight and chemical parameters in m. longissimus dorsi, hind leg and m.longissimus dorsi+delly**

| Meat parts | Chemical parameters | n | r |
|---|---|---|---|
| M. longissimus dorsi | Water, % | 105 | -0.47 |
| | Fat, % | 105 | 0.33 |
| Hind legs | Water, % | 129 | -0.33 |
| | Fat, % | 129 | 0.31 |
| M. longissimus dorsi + belly | Water, % | 129 | -0.51 |
| | Fat, % | 129 | 0.45 |

The relationship between body weight and water content is shown by the weak or intermediate - negative - correlation values detected between these two traits (Table 2). Regarding the closeness of this relationship similar data have been published by MAERTENS and De GROOTE (1992) based on examinations on whole carcass (with no fat deposit).

**Protein**

The average protein content of the three meat samples varied between 21.7 and 23.2 %. There was only one sample in which protein content remained below 20 % (Table 1). These data prove that rabbit meat is very rich in protein as compared to the meat of other farm animals. In this respect LD is the most valuable part (23.2 %), but the protein content of HL is also high (22.1 %). PARIGI-BINI et al. (1992) found a difference of 0.5 % between the protein content of LD and HL (m. biceps femoris), while the differences reported by MÖSCH et al. (1984) and RUDOLPH and FISCHER (1979) were 0.8-1.9 % and 1.1-1.2 %, respectively.
The difference between the lowest and highest values fell between 3.5-4.5 %. Our findings suggest that slaughter weight has no effect on protein content, and there is no detectable tendency, either positive or negative, in this respect (Table 1). Neither could PARIGI-BINI et al. (1992) for L + HL nor MAERTENS and De GROOTE (1992) detect any significant relationship between protein content of these and age or body weight.

**Fat**

The average fat content of LD, HL and LD + B were 1.1, 3.2 and 6.4 %, respectively. Values over 10 % were only found in some cases of LD + B (Table 1). For the fat content of LD 2.1 %, 1.4-1.6 % and 1.6-1.8 % have been reported by PARIGI-BINI et al. (1992), RUDOLPH and FISCHER (1979) and MÖSCH et al. (1984), respectively. The same authors reported 4.5, 4.3-5.0 and 3.5-4.6 % for HL, i.e. the m. biceps femoris, respectively, which differ only slightly from our findings. These data give evidence that rabbit meat is low in fat as compared to the meat of other farm animals. This statement is true despite the fact that HL contains 3 times and LD + B cointains 6 times as much fat as LD on average. Presumably, the fat content of B is high because we measured 6 times higher fat content despite its lower weight as compared to LD.
The fat content of LD is fairly stable. This varies between 0.2 and 2.9 %. Greater by far is the standard deviation in the case of HL, where the difference between the lowest and highest values is 6 %. In the case of LD + B the lowest value is similar (below 1 %) but the highest value is over 13 %.
The effect of body weight was greatest in the case of fat. Between 2.2 and 3.5 kg, fat content increased from 0.73 to 1.32 % in LD, from 2.5 to 3.9 % in HL and from 6.2 to 8.2 % in LD + B. The difference between the lowest and highest values proved to be 0.6, 1.7 and 3.4 % in the three types of meat (numbers enrolled in the previous order). There was a weak correlation between body weight and fat content (r = 0.31-0.45, Table 2.). PARIGI-BINI et al. (1992) observed a significant increase (2.8 and 3.5 %) in the fat content of LD + HL between the weights of 2.07 and 3.07 kg (9 and 13 weeks of age). On the contrary, MAERTENS and De GROOTE observed no significant relationship between body weight and fat content of the carcass.

Our results are in agreement with our previous data and with the data published by other authors indicating that with an increase in body weight it is the fat deposit (especially around the kidneys) which accumulates. Since there is little intramuscular fat in the meat of rabbits, meat also remains low in fat in larger-bodied animals.

**Ash**

The average ash content of LD (1.15 %) exceeded that of HL (1.08 %) and LD + B (1.05 %) by approximately 0.1 % (Table 1). Disregarding this difference the standard deviation of the trait was the same and the values did not change by the influence of body weight. PARIGI-BINI et al. (1992) reported values of 1.26 and 1.20 % for

the ash content of HL and LD. In their experiment ash content decreased significantly (1.27 and 1.18 %) between the ages of 9 and 13 weeks (2.07 and 3.07 kg). RUDOLPH and FISCHER (1979) found no difference between the ash content of LD and m. biceps femoris (1.2-1.3 %). MAERTENS and De GROOTE (1992) detected a correlation of r = 0.45 between body weight and the ash content of the carcass.

## CONCLUSION

Our findings and the relevant literature suggest that

- the water, protein, fat and ash content of the meat of Pannon White rabbits is favourable as compared to other breeds,
- the average water (74.8, 73.8 and 71.0 %), protein (23.2, 22.1 and 21.7 %), fat (1.08, 3.24 and 6.39 %) and ash (1.16, 1.09, 1.04 %) content of LD, HL and LD + B make rabbit meat highly favourable for human consumption.
- water content decreases, fat content increases, and protein and ash content remain constant between the weights of 2.2 and 3.5 kg.

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SZENDRÓ ZS., ROMVÁRI R., RADNAI I., BIRÓNÉ NÉMETH E., QUINTZ ZS., 1993. Effect of body weight on carcass traits of Pannon White rabbits. (In Hung.) 5. *Nyúltenyésztési Tudományos Nap*, Kaposvár, 23-30.



**Die veränderungen des wasser-, protein-, fett und aschegehaltes im kaninchenfleish bei einem körpergewicht zwischen 2,2 und 3,5** - 129 Weiße Pannon Jungkaninchen zwischen 2,2 und 3,5 kg wurden geschlachtet. Untersucht wurde Wasser-, Protein-, Fett- und Aschegehalt im m. longissimus dorsi (LD), im Hinterlauf (HL) sowie in m. longissimus dorsi + Bauchlappen (LD+B). In der Reihenfolge LD, HL und LD+B betrug der Wassergehalt 74.8, 73.8, 71.0 %, der Proteingehalt 23.2, 22.1, 21.7 %, der Fettgehalt 1.08, 3.24, 6.39 % und der Aschegehalt 1.15, 1.09, 1.04 %. Mit steigendem Körpergewicht sank der Wassergehalt ab (in der obigen Reihenfolge: r = -0.47, -0.33, -0.51) und der Fettgehalt stieg an (in der obigen Reihenfolge: r = 0.38, 0.31, 0.45). Protein- und Aschegehalt zeigten keinen Zusammenhang zum Körpergewicht.