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Short Communication

Physico-chemical and sensory characteristics of pork loin roast cooked to three internal temperatures

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Abstract

The experiment was conducted to examine the effects of three cooking internal temperatures (65, 75 or 85°C) on the physical, chemical and sensory characteristics of pork. Pork muscle, Longissimus dorsi, used were collected immediately after slaughter dnd stored overnight at –18°C. Loins were removed, allowed to thaw at room temperature, and cut into fifteen chops with an average weight of 300g. The chops were randonly allocated to three internal temperatures, 65, 75 or 85°C and transferred into the oven where they were roast cooked until the desired internal temperature was reached. The cooked weight, cooking loss, Warner Bratzler shear value and proximate composition were determined on cooked pork. Sensory attributes were also assessed by a 10-member panel using a 9-point hedonic scale. The results of the study indicated that final internal cooking temperature had no effect ($P>0.05$) on cooking loss and shear value. No significant effect was observed on tenderness, juiciness and flavour. Overall acceptability was significantly $P<0.05$) affected with pork loin cooked to internal temperature of 85°C most acceptable. While moisture and ash contact decreased with increased. The fat content was not consistent influenced. The final internal cooking temperatures had no effect on the proximate composition ($P>0.05$) of the pork loin.

Keyword: *Physico-chemical, internal temperature, longissimus dorsi*

Introduction

The supply of consumable animal protein is grossly inadequate, this fact has been repeatedly echoed over decades and as long as the situation needs improvements, no amount of emphasis to the effect can be overly laid. The 35g daily intake of animal protein per caput recommended by the Food and Agricultural Organisation has not been met in Africa (ILCA, 1980; FAO, 1986).

Meat is any flesh of an animal that is used for food. It is nutritious and highly attractive in appearance. There are different kinds of meat depending on the source from which they are obtained, for example, mutton from sheep, chevon from goat, beef from cattle and pork from pig. These various meat types vary slightly in their chemical compositions. The average proximate composition and caloric content of raw retail cut indicates that pork contains 56.74% moisture, 15-18% protein, 26.78% Fat, 0.8% Ash and about 30.8cal/g (Price and Scheweigert, 1971).

Many factors influence the customer's public decisions when selecting fresh meat products. Some of the important criteria that are considered when shopping at the retail market include cost, appearance and anticipated eating satisfaction. Once the initial purchase has been made, proper meat cookery becomes important and most importantly the cooking internal temperature due to its effect on the ultimate palatability characteristics (colour, flavour, juiciness and tenderness) of the end product.

Cooking has been known to bring about highly complex reactions, which have direct effects on the nutrients in the cooked product. The purpose of this study was to determine the effects of three final internal cooking temperatures on the physical, chemical and sensory characteristics of pork.

Materials and methods

Pork loin Longissimus dorsi, used for this experiment were collected from five matured pigs immediately after slaughter and stored at $-18^{o}C$ overnight. The meat were removed, allowed to thaw at room temperature and cut into fifteen (15) chops of an average weight of 300g. Chops were randomly allotted to three different internal temperature of 65, 75 or $85^{o}C$ and roast cooked in the oven until the desired internal cooking temperature is reached as indicated by a themocouple probe.

Cooking loss was determined as the different between precooked and post cooked weights and divided by precooked weight of meat and multiplied by 100.

A 10-member panel was used to adjudge for flavour, juiciness, tenderness and overall acceptability using a nine point hedonic scale did the sensory evaluation. One (1) corresponding to extremely dislike and nine (9) corresponding to extremely like. The objective tenderness was done using a Warner-Bratzler shear force. Moisture, protein, fat and ash content were determined on cooked meat samples using the AOAC (1990) method.

All the data obtained were subjected to analysis of variance and where significant, treatment means were separated using least significant difference (Steel and Torrie, 1980).

Results

Data in Table 1 shows the sensory and physical characteristics of pork loin roast cooked to three internal temperatures. Internal temperature had no significant effect ($P>0.05$) on taste scores for tenderness, juiciness and flavour but had effect on overall acceptability ($P<0.05$) pork loin roast cooked to an internal temperature of $85^{o}C$ had the highest cooking loss (25.78%) but lowest shear value (2.92kg). Nevertheless, there were no differences between temperatures ($P>0.05$) with regards to cooking loss and shear force value. In Table 2 significant ($P>0.05$) differences were not observed with regards to the various nutritional constituents of the roasted pork.

Discussion

The results for juiciness and tenderness are in general agreement with other published work showing that as final internal temperature is increased from about $60^{o}C$ to $80^{o}C$, both decline, but more pronounced in juiciness than tenderness (Fjelkner – Modig 1985; Simmons *et al.*, 1985).

The results for flavour were similar to those obtained by Heyman *et al.* (1990) in eight different roasted cuts showing an increase in pork flavour as final internal temperature increased.

The reduction in tenderness and juiciness as cooking temperature increases might be due to myofibrillar protein denaturation and structural changes in muscle which cause water to be expelled from tissue. At higher temperature, according to Bailey (1988), denaturation and shrinkage of endomysial and primysial collagen sheaths contributes to the loss of water and increase in toughness.

Table 1 *Physical and sensory characteristics of pork loin roast cooked to three internal temperatures*

	65°C	75°C	85°C
Shear values (kg)	2.98±071	3.15±0.87	2.92±0.93
Cooking Loss (%)	20.89±3.48	23.67±3.06	25.78±2.30
Tenderness	6.48±0.89	6.41±0.68	5.96±0.88
Juiciness	6.18±0.69	5.85±0.45	5.52±0.59
Flavour	6.41±0.42	6.55±0.52	6.96±0.53
Overall acceptability	6.56a±0.50 [a]	6.78ab±0.44 [ab]	7.07b±0.41 [b]

Means on same row with different superscripts differ significantly ($P<0.05$)

The release of more flavour components due to increased fat solubilization at higher temperature may have contributed to the improved pork flavour at higher cooking internal temperatures. Simoons *et al.* (1985) found that the increase in pork flavour is caused by a greater activity of the Maillard reaction and associated reactions involving muscle protein (amine groups), carbohydrates (reducing sugars such as free glucose) and lipids and their degradation products.

Although, there was no significant differences among the three internal temperatures for tenderness, juiciness and flavour, the pork roasted to the highest internal temperature (85°C) had the highest score of overall acceptability (7.07). This may not be unconnected with the fact that most Nigerians are used to eating meat cooked to high internal temperature.

Cooking loss was observed to increase with increased internal temperature. This result agrees with the results reported by Weir *et al.* (1963); Webb *et al.* (1969) and Pengilly and Harrison (1970) that cooking loss increase with increased cooking temperature.

The decreased in weight of cooked pork when compared to the raw pork may be attributed to the denaturation and shrinkage of endomysial and perimysial collagen sheaths, that results in loss of water at high temperature.

Increased internal temperature decreased moisture content may be due to the amount of intramuscular fat (marbling) in the meat and the rate of solubilization of the fat which is also influenced by pork thickness. While the decline in ash content may be due to the escape of some salts from the meat through drip loss.

Conclusion

Roasting of fresh pork loin to high internal temperature of 85°C was most acceptable to consumers even without adding salt or other ingredients. Furthermore, the decrease in moisture content as a result of cooking to high internal temperature increased the protein content of the loin roast.

Table 2 *Proximate composition of pork loin roast cooked to three internal temperatures*

	65°C	75°C	85°C
Moisture (%)	63.37	56.69	54.74
Protein (%)	69.75	71.92	72.14
Fat (%)	25.31	23.87	24.81
Ash (%)	4.26	4.20	3.08

References

A.O.A.C. 1990. *Official method of analysis of the Association of Official Analytical Chemist* (ed. Helrich). 15th ed. Virgina, U.S.A.

Bailey, A.J. 1988. Proc. 34th Int. Congr. *Meat Sci. Technol*; 152.

FAO 1986. **Food and Agricultural Organisation.** *African Agriculture, the next 25 years.* Food and Agricultural Organisation of the United Nation Rome, Italy.

Fjelkner Modig S., 1985. Sensory and Biophysical properties of pork. Swedish meat Research Institute. Kavilinge, Sweden.

Heymann, H., Hedrick, H.B. Karrasch, M.A. Eggeman, M.K., and Ellersiech, M.R. 1990. Sensory and Chemical characteristics of fresh pork roasts cooked to differ eat endpoint temperatures *J. Food Sci.* 55:613.

ILCA, 1980. International Livestock Centre for Africa. *Livestock production in Africa – the challenge*; P.7-14 in ILCA. The first year, Addis Ababa, Ethiopia.

Pengilly, C.I. and **Harrison D.L.** 1970. Effect of heat treatment on the acceptability of *Pork Technol.* 20:330.

Price, J.F. and **Schweigert B.S.** 1971. *The science of meat and products.* W.H. Freeman and Coy. San Francisco. U.S.A.

Simmon, S.I. Car, T.R. and **Mckeitech, J.K.** 1985. Effect of internal temperature and thickness on palatability of pork loin chops. *J. Food Sci.* 50:313-315.

Steel, R.G.S. and **Torrie, J.H.** 1980. *Principles and procedures of statistics,* New York, Mcgraw-Hill 137-269.

Webb, M.L., Webb, N.B., Cedarquist D. and **Bratzler L.J.** 1969. The effect of internal temperature and time of cooking on the palatability of pork loin roasts. *Food Technol.* 15:371.

Weir, C.E., Pohl, C., Aucrbach, E. and Wilsom, G.D. 1963. The effects of conditions upon the yield and palatability of pork loin roasts. *Food Technol.* 17:1567.

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