RESPONSE
of the official opponent

Doctor of Technical Sciences, Associate Professor, Professor of the Department of Meat Technology of State Biotechnological University Onyshchenko Viacheslav Mykolaiovych for the dissertation work by Nan Haijuan on the topic «Development of low-fat meat products technology using edible mushrooms» which was submitted for obtaining a scientific degree of Doctor of Philosophy in speciality 181 «Food technology» (field of study 18 – Manufacturing and technology)

Relevance of the chosen theme and its connection with scientific programs, plans, and topics.

The central role of nutrition in improving human health has always set and continues to set actual challenges for the scientific community and practical circle of professionals in many fields and spheres of activity. With the account of modern trends in healthy eating, the contemporary specifics of the life cycle of food production (technogenic factors, comprehensive intensification of production, etc.), the increasing pace of life, and simultaneously the decrease in physical activity, special attention is given to the scientific substantiation, development, and improvement of food technologies in view of current needs, because the creation of food products that contribute to strengthening human health and preventing the development of diseases is an important and pressing problem in the food industry.

A significant amount of ready-to-eat meat products, including sausages with a high nutritional value, which are popular among the population, contain a considerable amount of fat (up to 30%). At the same time, the currently prevalent sedentary lifestyle exacerbates the risks associated with obesity and other gastrointestinal tract diseases. The recommended daily intake of total fat for a person following a 2000–2500 kcal/day diet equals, according to various estimates, approximately 70–75 grams. It is recommended that the combination of plant and animal fats be balanced at a ratio of 1:1 or 1/3:2/3. On the other hand, the functional-technological role of fat in forming the structural-mechanical and organoleptic properties, as well as in influencing quantitative indicators of the technology, is difficult to overestimate. Under these conditions, finding effective ways to create meat products with the reduced fat content, both overall and specifically animal fat, presents a challenging and highly relevant problem.

Based on the analysis of the progress in technology for producing low-fat products, the state of cultivated mushroom production and their use in the food industry, particularly considering the widespread cultivation and consumption of edible mushrooms like Ab (champignon), the dissertation author has theoretically forecasted and justified the relevance of research aimed at achieving the defined goal. Therefore, the relevance of the topic chosen by the author and its substantiation are beyond doubt.

The dissertation research is carried out in accordance with the main directions of scientific research of the Sumy National Agrarian University and the Henan Science and Technology Institute. The results obtained from the work are supported by the scientific and technical innovation project No. 224200510019 (Zhongyuan, 2021 and Henan Province, 2022), and the key scientific and technical research project No. 222102110179 «Development of low-fat chicken sausage with Agaricus bisporus and study of its mechanism of action».

The degree of scientific statements' validity, conclusions and recommendations formulated in the dissertation, and their reliability.

The results of experimental research confirm the necessary degree of substantiation of the scientific propositions are put forward by the author. The conclusions and recommendations formulated in the dissertation are sufficiently justified both from the perspective of modern scientific-theoretical positions of food science and from the standpoint of their practical feasibility in production conditions.

The substantiation of the scientific propositions is beyond doubt and is confirmed by the application of traditional standard and modern analytical, physicochemical, physical-mechanical, microbiological, biochemical, organoleptic research methods, as well as the use of modeling methods, systems analysis, experimental design, and mathematical-statistical processing of the obtained data. Particularly noteworthy are the methods used by the author, such as nuclear magnetic resonance, spectral, and rheological studies, which convincingly proved the results obtained in establishing the mechanism of interaction between Ab-mushroom and myofibrillar chicken protein.

The obtained results correlate with known data from related research. The new scientific results are confirmed by the validation of conclusions and recommendations at scientific-practical conferences. The main provisions of the dissertation are published in scientific professional journals in Ukraine and in periodic scientific publications indexed in the Web of Science Core Collection and Scopus databases.

The scientific novelty of the obtained results.

A novel scientific outcome of the dissertation is the substantiation of the of emulsion-structured meat products' technology improvement – boiled chicken sausages – with a reduced content of pork fat, using edible Ab-mushrooms and soybean oil. This approach ensures the formation of high consumer properties of the finished product, creates the conditions for promoting human health, preventing the development of diseases, and industrial production of a wide range of health food products.

A series of new regularities concerning the impact of the introduction (partial replacement of animal fat) of complex fat substitutes like Ab mushroom and soybean oil, as well as technological factors, on the characteristics of chicken mince, which include improvements in gel properties, rheological properties, moisture distribution, and microstructure of chicken mince, consistency, color, oxidation potential, pH, and microbiological indicators of chicken sausages with reduced pork fat content, including during storage are discovered.

The candidate's perso nal contribution lies in the analysis of the scientific problem and formulation of the aim and objectives of the research, development of the research program and methodology, in planning, organization, and conducting experimental work, in the analysis, processing, and summarization of the obtained data, formulation of conclusions, and preparation of materials for publication, validation of scientific research at scientific-practical conferences and development of normative and technological documentation for chicken sausages with the reduced pork fat content.

The specific personal contribution of the candidate in the scientific works published with co-authors is indicated in the list of published works on the topic of the dissertation.

The completion of the set scientific task and the mastery of the methodology of scientific activity by the candidate is demonstrated at a fairly high level.

Practical value of the obtained results.

The technology for chicken mince and sausages based on it with low pork fat content, using Ab mushroom and soybean oil as substitutes for pork fat, are developed and tested. The range of emulsion-structured meat products has been expanded, which creates conditions for strengthening human health and preventing the development of diseases.

An instruction standardizing the technological process for the production of chicken sausages with low pork fat content is developed and approved. The results obtained form the basis for the development of new technologies and the industrial production of low-fat products based on poultry meat of emulsion structure with Ab mushroom and soybean oil.

The economic efficiency of innovative technological solutions is proven.

The completeness of the presentation of the scientific provisions of the dissertation in published works.

The dissertation materials have been sufficiently published.

The main materials of the dissertation are published in 15 scientific works, including: 1 monograph; 8 articles, of which 5 are in scientific professional journals included in the scientometric databases Scopus and Web of Science Core Collection (among them, 3 articles in Ukrainian journals included in category A list, and 2 articles in journals of other countries), 3 articles in scientific professional journals of Ukraine included in the category B list; 6 abstracts and materials of reports at scientific-practical conferences.

Academic integrity.

No violations of academic integrity (academic plagiarism, fabrication, falsification) in the dissertation and scientific publications, which highlight the main scientific results of the dissertation research of Nan Haijuan, were detected.

The work does not contain incorrect borrowings. The use of ideas, results and texts of other authors are linked to the appropriate source.

The design of the work corresponds to the «Requirements for the design of the dissertation», approved by the Order of the Ministry of Education and Science of Ukraine dated January 12, 2017 No. 40.

Remarks on the dissertation work.

1. It is not clear why the author has narrowed the scope of the research (stating it as gels made from chicken meat with reduced fat content using Ab mushroom as a fat substitute), whereas the research object in the work is defined as the technology of chicken meat product with reduced fat content using Ab mushroom as a fat substitute.

2. In the statement of the scientific novelty of the research (second and third paragraphs), the author combines it with a practical component, which, in my opinion, should be placed in the section of practical significance. On the other hand, the statement of practical significance of the research should have included the presence of the developed and approved technological documentation (provided in the appendix).

3. In my opinion, based on the content of the work, such keywords as «quality of chicken meat», «semi-finished products» are not quite appropriate; it would be better to add «soybean oil», «chicken mince», etc., as the regulated range of the number of keywords is from five to fifteen.

4. It would be desirable to adhere to the traditional presentation of recipes. In particular, separate submission of the main non-salted raw materials (kg/100 kg), spices, and ice water for cutter mixing.

5. Based on the recipe for chicken sausages with Ab-mushroom powder (table 2.4 of the dissertation), the total fat content (pork and soybean oil) for all experimental samples is 18%, while the basic recipe contains 20% exclusively of pork fat. With such data, in my opinion, it would be more correct to indicate not a reduced fat content but a replacement of animal (pork) fat with vegetable fat, which brings the resulting product closer to a meat-vegetable product.

6. Regarding the amount of starch in the recipe, it remains a constant 5% (relative to the meat mince) regardless of the presented variants, while the ratio of pork fat to the mixture of soybean oil and mushrooms varies (%) from 20/0+0 to 2/6+12. An explanation is required.

An additional explanation is also required on why exactly 20% (by weight of the meat mince) of ice water is added.

7. The technological scheme for the production of chicken sausages (fig. 4.7) would be better presented with a distribution by systems and subsystems.

8. It is not clear on what basis the author chose a 35-day experimental storage period for chicken sausages for the studies.

9. For the sausage casings, the author has chosen collagen in the presented study, but their characteristics (edible, non-edible, permeability, etc.) are not specified. The quantitative indicators of sausage technology significantly differ depending on the types of casings used, for example, permeable and impermeable.

10. In my opinion, the work would have benefited if the author's efforts were directed towards conducting research on a broader range of meat-vegetable products with an emulsion structure based on the proposed main raw materials.

11. Considering the new technological solutions obtained, it would be appropriate to acquire a corresponding protective document for the intellectual property object.

The aforementioned comments do not diminish the overall positive assessment of the work.

Conclusion on the dissertation work.

Based on the analysis of the work, I believe that Nan Haijuan's dissertation on the theme «Development of low-fat meat products technology using edible mushrooms» is a qualified, completed, independently conducted scientific work. It contains new, scientifically substantiated results of the research conducted by the candidate, which fulfill a specific scientific task – the justification of improving the technology of emulsion-structured meat products – boiled chicken sausages – with reduced pork fat content using edible Ab-mushrooms and soybean oil. This ensures the formation of high consumer properties of the finished product, creates conditions for promoting human health, preventing the development of diseases, and the industrial production of a wide range of healthy food products, which is of significant importance for food technologies as a field of knowledge.

The dissertation «Development of low-fat meat products technology using edible mushrooms» in terms of volume and content, relevance, scientific novelty, practical significance, substantiation and probability of scientific positions, their authenticity, and completeness of presentation in scientific professional publications meets the requirements of the «Procedure for awarding the degree of Doctor of Philosophy and revocation of the decision of the one-time specialized scientific council of the higher education institution, scientific institution on awarding the degree of Doctor of Philosophy», approved by the resolution of the Cabinet of Ministers of Ukraine on 12.01.2022, No. 44. Its author, Nan Haijuan, deserves to be awarded the degree of Doctor of Philosophy in the speciality 181 «Food technology», field of study 18 – Manufacturing and technology.

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Підпис Онищенка В.М. засвідчую:
т.в.о. начальника відділу кадрів Харчевнікова М.С.