foods

Article

Hemp Seed Cake Flour as a Source of Proteins, Minerals and Polyphenols and Its Impact on the Nutritional, Sensorial and Technological Quality of Bread

Tatiana Capcanari *, Eugenia Covaliov, Cătălina Negoița, Rodica Siminiuc, Aurica Chirsanova, Vladislav Reșitca and Dinu Țurcanu

Faculty of Food Technology, Technical University of Moldova, 9/9 Studentilor St., MD-2045 Chisinau, Moldova; eugenia.covaliov@toap.utm.md (E.C.); catalina.cerchez@toap.utm.md (C.N.); rodica.siminiuc@adm.utm.md (R.S.); aurica.chirsanova@toap.utm.md (A.C.); vladislav.resitca@adm.utm.md (V.R.); dinu.turcanu@adm.utm.md (D.Ț.)
* Correspondence: tatiana.capcanari@toap.utm.md

Abstract: Hemp (*Cannabis sativa* L.) seeds contain a high concentration of proteins and biologically active compounds. The protein content is even higher in case of lipid part removal in oil production. The remaining part is considered a leftover, usually being used in animal feed. The aim of this study was to investigate the physicochemical composition of hemp seed cake flour, its nutritional quality and its impact on bread quality parameters. The properties of hemp seed cake flour were assessed in terms of protein quality, mineral composition, polyphenols and antioxidant activity. Hemp seed cake proved to be an important source of high-quality protein (31.62% d.m.) with the presence of eight essential amino acids. The biologically active potential of hemp seed cake has been demonstrated by the high content of polyphenols, especially those from the Cannabisin group. Hemp seed cake flour was incorporated in wheat flour at levels from 5 to 40% (*w*/*w*) to investigate its influence on bread quality parameters. The addition of hemp seed cake flour increased the total phenol content of bread, thus greatly enhancing the antioxidant activity. The protein content of bread was found to be enhanced from 11.11% d.m (control sample) to 18.18% d.m (for sample with 40% hemp seed cake flour). On the other hand, the addition of hemp seed cake flour led to decreased bread porosity, increased hardness and decreased resilience in the seed cake. Although, all bread samples recorded sensorial attributes ranging between "slightly like" and "like it very much".

Keywords: *Cannabis sativa* L.; hemp seed cake flour; bread; protein; amino acids; phenols; antioxidant activity; sensorial acceptance; CATA

Citation: Capcanari, T.; Covaliov, E.; Negoița, C.; Siminiuc, R.; Chirsanova, A.; Reșitca, V.; Țurcanu, D. Hemp Seed Cake Flour as a Source of Proteins, Minerals and Polyphenols and Its Impact on the Nutritional, Sensorial and Technological Quality of Bread. *Foods* **2023**, *12*, 4327. https://doi.org/10.3390/foods12234327

Academic Editor: João Miguel F. Rocha

Received: 6 November 2023
Revised: 20 November 2023
Accepted: 24 November 2023
Published: 29 November 2023

1. Introduction

Food has always been a basic necessity, but it is also often a pleasure that prompts people to buy more and more products, whether or not it is necessary [1,2]. In a world where food waste is becoming a "normality", the problem of the resulting waste is increasingly pronounced, and the consequences for the environment are not at all negligible [3–5]. Food waste is among the main sources of environmental pollution and can also be an ethical issue in terms of global hunger [6–9]. For these reasons, correct food waste management must be a significant objective for consumers and companies operating in this industry [10–12].

Hemp (*Cannabis sativa* L.) is a low-cost, unconventional feed resource with a unique phytochemical composition and various uses (pharmaceutical industry, food industry, etc.) [13–15]. However, it has long been controversial because of the confusion about the health risk due to the increased content of hallucinogenic substances (tetrahydrocannabiol, THC) [16,17]. Taking as a starting point the multiple therapeutic effects ascribed to the content in active biocompounds and the content of THC below the toxicity limits (≥0.2%), the use of industrial (*Cannabis sativa* L.) hemp has been rethought and acquired new valences [18–21]. More than that, starting in January 2023, the new Common Agricultural

Policy (CAP), adopted by European Council and the European Parliament, entered into force. The new CAP stipulated that the permitted THC level in hemp products was raised from 0.2% to 0.3% [22,23]. Hemp seeds stand out due to their fairly high protein content (22.17%) with high biological value, reflected in a high essential amino acid content [24–26]. Equally, hemp seeds have a high energy value due to their fat content (26.25% (*w*/*w*) to 37.50%), to which the beneficial fatty acid structure is added. Nowadays, the by-products or leftovers of hemp seeds (cakes from oil factories) are unutilized for human consumption, being used in animal feed [27–29]. However, hemp seed cake contains up to 50% proteic substances, 9–20% lipids, 6–7% dietary fibre, important amounts of minerals and could be successfully used in the manufacture of food products for human consumption [30–34].

Bread has been an important staple food product to many cultures over the centuries [35,36]. It is referred to as the "staff of life" in the *Bible* and it is still the most eaten product in some regions [37]. On the other hand, several studies have found a significant relation between bread consumption and body weight, abdominal fat distribution, high postprandial glucose, etc. [38–41]. This may be attributed to the fact that nowadays most bread is refined, with a low content of fibre and vitamins, thus providing quick and easily digestible carbohydrates. Thus, people are encouraged to restrict bread from their diet or to give preference to breads enriched with fibres, proteins and other biologically active compounds [41–43]. As a result of these considerations, consumer demands have increased; they want their bakery products to have a satisfying taste and texture, while respecting nutritional health trends [42,44]. To satisfy all these attributes, in the challenging global context, the bakery industry has to face many challenges [45,46]. Thus, innovative solutions are sought to be able to provide distribution networks with tasty and nutritious bakery products, which keep their freshness longer and which are obtained using sustainable means [47–50].

Therefore, the objective of this study was to evaluate the nutritional and biological value of hemp (*Cannabis sativa* L.) seed cake and therefore the impact of the wheat flour substitution by hemp seed cake on the sensory, physicochemical, textural and technological characteristics of bread.

References

1. Bublitz, M.G.; Peracchio, L.A.; Block, L.G. Why Did I Eat That? Perspectives on Food Decision Making and Dietary Restraint. *J. Consum. Psychol.* **2010**, *20*, 239–258. [CrossRef]
2. Sommer, I.; MacKenzie, H.; Venter, C.; Dean, T. Factors Influencing Food Choices of Food-Allergic Consumers: Findings from Focus Groups. *Allergy* **2012**, *67*, 1319–1322. [CrossRef] [PubMed]
3. Gollnhofer, J.F. Normalising Alternative Practices: The Recovery, Distribution and Consumption of Food Waste. *J. Mark. Manag.* **2017**, *33*, 624–643. [CrossRef]
4. Barone, A.M.; Grappi, S.; Romani, S. "The Road to Food Waste Is Paved with Good Intentions": When Consumers' Goals Inhibit the Minimization of Household Food Waste. *Resour. Conserv. Recycl.* **2019**, *149*, 97–105. [CrossRef]
5. Saputro, W.A.; Purnomo, S.; Salamah, U. Study of Food Waste of Farmers' Households in Klaten to Support Food Security. *Anjoro* **2021**, *2*, 58–64. [CrossRef]
6. Grizzetti, B.; Pretato, U.; Lassaletta, L.; Billen, G.; Garnier, J. The Contribution of Food Waste to Global and European Nitrogen Pollution. *Environ. Sci. Policy* **2013**, *33*, 186–195. [CrossRef]
7. Torres-León, C.; Ramírez-Guzman, N.; Londoño-Hernandez, L.; Martinez-Medina, G.A.; Díaz-Herrera, R.; Navarro-Macias, V.; Alvarez-Pérez, O.B.; Picazo, B.; Villarreal-Vázquez, M.; Ascacio-Valdes, J.; et al. Food Waste and Byproducts: An Opportunity to Minimize Malnutrition and Hunger in Developing Countries. *Front. Sustain. Food Syst.* **2018**, *2*, 52. [CrossRef]
8. Chu, Z.; Fan, X.; Wang, W.; Huang, W. Quantitative Evaluation of Heavy Metals' Pollution Hazards and Estimation of Heavy Metals' Environmental Costs in Leachate during Food Waste Composting. *Waste Manag.* **2019**, *84*, 119–128. [CrossRef]
9. Karandish, F.; Hoekstra, A.Y.; Hogeboom, R.J. Reducing Food Waste and Changing Cropping Patterns to Reduce Water Consumption and Pollution in Cereal Production in Iran. *J. Hydrol.* **2020**, *586*, 124881. [CrossRef]
10. Corrado, S.; Sala, S. Food Waste Accounting along Global and European Food Supply Chains: State of the Art and Outlook. *Waste Manag.* **2018**, *79*, 120–131. [CrossRef]
11. Lin, Z.; Ooi, J.K.; Woon, K.S. An Integrated Life Cycle Multi-Objective Optimization Model for Health-Environment-Economic Nexus in Food Waste Management Sector. *Sci. Total Environ.* **2022**, *816*, 151541. [CrossRef] [PubMed]
12. Deng, Y.; Shi, Y.; Huang, Y.; Xu, J. An Optimization Approach for Food Waste Management System Based on Technical Integration under Different Water/Grease Proportions. *J. Clean. Prod.* **2023**, *394*, 136254. [CrossRef]
13. Rehman, M.S.U.; Rashid, N.; Saif, A.; Mahmood, T.; Han, J.-I. Potential of Bioenergy Production from Industrial Hemp (*Cannabis sativa*): Pakistan Perspective. *Renew. Sustain. Energy Rev.* **2013**, *18*, 154–164. [CrossRef]

14. Morin-Crini, N.; Loiacono, S.; Placet, V.; Torri, G.; Bradu, C.; Kostić, M.; Cosentino, C.; Chanet, G.; Martel, B.; Lichtfouse, E.; et al. Hemp-Based Adsorbents for Sequestration of Metals: A Review. *Environ. Chem. Lett.* **2019**, *17*, 393–408. [CrossRef]
15. Crini, G.; Lichtfouse, E.; Chanet, G.; Morin-Crini, N. Traditional and New Applications of Hemp. In *Sustainable Agriculture Reviews 42*; Sustainable Agriculture Reviews; Crini, G., Lichtfouse, E., Eds.; Springer International Publishing: Cham, Switzerland, 2020; Volume 42, pp. 37–87. ISBN 978-3-030-41383-5.
16. Agrawal, A.; Lynskey, M.T. Cannabis Controversies: How Genetics Can Inform the Study of Comorbidity: Genetics of Cannabis Comorbidities. *Addiction* **2014**, *109*, 360–370. [CrossRef]
17. Miller, L.L. *Marijuana*; Effects on Human Behavior; Academic Press: New York, NY, USA, 1974; ISBN 978-0-12-497050-2.
18. Greydanus, D.E.; Hawver, E.K.; Greydanus, M.M.; Merrick, J. Marijuana: Current Concepts. *Front. Public Health* **2013**, *1*, 42. [CrossRef] [PubMed]
19. Sorrentino, G. Introduction to Emerging Industrial Applications of Cannabis (*Cannabis sativa* L.). *Rend. Lincei Sci. Fis. Nat.* **2021**, *32*, 233–243. [CrossRef]
20. Simiyu, D.C.; Jang, J.H.; Lee, O.R. Understanding *Cannabis sativa* L.: Current Status of Propagation, Use, Legalization, and Haploid-Inducer-Mediated Genetic Engineering. *Plants* **2022**, *11*, 1236. [CrossRef]
21. Fabre, A.-J. Cannabis, hemp and hashish: Always returning. *Hist. Sci. Med.* **2006**, *40*, 191–202.
22. Regulation 2021/2115—Rules on Support for Strategic Plans to Be Drawn up by Member States under the Common Agricultural Policy (CAP Strategic Plans) and Financed by the European Agricultural Guarantee Fund (EAGF) and by the European Agricultural Fund for Rural Development (EAFRD)—EU Monitor. Available online: https://www.eumonitor.eu/9353000/1/j4nvk6yhcbpeywk_j9vvik7m1c3gyxp/vlok8fwdhhzj (accessed on 17 November 2023).
23. European Monitoring Centre for Drugs and Drug Addiction. *Cannabis Laws in Europe: Questions and Answers for Policymaking*; Publications Office: Luxembourg, 2023.
24. Kriese, U.; Schumann, E.; Weber, W.E.; Beyer, M.; Brühl, L.; Matthäus, B. Oil Content, Tocopherol Composition and Fatty Acid Patterns of the Seeds of 51 *Cannabis sativa* L. Genotypes. *Euphytica* **2004**, *137*, 339–351. [CrossRef]
25. Razmaitė, V.; Pileckas, V.; Bliznikas, S.; Šiukščius, A. Fatty Acid Composition of *Cannabis sativa*, *Linum usitatissimum* and *Camelina sativa* Seeds Harvested in Lithuania for Food Use. *Foods* **2021**, *10*, 1902. [CrossRef]
26. Taaifi, Y.; Benmoumen, A.; Belhaj, K.; Aazza, S.; Abid, M.; Azeroual, E.; Elamrani, A.; Mansouri, F.; Serghini Caid, H. Seed Composition of Non-industrial Hemp (*Cannabis sativa* L.) Varieties from Four Regions in Northern Morocco. *Int. J. Food Sci. Technol.* **2021**, *56*, 5931–5947. [CrossRef]
27. Pojić, M.; Mišan, A.; Sakač, M.; Dapčević Hadnađev, T.; Šarić, B.; Milovanović, I.; Hadnađev, M. Characterization of Byproducts Originating from Hemp Oil Processing. *J. Agric. Food Chem.* **2014**, *62*, 12436–12442. [CrossRef] [PubMed]
28. Klir, Ž.; Novoselec, J.; Antunović, Z. An Overview on the Use of Hemp (*Cannabis sativa* L.) in Animal Nutrition. *Poljoprivreda* **2019**, *25*, 52–61. [CrossRef]
29. Mirpoor, S.F.; Giosafatto, C.V.L.; Porta, R. Biorefining of Seed Oil Cakes as Industrial Co-Streams for Production of Innovative Bioplastics. A Review. *Trends Food Sci. Technol.* **2021**, *109*, 259–270. [CrossRef]
30. Teterycz, D.; Sobota, A.; Przygodzka, D.; Łysakowska, P. Hemp Seed (*Cannabis sativa* L.) Enriched Pasta: Physicochemical Properties and Quality Evaluation. *PLoS ONE* **2021**, *16*, e0248790. [CrossRef] [PubMed]
31. Merlino, M.; Tripodi, G.; Cincotta, F.; Prestia, O.; Miller, A.; Gattuso, A.; Verzera, A.; Condurso, C. Technological, Nutritional, and Sensory Characteristics of Gnocchi Enriched with Hemp Seed Flour. *Foods* **2022**, *11*, 2783. [CrossRef] [PubMed]
32. Zając, M.; Guzik, P.; Kulawik, P.; Tkaczewska, J.; Florkiewicz, A.; Migdał, W. The quality of pork loaves with the addition of hemp seeds, de-hulled hemp seeds, hemp protein and hemp flour. *LWT* **2019**, *105*, 190–199. [CrossRef]
33. Nakov, G.; Trajkovska, B.; Atanasova-Pancevska, N.; Daniloski, D.; Ivanova, N.; Lučan Čolić, M.; Jukić, M.; Lukinac, J. The Influence of the Addition of Hemp Press Seed cake Flour on the Properties of Bovine and Ovine Yoghurts. *Foods* **2023**, *12*, 958. [CrossRef]
34. Boaghi, E.; Capcanari, T.; Mija, N.; Deseatnicova, O.; Opopol, N. The Evolution of Food Products Consumption in Republic of Moldova in the Demographic Transition Period. *J. Eng. Sci.* **2018**, *25*, 74–81. [CrossRef]
35. Figueroa, L.M. The Staff of Life: Wheat and 'Indian Bread' in the New World. *Colon. Lat. Am. Rev.* **2010**, *19*, 301–322. [CrossRef]
36. Wilkins, J.; Hill, S. *Food in the Ancient World*; Ancient cultures; Blackwell Pub: Malden, MA, USA; Oxford, UK; Carlton, Victoria, Australia, 2006; ISBN 978-0-631-23550-7.
37. Sandvik, P.; Kihlberg, I.; Lindroos, A.K.; Marklinder, I.; Nydahl, M. Bread Consumption Patterns in a Swedish National Dietary Survey Focusing Particularly on Whole-Grain and Rye Bread. *Food Nutr. Res.* **2014**, *58*, 24024. [CrossRef]
38. Juntunen, K.S.; Niskanen, L.K.; Liukkonen, K.H.; Poutanen, K.S.; Holst, J.J.; Mykkänen, H.M. Postprandial Glucose, Insulin, and Incretin Responses to Grain Products in Healthy Subjects. *Am. J. Clin. Nutr.* **2002**, *75*, 254–262. [CrossRef]
39. Najjar, A.M.; Parsons, P.M.; Duncan, A.M.; Robinson, L.E.; Yada, R.Y.; Graham, T.E. The Acute Impact of Ingestion of Breads of Varying Composition on Blood Glucose, Insulin and Incretins Following First and Second Meals. *Br. J. Nutr.* **2008**, *101*, 391–398. [CrossRef]
40. Bautista-Castaño, I.; Serra-Majem, L. Relationship between Bread Consumption, Body Weight, and Abdominal Fat Distribution: Evidence from Epidemiological Studies. *Nutr. Rev.* **2012**, *70*, 218–233. [CrossRef]
41. Serra-Majem, L.; Bautista-Castaño, I. Relationship between Bread and Obesity. *Br. J. Nutr.* **2015**, *113*, S29–S35. [CrossRef] [PubMed]

42. Mohammadifard, N.; Khaje, M.-R.; Sarrafzadegan, N.; Sajjadi, F.; Alikhasi, H.; Maghroun, M.; Iraji, F.; Ehteshami, S. Healthy Bread Initiative: Methods, Findings, and Theories—Isfahan Healthy Heart Program. *J. Health Popul. Nutr.* **2013**, *31*, 49–57. [CrossRef] [PubMed]
43. Lockyer, S.; Spiro, A. The Role of Bread in the UK Diet: An Update. *Nutr. Bull.* **2020**, *45*, 133–164. [CrossRef]
44. Ktenioudaki, A.; Gallagher, E. Recent Advances in the Development of High-Fibre Baked Products. *Trends Food Sci. Technol.* **2012**, *28*, 4–14. [CrossRef]
45. Cappelli, A.; Cini, E. Challenges and Opportunities in Wheat Flour, Pasta, Bread, and Bakery Product Production Chains: A Systematic Review of Innovations and Improvement Strategies to Increase Sustainability, Productivity, and Product Quality. *Sustainability* **2021**, *13*, 2608. [CrossRef]
46. Siddiqui, S.A.; Mahmud, M.M.C.; Abdi, G.; Wanich, U.; Farooqi, M.Q.U.; Settapramote, N.; Khan, S.; Wani, S.A. New Alternatives from Sustainable Sources to Wheat in Bakery Foods: Science, Technology, and Challenges. *J. Food Biochem.* **2022**, *46*, e14185. [CrossRef]
47. Virginio, C.D.; Garcia, C.; Cruz, A.; Galon, A.; Hizon, J.S.; Vigonte, F.; Malang, B. Overcoming Challenges in the Quality Service and Production of a Bakery Business: A Literature Review. *SSRN J.* **2022**, 1–12. [CrossRef]
48. Chirsanova, A.; Reșitca, V.; Siminiuc, R.; Suhodol, N.; Popovici, C.; Deseatnicova, O.; Capcanari, T.; Gutium, O.; Covaliov, E.; Grosu, C.; et al. *Produse Alimentare Inovative*; Universitatea Tehnică a Moldovei: Chișinău, Moldova, 2021; ISBN 978-9975-45-704-0.
49. Covaliov, E.; Capcanari, T.; Resitca, V.; Chirsanova, A. Quality Evaluation of Sponge Seed cake with Milk Thistle (*Silybum marianum* L.) Seed Powder Addition. *Ukr. Food J.* **2023**, *12*, 7–20. [CrossRef]
50. Capcanari, T.; Chirsanova, A.; Covaliov, E.; Radu, O.; Siminiuc, R. Pastry Sauce with Carob (*Ceratonia siliqua*) Powder. *Ukr. Food J.* **2022**, *11*, 235–258. [CrossRef]
51. Ramos, L.; Alonso-Hernando, A.; Martínez-Castro, M.; Morán-Pérez, J.A.; Cabrero-Lobato, P.; Pascual-Maté, A.; Téllez-Jiménez, E.; Mujico, J.R. Sourdough Biotechnology Applied to Gluten-Free Baked Goods: Rescuing the Tradition. *Foods* **2021**, *10*, 1498. [CrossRef] [PubMed]
52. Di Cagno, R.; De Angelis, M.; Lavermicocca, P.; De Vincenzi, M.; Giovannini, C.; Faccia, M.; Gobbetti, M. Proteolysis by Sourdough Lactic Acid Bacteria: Effects on Wheat Flour Protein Fractions and Gliadin Peptides Involved in Human Cereal Intolerance. *Appl. Environ. Microbiol.* **2002**, *68*, 623–633. [CrossRef] [PubMed]
53. Siminiuc, R.; Țurcanu, D. Impact of Artisanal Technologies on the Quality Indices of the Cozonac. *Food Syst.* **2020**, *3*, 25–31. [CrossRef]
54. Siminiuc, R.; Țurcanu, D. Technological Approaches Applied in the Design of Gluten-Free Bakery Products. *Czech J. Food Sci.* **2023**, *41*, 155–172. [CrossRef]
55. Lau, S.W.; Chong, A.Q.; Chin, N.L.; Talib, R.A.; Basha, R.K. Sourdough Microbiome Comparison and Benefits. *Microorganisms* **2021**, *9*, 1355. [CrossRef]
56. Dapčević-Hadnađev, T.; Tomić, J.; Škrobot, D.; Šarić, B.; Hadnađev, M. Processing Strategies to Improve the Breadmaking Potential of Whole-Grain Wheat and Non-Wheat Flours. *Discov. Food* **2022**, *2*, 11. [CrossRef]
57. Moran, C.A.; Scholten, R.H.J.; Tricarico, J.M.; Brooks, P.H.; Verstegen, M.W.A. Fermentation of Wheat: Effects of Backslopping Different Proportions of Pre-Fermented Wheat on the Microbialand Chemical Composition. *Arch. Anim. Nutr.* **2006**, *60*, 158–169. [CrossRef]
58. Siminiuc, R.; Cosciug, L.; Rubțov, S.; Balan, I.; Vidrașco, A. Qualityindexes of Spontaneous Flora Sourdough of Different Flours. In *Modern Technologies in the Food Industry*; Tehnica-Info: Chisinau, Moldova, 2014; pp. 287–292.
59. AACC. *International Approved Methods of American Association of Cereal Chemists*, 10th ed.; American Association of Cereal Chemists: St. Paul, MN, USA, 2000.
60. Decision of the Government of the Republic of Moldova No. 68 of 29.01.2009. Regarding the Approval of the Technical Regulations "Flour, Semolina and Cereal Bran". 2009. Available online: https://www.Legis.Md/Cautare/getResults?Doc_id=22139&lang=ro (accessed on 30 September 2023).
61. Association of Official Analytical Chemists (AOAC). *Official Methods of Analysis*, 3rd ed.; Association of Official Analytical Chemists: Washington, DC, USA, 2002.
62. Dodok, L.; Modhir, A.A.; Buchtová, V.; Halásová, G.; Poláček, I. Importance and utilization of amaranth in food industry. Part 2. Composition of amino acids and fatty acids. *Nahrung* **1997**, *41*, 108–110. [CrossRef]
63. Food and Agriculture Organization of the United Nations. *Dietary Protein Quality Evaluation in Human Nutrition: Report of an FAO Expert Consultation, 31 March–2 April 2011, Auckland, New Zealand*; Food and Agriculture Organization of the United Nations, Ed.; FAO food and nutrition paper; Food and Agriculture Organization of the United Nations: Rome, Italy, 2013; ISBN 978-92-5-107417-6.
64. Kowalczewski, P.Ł.; Olejnik, A.; Białas, W.; Rybicka, I.; Zielińska-Dawidziak, M.; Siger, A.; Kubiak, P.; Lewandowicz, G. The Nutritional Value and Biological Activity of Concentrated Protein Fraction of Potato Juice. *Nutrients* **2019**, *11*, 1523. [CrossRef] [PubMed]
65. James, C.S. *Analytical Chemistry of Foods*; Springer: Boston, MA, USA, 1995; ISBN 978-1-4613-5905-0.
66. European Food Safety Authority (EFSA). Dietary Reference Values for Nutrients Summary Report. *EFS3* **2017**, *14*, e15121E. [CrossRef]

67. Rumeus, I.; Turtoi, M. Influence of Sourdough Use on Rope Spoilage of Wheat Bread. *J. Agroaliment. Process. Technol.* **2013**, *19*, 94–98.
68. Lu, T.-M.; Lee, C.-C.; Mau, J.-L.; Lin, S.-D. Quality and Antioxidant Property of Green Tea Sponge Cake. *Food Chem.* **2010**, *119*, 1090–1095. [CrossRef]
69. Hussain, M.; Saeed, F.; Niaz, B.; Afzaal, M.; Ikram, A.; Hussain, S.; Mohamed, A.A.; Alamri, M.S.; Anjum, F.M. Biochemical and Nutritional Profile of Maize Bran-enriched Flour in Relation to Its End-use Quality. *Food Sci. Nutr.* **2021**, *9*, 3336–3345. [CrossRef]
70. Young, L.S. Applications of Texture Analysis to Dough and Bread. In *Breadmaking*; Elsevier: Amsterdam, The Netherlands, 2012; pp. 562–579, ISBN 978-0-85709-060-7.
71. Makkar, H.P.S. Measurement of Total Phenolics and Tannins Using Folin-Ciocalteu Method. In *Quantification of Tannins in Tree and Shrub Foliage*; Springer: Dordrecht, The Netherlands, 2003; pp. 49–51, ISBN 978-90-481-6428-8.
72. Lin, J.; Zhou, W. Role of Quercetin in the Physicochemical Properties, Antioxidant and Antiglycation Activities of Bread. *J. Funct. Foods* **2018**, *40*, 299–306. [CrossRef]
73. Flander, L.; Salmenkallio-Marttila, M.; Suortti, T.; Autio, K. Optimization of Ingredients and Baking Process for Improved Wholemeal Oat Bread Quality. *LWT-Food Sci. Technol.* **2007**, *40*, 860–870. [CrossRef]
74. Elía, M. A Procedure for Sensory Evaluation of Bread: Protocol Developed by a Trained Panel: Bread Sensory Analyses. *J. Sens. Stud.* **2011**, *26*, 269–277. [CrossRef]
75. Biró, B.; Sipos, M.A.; Kovács, A.; Badak-Kerti, K.; Pásztor-Huszár, K.; Gere, A. Cricket-Enriched Oat Biscuit: Technological Analysis and Sensory Evaluation. *Foods* **2020**, *9*, 1561. [CrossRef]
76. Mtelisi Dube, N.; Xu, F.; Zhao, R. The Efficacy of Sorghum Flour Addition on Dough Rheological Properties and Bread Quality: A Short Review. *Grain Oil Sci. Technol.* **2020**, *3*, 164–171. [CrossRef]
77. Zlateva, D.; Ivanova, P.; Chochkov, R.; Stefanova, D. Effect of Spirulina Platensis and Kelp on the Antioxidant Activity of Wheat Bread. *Ukr. Food. J* **2020**, *9*, 636–650. [CrossRef]
78. Rajasekhar, K.; Fausto, S.; Byron, S.; Frank, C.; Chris, B.; Rodney, C.; Eric, W. Characterization of the Nutritional and Safety Properties of Hemp Seed cake as Animal Feed Ingredient. *Int. J. Livest. Prod.* **2021**, *12*, 53–63. [CrossRef]
79. Mierliță, D. Fatty Acids Profile and Oxidative Stability of Eggs from Laying Hens Fed Diets Containing Hemp Seed or Hempseed Cake. *S. Afr. J. Anim. Sci.* **2019**, *49*, 310. [CrossRef]
80. Xu, J.; Bai, M.; Song, H.; Yang, L.; Zhu, D.; Liu, H. Hemp (*Cannabis sativa* subsp. sativa) Chemical Composition and the Application of Hempseeds in Food Formulations. *Plant Foods Hum. Nutr.* **2022**, *77*, 504–513. [CrossRef] [PubMed]
81. Aluko, R.E. Hemp Seed (*Cannabis sativa* L.) Proteins. In *Sustainable Protein Sources*; Elsevier: Amsterdam, The Netherlands, 2017; pp. 121–132. ISBN 978-0-12-802778-3.
82. Ebert, S.; Gibis, M.; Terjung, N.; Weiss, J. Survey of Aqueous Solubility, Appearance, and pH of Plant Protein Powders from Carbohydrate and Vegetable Oil Production. *LWT* **2020**, *133*, 110078. [CrossRef]
83. Wang, X.-S.; Tang, C.-H.; Yang, X.-Q.; Gao, W.-R. Characterization, Amino Acid Composition and in Vitro Digestibility of Hemp (*Cannabis sativa* L.) Proteins. *Food Chem.* **2008**, *107*, 11–18. [CrossRef]
84. Dimina, L.; Rémond, D.; Huneau, J.-F.; Mariotti, F. Combining Plant Proteins to Achieve Amino Acid Profiles Adapted to Various Nutritional Objectives—An Exploratory Analysis Using Linear Programming. *Front. Nutr.* **2022**, *8*, 809685. [CrossRef]
85. Shoup, F.K.; Pomeranz, Y.; Deyoe, C.W. Amino Acid Composition of Wheat Varieties and Flours Varying Widely in Bread-Making Potentialities. *J. Food Sci.* **1966**, *31*, 94–101. [CrossRef]
86. House, J.D.; Neufeld, J.; Leson, G. Evaluating the Quality of Protein from Hemp Seed (*Cannabis sativa* L.) Products Through the Use of the Protein Digestibility-Corrected Amino Acid Score Method. *J. Agric. Food Chem.* **2010**, *58*, 11801–11807. [CrossRef] [PubMed]
87. Heger, J.; Frydrych, Z.; Froněk, P. The Effect of Nonessential Nitrogen on the Utilization of Dietary Protein in the Growing Rat. *Anim. Physiol. Nutr.* **1987**, *57*, 130–139. [CrossRef]
88. Heger, J. Essential to Non-Essential Amino Acid Ratios. In *Amino Acids in Animal Nutrition*; D'Mello, J.P.F., Ed.; CABI Publishing: Wallingford, UK, 2003; pp. 103–124, ISBN 978-0-85199-654-7.
89. Meybodi, N.M.; Mirmoghtadaie, L.; Sheidaei, Z.; Mortazavian, A.M. Wheat Bread: Potential Approach to Fortify Its Lysine Content. *Curr. Nutr. Food Sci.* **2019**, *15*, 630–637. [CrossRef]
90. Anjum, F.M.; Ahmad, I.; Butt, M.S.; Sheikh, M.A.; Pasha, I. Amino Acid Composition of Spring Wheats and Losses of Lysine during Chapati Baking. *J. Food Compos. Anal.* **2005**, *18*, 523–532. [CrossRef]
91. Albert, C.; Gombos, S.; Salamon, R.V.; Csiki, Z.; Prokisch, J.; Csapó, J. Production of Highly Nutritious Functional Food with the Supplementation of Wheat Flour with Lysine. *Acta Univ. Sapientiae Aliment.* **2017**, *10*, 5–20. [CrossRef]
92. Mykolenko, S.; Hez, Y.; Pivovarov, O. Effect of Bioactivated Amaranth Grain on the Quality and Amino Acid Composition of Bread. *Ukr. Food J.* **2021**, *10*, 576–592. [CrossRef]
93. Stamatie, G.D.; Susman, I.E.; Bobea, S.A.; Matei, E.; Duta, D.E.; Israel-Roming, F. The Influence of the Technological Process on Improving the Acceptability of Bread Enriched with Pea Protein, Hemp and Sea Buckthorn Press Cake. *Foods* **2022**, *11*, 3667. [CrossRef] [PubMed]
94. Leser, S. The 2013 FAO Report on Dietary Protein Quality Evaluation in Human Nutrition: Recommendations and Implications: FAO Dietary Protein Report. *Nutr. Bull.* **2013**, *38*, 421–428. [CrossRef]

95. Millward, D.J. Metabolic Demands for Amino Acids and the Human Dietary Requirement: Revisited. *J. Nutr.* **1998**, *128*, S2563–S2576. [CrossRef]
96. Schaafsma, G. The Protein Digestibility–Corrected Amino Acid Score. *J. Nutr.* **2000**, *130*, 1865S–1867S. [CrossRef]
97. Silversides, F.G.; Lefran Çois, M.R. The Effect of Feeding Hemp Seed Meal to Laying Hens. *Br. Poult. Sci.* **2005**, *46*, 231–235. [CrossRef] [PubMed]
98. Gibb, D.J.; Shah, M.A.; Mir, P.S.; McAllister, T.A. Effect of Full-Fat Hemp Seed on Performance and Tissue Fatty Acids of Feedlot Cattle. *Can. J. Anim. Sci.* **2005**, *85*, 223–230. [CrossRef]
99. Ramos-Ruiz, R.; Poirot, E.; Flores-Mosquera, M. GABA, a Non-Protein Amino Acid Ubiquitous in Food Matrices. *Cogent Food Agric.* **2018**, *4*, 1534323. [CrossRef]
100. De Francischi, M.L.P.; Salgado, J.M.; Leitão, R.F.F. Chemical, Nutritional and Technological Characteristics of Buck Wheat and Non-Prolamine Buckwheat Flours in Comparison of Wheat Flour. *Plant Food Hum. Nutr.* **1994**, *46*, 323–329. [CrossRef] [PubMed]
101. Mourtzinos, I.; Menexis, N.; Iakovidis, D.; Makris, D.; Goula, A. A Green Extraction Process to Recover Polyphenols from Byproducts of Hemp Oil Processing. *Recycling* **2018**, *3*, 15. [CrossRef]
102. Benkirane, C.; Ben Moumen, A.; Fauconnier, M.-L.; Belhaj, K.; Abid, M.; Caid, H.S.; Elamrani, A.; Mansouri, F. Bioactive Compounds from Hemp (*Cannabis sativa* L.) Seeds: Optimization of Phenolic Antioxidant Extraction Using Simplex Lattice Mixture Design and HPLC-DAD/ESI-MS ^{2} Analysis. *RSC Adv.* **2022**, *12*, 25764–25777. [CrossRef] [PubMed]
103. Leonard, W.; Zhang, P.; Ying, D.; Xiong, Y.; Fang, Z. Effect of Extrusion Technology on Hempseed (*Cannabis sativa* L.) Oil Cake: Polyphenol Profile and Biological Activities. *J. Food Sci.* **2021**, *86*, 3159–3175. [CrossRef]
104. Nigro, E.; Crescente, G.; Formato, M.; Pecoraro, M.T.; Mallardo, M.; Piccolella, S.; Daniele, A.; Pacifico, S. Hempseed Lignanamides Rich-Fraction: Chemical Investigation and Cytotoxicity towards U-87 Glioblastoma Cells. *Molecules* **2020**, *25*, 1049. [CrossRef]
105. Rea Martinez, J.; Montserrat-de La Paz, S.; De La Puerta, R.; García-Giménez, M.D.; Fernández-Arche, M.Á. Characterization of Bioactive Compounds in Defatted Hempseed (*Cannabis sativa* L.) by UHPLC-HRMS/MS and Anti-Inflammatory Activity in Primary Human Monocytes. *Food Funct.* **2020**, *11*, 4057–4066. [CrossRef]
106. Jaimes, E.M.S.; Torres, I.B.; Villarreal, H.H.P. Sensory Evaluation of Commercial Coffee Brands in Colombia. *Int. J. Bus. Syst. Res.* **2015**, *9*, 195. [CrossRef]
107. Maiboroda, H. The Study of Consumer Behavior in the Market of Bakery Products in the Conditions of Brand Management. *Three Seas Econ. J.* **2021**, *2*, 34–39. [CrossRef]
108. Turcanu, D. Securitatea Nutrițională a Persoanelor cu Tulburări Corelate Consumului de Gluten în Republica Moldova. Ph.D. Thesis, Technical University of Moldova, Chișinău, Moldova, 2023.
109. Nicolosi, A.; Laganà, V.R.; Di Gregorio, D. Habits, Health and Environment in the Purchase of Bakery Products: Consumption Preferences and Sustainable Inclinations before and during COVID-19. *Foods* **2023**, *12*, 1661. [CrossRef]
110. Korus, J.; Witczak, M.; Ziobro, R.; Juszczak, L. Hemp (*Cannabis sativa* subsp. sativa) Flour and Protein Preparation as Natural Nutrients and Structure Forming Agents in Starch Based Gluten-Free Bread. *LWT* **2017**, *84*, 143–150. [CrossRef]
111. García-Gómez, B.; Fernández-Canto, N.; Vázquez-Odériz, M.L.; Quiroga-García, M.; Muñoz-Ferreiro, N.; Romero-Rodríguez, M.Á. Sensory Descriptive Analysis and Hedonic Consumer Test for Galician Type Breads. *Food Control* **2022**, *134*, 108765. [CrossRef]
112. Mikulec, A.; Kowalski, S.; Sabat, R.; Skoczylas, Ł.; Tabaszewska, M.; Wywrocka-Gurgul, A. Hemp Flour as a Valuable Component for Enriching Physicochemical and Antioxidant Properties of Wheat Bread. *LWT* **2019**, *102*, 164–172. [CrossRef]
113. Atudorei, D.; Atudorei, O.; Codină, G.G. The Impact of Germinated Chickpea Flour Addition on Dough Rheology and Bread Quality. *Plants* **2022**, *11*, 1225. [CrossRef] [PubMed]
114. Bchir, B.; Rabetafika, H.N.; Paquot, M.; Blecker, C. Effect of Pear, Apple and Date Fibres from Cooked Fruit By-Products on Dough Performance and Bread Quality. *Food Bioprocess Technol.* **2014**, *7*, 1114–1127. [CrossRef]
115. Koletta, P.; Irakli, M.; Papageorgiou, M.; Skendi, A. Physicochemical and Technological Properties of Highly Enriched Wheat Breads with Wholegrain Non Wheat Flours. *J. Cereal Sci.* **2014**, *60*, 561–568. [CrossRef]
116. Franco-Miranda, H.; Chel-Guerrero, L.; Gallegos-Tintoré, S.; Castellanos-Ruelas, A.; Betancur-Ancona, D. Physicochemical, Rheological, Bioactive and Consumer Acceptance Analyses of Concha-Type Mexican Sweet Bread Containing Lima Bean or Cowpea Hydrolysates. *LWT* **2017**, *80*, 250–256. [CrossRef]
117. Xu, J.; Li, Y.; Zhao, Y.; Wang, D.; Wang, W. Influence of Antioxidant Dietary Fiber on Dough Properties and Bread Qualities: A Review. *J. Funct. Foods* **2021**, *80*, 104434. [CrossRef]
118. Rusu, I.E.; Marc (Vlaic), R.A.; Mureşan, C.C.; Mureşan, A.E.; Mureşan, V.; Pop, C.R.; Chiş, M.S.; Man, S.M.; Filip, M.R.; Onica, B.-M.; et al. Hemp (*Cannabis sativa* L.) Flour-Based Wheat Bread as Fortified Bakery Product. *Plants* **2021**, *10*, 1558. [CrossRef]
119. FAO. Food Energy—Methods of Analysis and Conversion Factors. In *Report of a Technical Workshop*; FAO Food and Nutrition Paper 77; FAO: Rome, Italy, 2003.
120. EC Regulation No 1924/2006 of the European Parliament and the of the Council on Nutrition and Health Claims Made on Foods; 1924/2006/EC. 2006. Available online: http://data.europa.eu/eli/reg/2006/1924/oj (accessed on 8 September 2023).
121. Maravić, N.; Škrobot, D.; Dapčević-Hadnađev, T.; Pajin, B.; Tomić, J.; Hadnađev, M. Effect of Sourdough and Whey Protein Addition on the Technological and Nutritive Characteristics of Sponge Cake. *Foods* **2022**, *11*, 1992. [CrossRef] [PubMed]
122. Mohtarami, F. Effect of Carrot Pomace Powder and Dushab (Traditional Grape Juice Concentrate) on the Physical and Sensory Properties of Cakes: A Combined Mixtures Design Approach. *Curr. Nutr. Food Sci.* **2019**, *15*, 572–582. [CrossRef]

123. Abdullah, M.M.; Aldughpassi, A.D.H.; Sidhu, J.S.; Al-Foudari, M.Y.; Al-Othman, A.R.A. Effect of Psyllium Husk Addition on the Instrumental Texture and Consumer Acceptability of High-Fiber Wheat Pan Bread and Buns. *Ann. Agric. Sci.* **2021**, *66*, 75–80. [CrossRef]
124. Raczyk, M.; Kruszewski, B.; Zachariasz, E. Effect of Tomato, Beetroot and Carrot Juice Addition on Physicochemical, Antioxidant and Texture Properties of Wheat Bread. *Antioxidants* **2022**, *11*, 2178. [CrossRef] [PubMed]
125. Guardianelli, L.M.; Carbas, B.; Brites, C.; Puppo, M.C.; Salinas, M.V. White Lupine (*Lupinus albus* L.) Flours for Healthy Wheat Breads: Rheological Properties of Dough and the Bread Quality. *Foods* **2023**, *12*, 1645. [CrossRef] [PubMed]
126. Hrušková, M.; Švec, I. Cookie Making Potential of Composite Flour Containing Wheat, Barley and Hemp. *Czech J. Food Sci.* **2015**, *33*, 545–555. [CrossRef]
127. Švec, I.; Hrušková, M. The Mixolab Parameters of Composite Wheat/Hemp Flour and Their Relation to Quality Features. *LWT-Food Sci. Technol.* **2015**, *60*, 623–629. [CrossRef]
128. Nasir, S.; Allai, F.M.; Gani, M.; Ganaie, S.; Gul, K.; Jabeen, A.; Majeed, D. Physical, Textural, Rheological, and Sensory Characteristics of Amaranth-Based Wheat Flour Bread. *Int. J. Food Sci.* **2020**, *2020*, 8874872. [CrossRef]
129. Meullenet, J.; Lyon, B.G.; Carpenter, J.A.; Lyon, C.E. Relationship between Sensory and Instrumental Texture Profile Attributes. *J. Sens. Stud.* **1998**, *13*, 77–93. [CrossRef]
130. Gåmbaro, A.; Varela, P.; Giménez, A.; Aldrovandi, A.; Fiszman, S.M.; Hough, G. Textural Quality of White Pan Bread by Sensory and Instrumental Measurements. *J. Texture Stud.* **2002**, *33*, 401–413. [CrossRef]
131. Scheuer, P.M.; Luccio, M.D.; Zibetti, A.W.; De Miranda, M.Z.; De Francisco, A. Relationship between Instrumental and Sensory Texture Profile of Bread Loaves Made with Whole-Wheat Flour and Fat Replacer. *J. Texture Stud.* **2016**, *47*, 14–23. [CrossRef]