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DOCTORAL DISSERTATION REVIEW

Doctoral dissertation of **MSc Charles Odilichukwu R. Okpala** entitled “**The effect of marination process on meat quality in relation to the relevance of quality management in the agrifood sector**” was carried out under the supervision of Associate Professor Małgorzata Korzeniowska, Faculty of Biotechnology and Food Science, Wrocław University of Environmental and Life Sciences, and Professor Raquel P.F. Guiné, Politechnic Institute of Viseu, Portugal as second supervisor.

Formal basis: Resolution No. 25.2023.TZZ of the Discipline Council Food and Nutrition Technology of the Wrocław University of Environmental and Life Sciences of July 04, 2023.

Legal basis: Regulation of the Minister of Science and Higher Education of July 20, 2018 (Journal of Laws of 2023, item 742).

Wpływ procesu marynowania na jakość mięsa w kontekście znaczenia zarządzania jakością w sektorze rolno-spożywczym

1. The selection and meaning of the topic

Creating the quality of food products constitutes a challenge that the agrifood processing companies are taking up every day. The crucial determining factors provoking the need to modify already existing products and developing new ones, are primarily the changing expectations of the consumers, but also the need to meet the legal requirements, including hygiene standards. Consumers requirements concern not only the quality, used additives, ease of use, but more and more frequently they concentrate on the environmental effect of products and production itself. Therefore, quality management in the agrifood sector covers far more aspects compared to the initial phase of standardized quality management systems. However, the formative influence on food product quality is, invariably, the guarantee that the food will

not affect the consumer's health in any way provided it is prepared and/or consumed in accordance with its intended purpose. Following good practices is a prerequisite for ensuring food safety. Nevertheless, the awareness of good practices and most importantly, applying them by the workers at food-processing plants and distributors leaves much space for improvement.

Meat marination is one of the technological procedures influencing the sensory characteristics of food products, and therefore can contribute to the increased acceptability of products among the consumers. The addition of herbs and plants to marinades can positively affect the appearance, taste and smell of meat; its tenderness and consistency, while increasing the content of bioactive ingredients, and limiting the introduction of synthetic additives, which is very important in the context of the clean label and clean production trend.

MSc Charles Odilichukwu R. Okpala focused on the enhancement of marinated oven grilled meat processing in relation to the relevance of quality management in the agrifood sector. The author of the dissertation focused on the study of three types of meat: chicken breast, pork neck and beef entrecôte, most frequent choices of Polish consumers when it comes to grilling. He pointed out to the need for respecting good practices applied by the main participants of the food chain, i.e. slaughterhouses and food distributors in the process of providing the consumers with safe meat products.

In view of the above, the choice of dissertation topic is in good standing and fully justified. I believe that the subject matter is domain-relevant from the research and application point of view and falls within the scope of scientific discipline of food and nutrition technology.

2. Formal aspects of the work

The submitted dissertation was comprised in the form of a study consisting of six parts and attachments containing copies of eight scientific publications with statements about the percentage share of individual authors. The doctoral thesis is preceded by a summary in both, Polish and English and a list of abbreviations.

The thesis starts with the *Introduction* (8 pages), which describes the background of the study, including quality as a principal player in the agrifood industry, assuring and managing quality applicable to meat process technology and towards achieving optimization of meat products using marination preservation prospects. The second chapter *Research hypothesis/problem statement* (4 pages) contains the justification for the choice of the research topic in the context of food product development process as well as the staff knowledge as a key aspect of meat stakeholders supply chain. The chapter *Overall aim, and specific objectives of the study* (1 page) is the outline of the thesis and highlights research objectives. The fourth

chapter *Research methodology* (6 pages) presents the strategy of the literature study, methodology of experimental process, from the selection of meat products through the marination process and oven-grill activity including analytical determinations of the end product (chemical, physical and organoleptic attributes), as well as procedures used for the conducted surveys. The chapter entitled *Reflection on published works* (21 pages) contains a summary and additional reflections on each of the articles constituting the doctoral dissertation. The thesis ends with the *Summary and recommendation for future studies* (3 pages) and *References*.

The series of publications composing a doctoral dissertation is a thematically coherent collection of eight peer-reviewed scientific articles entitled “**The effect of marination process on meat quality in relation to the relevance of quality management in the agrifood sector**” includes:

A. Review papers:

1. Okpala, C.O.R., Imamou Hassani, M., Korzeniowska, M., Guiné, R.P.F. Enhancing the quality of animal meat products by combining plant-based marinades and thermal processes: A treatise. *Food Sci. Technol.* (Accepted 06.04.2023) (40 p. MES, IF = 1,718)
2. Okpala, C.O.R., Korzeniowska M. (2020). Concept, Content and Context Perspectives of Quality of Agrofood Products: Reflections an Some Consumer Decision-Making-Purchase Scenarios. *Front. Nutr.* 7, 578941. (70 p. MES, IF = 6,590)
3. Okpala, C.O.R., Korzeniowska M. (2023). Understanding the relevance of quality management in agro-food product industry: From ethical considerations to assuring food hygiene quality safety standards and its associated processes. *Food Rev. Int.* 39(4) 1879-1952. (100 p. MES, IF = 6,043)

B. Research papers:

4. Okpala, C.O.R., Juchniewicz, S., Leicht, K., Korzeniowska, M., Guiné, R.P.F. (2022). Antioxidant, Organoleptic and Physicochemical Changes in Different Marinated Oven-Grilled Chicken Breast. *Foods* 11(24), 3951. (100 p. MES, IF = 5,561)
5. Okpala, C.O.R., Juchniewicz, S., Leicht, K., Skendrović, H., Korzeniowska, M., Guiné, R.P.F. (2023). Quality attributes of different marinated oven-grilled pork neck meat. *Int. J. Food Prop.* 26(1), 453-470. (70 p. MES, IF = 3,388)

6. Okpala, C.O.R., Juchniewicz, S., Leicht, K., Korzeniowska, M., Guiné, R.P.F. (2023). Marinated oven-grilled beef entrecôte meat from a bovine farm: Evaluation of resultant physicochemical and organoleptic attributes. *Peer J.* 11, e15116 (100 p. MES, IF = 3,06)
7. Okpala, C.O.R., Nwobi, O.C., Korzeniowska, M. (2021). Assessing Nigerian Butchers' Knowledge and Perception of Good Hygiene and Storage Practices: A Cattle Slaughterhouse Case Analysis. *Foods* 10(6), 1165. (100 p. MES, IF = 5,561)
8. Okpala, C.O.R. (2023). Good Practices contributing to Cleaner Production? A Preliminary Survey Analysis involving Wroclaw-Poland Food Retail Sector. *Processes* 11(4), 1224. (40 p. MES, IF = 3,352)

The papers were published between 2020 and 2023 in journals from the Journal Citation Reports (JCR) list. According to the MES, six journals are assigned to the food and nutrition technology discipline.

Two of the journals were assigned to different scientific disciplines, i.e. *Processes* and *Peer J* were assigned, among others, to the disciplines of agriculture, horticulture and biotechnology. Including these publications among the achievements of Mr Okpala has been fully justified, since thematically they are closely related to food and nutrition technology.

The total number of MES points calculated according to the papers' publication date equals 620, the total IF is very high and equals 35,273. Mr Okpala is the first author and corresponding author in each of them. The other co-authors provided statements with description of their contributions to the research projects and manuscripts. They showed that Mr Okpala's involvement in the preparation of all papers was significant. In one case he is the only author. The original research papers included in the monothematic collection contain a detailed description of the research methodology, conducted experiments, and research results with their discussion, statistical analyses and conclusions with clear tables and figures.

A very comprehensive and reliable review of the source literature, where the author referred not only to technological processes but also to quality management systems and food safety (publications 1 - 3) is surely worth noticing.

The literature has been selected accordingly and thoroughly, it includes the most important articles from recent years and the so-called classics of the subject, which were not overlooked either in this extensive review.

Summing up, the dissertation meets the formal requirements for this type of work presented in the procedure for doctoral degree, i.e., it is experimental and contains all the necessary chapters arranged in a typical sequence.

3. Substantive evaluation of the dissertation

The title of Mr Okpala's doctoral dissertation was formulated correctly, and the issues discussed in the above- mentioned publications, included in the thesis, fully refer to it.

The series of publications composing a doctoral dissertation begins with the presentation of the current state of the art related to natural meat preservatives and thermal processes applied to marinated meat products (P1), as well as reflections on consumer purchasing decisions (P2) and a review of food quality and safety management systems (P3). It is worth noting that in all publications regarding the review of the current state of knowledge, the PhD student has summarized the most important information in tables, moreover the number of cited articles is impressive (319 articles in P3!).

The overall aim and specific objectives of the dissertation were defined concisely and correctly. However, certain insufficiency can be observed in the *Research hypothesis/problem statement* chapter. Author of the thesis defined the problem accordingly but he did not formulate any research hypotheses as suggested in the title of the chapter. They were not defined in the publications either. Please formulate the above mentioned research hypotheses and state whether and how they have been verified, and then present them during the public defence.

Publications 4-6 focus on the impact of marinades with different composition and concentration of active ingredients and the impact of grilling process on the physicochemical properties (L*a*b* colour test, cooking weight loss, textural cutting force, pH, TBARS), antioxidant power (ABTS, DPPH, FRAP) and sensorial acceptability of chicken breast, pork neck and beef entrecôte.

The set of experiments in all cases was identical, accurate and clearly stated. The research results were comprised in the form of clear graphs and tables in published articles. The chapter entitled *Reflections on published works* includes some additional comments of the author on each of the publications. However, it is lacking some comprehensive summary of this part of the research, in which it would be clearly articulated which distinguishing features underwent significant changes and how it relates to the acceptance of final product by the consumers.

What constituted the most important achievements of the author in the context of existing knowledge and how the conducted research contributed to its development? Taking into account the customer-oriented principle of quality management, please indicate which of the research results are important from the consumer's point of view, and which are of great importance to food companies and also, how they can be applied in real life.

Publications 7-8 include the results of surveys on the awareness of employees regarding food safety in slaughterhouses in Nigeria (P7) and store managers in Wroclaw (P8). Though survey results were statistically analysed and discussed in detail in the publications, there was no connection between them. Can the results concerning awareness of the slaughterhouse employees be compared to the situation in Poland in any way? And, analogically, can the results on employees in Poland be compared with the situation in other countries? In P8, the author stated that “Managers’/supervisors’ responses considered good practices as compulsory responsibility, which through this knowledge, they are able to elevate the environmental awareness of the consumer/customer who visit their food retail shops/stores”. Please, if you may, clarify the issue concerning the influence the store managers have on the selection of goods on store shelf. In what way can they contribute to consumer choices in large area and discount stores? I fully agree with the definition of cleaner production provided by the author which is as follows “it is the effective and efficient utilization of good practices to deliver high quality food retail products through environmentally-friendly as well as sustainable processes”. Please take a position and try to refer to the following question: who is responsible for that? Does it exclusively apply to the fact of following good practices by the participants of the food chain, or also to the ecological awareness of the consumers?

In the last chapter of the reviewed dissertation, the author quite briefly summarized the experimental part, especially the one regarding the experiment with meat marination. The link between good practices and quality management can be found in Figure 13, however, I missed pointing out the good practices during meat processing: preparing the marinades, marination and thermal processing. Aren’t they necessary at the production stage? The final part contains a set of accurate recommendations for further research offered by the author.

Despite the above-mentioned comments, I believe that all the specific objectives and, most importantly, the overall aim of the dissertation have been achieved.

To sum up, I would like to emphasize that the topics discussed in the paper are valid and important. I believe that the research conducted by Mr. Charles Okpala and the conclusions he had drawn, are of cognitive importance and undoubtedly enrich knowledge in the discipline of food and nutrition technology. The research itself and the analysis of empirical material prove that the PhD student has demonstrated the ability to properly plan and carry out research, to approach the problem comprehensively and analytically, and to draw the conclusions in a consistent way. The comments on dissertation made in the review do not depreciate its value in any way and are solely an element of scientific discussion.

Final conclusion

Summing up the whole review, it can be concluded that the doctoral dissertation demonstrates the candidate's general knowledge in the food and nutrition technology discipline and the ability to conduct research independently. The subject matter of the doctoral dissertation is an original solution to a scientific problem.

In my opinion, the doctoral dissertation of MSc Charles Odilichukwu R. Okpala entitled "The effect of marination process on meat quality in relation to the relevance of quality management in the agrifood sector" meets the requirements set out in Article 187 items 1-4 of the Act of 20 July 2018 The Law on Higher Education and Science (Journal of Laws 2023, no 742).

In view of the above, I hereby apply to the Discipline Council for Food and Nutrition Technology of the Wrocław University of Environmental and Life Science to admit Mr Charles O.R. Okpala to further stages of the doctoral procedure.

