

DAFTAR KEPUSTAKAAN

- Adhyatma, M., N. Isnaini, dan Nuryadi. 2013. Pengaruh Bobot Badan terhadap Kualitas dan Kuantitas Semen Sapi Simmental. *J. Ternak Trop.* 14: 53–62. [diakses 5 Februari 2025].
- Agarwal, S., T. Jammu, A.K. Pandey, P.K. Verma, and T. Jammu. 2012. Effect of Anti-oxidant Supplementation on Post-Thaw Sperm Characteristics, Membrane Integrity, Migration Capability and Lipid Peroxidation in Bull Semen. *Indian J. Anim. Sci.* 82 (5): 457–460. [diakses 8 Februari 2025].
- Aghazarian, A., W. Huf, H. Pfüger, and T. Klatte. 2019. Standard Semen Parameters vs. Sperm Kinematics to Predict Sperm DNA Damage. *World J. Mens. Health.* 37: 116–122. <https://doi.org/10.5534/WJMH.190095>.
- Ahmat, B., E. Herawati, T. Rohayati, and A. Salamah. 2024. Differences in Quantity and Quality of Fresh Semen and Frozen Semen after Thawing in Limousin and Simmental Cattle at Lembang Artificial Insemination Center. *J. Ilmu Ternak Univ. Padjadjaran.* 24: 93–102. <https://doi.org/10.24198/jit.v24i1.51460>.
- Akhter, S., M. Zubair, M. Mahmood, S. M. H. Andrabi, N. Hameed, E. Ahmad, and M.K. Saleemi. 2023. Effects of Vitamins C and E in Tris Citric Acid Glucose Extender on Chilled Semen Quality of Kail Ram During Different Storage Times. *Sci. Rep.* 13: 1–8. <https://doi.org/10.1038/s41598-023-43831-2>.
- Alyethodi, R. R., A. S. Sirohi, S. Karthik, S. Tyagi, P. Perumal, U. Singh, A. Sharma, and A. Kundu. 2021. Cryobiology Role of Seminal MDA, ROS, and Antioxidants in Cryopreservation and their Kinetics under The Influence of Ejaculatory Abstinence in Bovine Semen. *Cryobiology.* 98: 187–193. <https://doi.org/10.1016/j.cryobiol.2020.11.002>.
- Anggraeni, F.D., S. D. Rasad, N. Solihati, and A. Kurnia. 2024. Effect of Skim Nanoparticles on the Motility and Kinematics of Simmental Cattle Frozen Semen. *J. Agripet.* 24: 121–127. <https://doi.org/https://doi.org/10.17969/agripet.v24i2.31736>.
- Ardiaria, M. 2019. Disfungsi Mitokondria dan Stress Oksidatif. *J. Nutr. Heal.* 7: 50–55. <https://download.garuda.kemdikbud.go.id/article.php?article=1390915&val=1248&tile=DISF> [diakses 22 Juli 2024].
- Argiris, A., Y. S. Ondho, S. I. Santoso, dan E. Kurnianto. 2018. Effect of Age and Bulls on Fresh Semen Quality and Frozen Semen Production of Holstein Bulls in Indonesia. *IOP Conf. Ser. Earth Environ. Sci.* 1–10. <https://doi.org/10.1088/1755-1315/119/1/012033>.
- Arifiantini, R. I. 2012. Teknik Koleksi dan Evaluasi Semen pada Hewan. Percetakan IPB, Bogor.

- Asad, L., S. S. Husain, M. G. M. Rahman, M. A. M. Y. Khandoker, M. E. Hossain and M. Z. Rahman. 2004. Genetic and non-Genetic Factors Affecting the Semen Quality of Bulls. *Pakistan J. Biol. Sci.* 7: 1903–1907. <https://doi.org/10.3923/pjbs.2004.1903.1907>.
- Asadpour, R., R. Jafari, dan H. T. Nasrabadi. 2011. Influence of Added Vitamin C and Vitamin E on Frozen-Thawed Bovine Sperm Cryopreserved in Citrate and Tris-Based Extenders. *Vet. Res. Forum.* 2: 37–44. https://vrf.iranjournals.ir/article_1524.html [diakses 29 Juli 2024].
- Ayudiah, R. U., D. T. Sitompul, dan T. Felly. 2023. Artikel Review: Stres Oksidatif dan Penyakitnya. *ResearchGate*. https://www.researchgate.net/publication/366903090_Artikel_Review_Stres_Oksidatif_dan_Penyakitnya [diakses 21 Juli 2024].
- Azura, S., H. Ratnani, S. Susilowati, M. Hariadi, A. Samik, and K. Soepranianondo. 2020. Effect of α -Tocopherol Supplementation in Diluents on the Motility, Viability and Plasma Membrane Integrity of Simmental Bull Spermatozoa after Cooling. *Ovozoa.* 9: 1-6. <https://doi.org/10.20473/ovzo.v9i1.2020.1-6>.
- Beconi, M. T., C. R. Francia, N. G. Mora, and M. A. Affranchino. 1993. Effect of Natural Antioxidants on Frozen Bovine Semen Preservation. *Theriogenology.* 40: 841–851. [https://doi.org/10.1016/0093-691X\(93\)90219-U](https://doi.org/10.1016/0093-691X(93)90219-U).
- Beheshti, R., A. Asadi, and N. M. Sis. 2011. The Effect of Vitamin E on Post-Thawed Buffalo Bull Sperm Parameters. *Journal of American Science.* 227-231. https://www.researchgate.net/publication/230838117_The_effect_of_vitamin_E_on_post-thawed_buffalo_bull_sperm_parameters [diakses 21 Juli 2024].
- Benko, F., A. M. Sangcheshmeh, M. Ďuračka, N. Lukáč, dan E. Tvrdá. 2022. In Vitro Versus Cryo-Induced Capacitation of Bovine Spermatozoa. Part 1: Structural, Functional, And Oxidative Similarities and Differences. *PLoS One.* 17: 1–26. <https://doi.org/10.1371/journal.pone.0276683>.
- Bhosrekar, M. R. 1990. Semen Production and Artificial Insemination. BAIF Development Research Foundation, Pune, India.
- Blakely, J., dan D. H., Bade. 1994. Ilmu Peternakan. Ed ke-4. B. Srigandono, penerjemah; Sudarsono, editor. Gajah Mada University Press, Yogyakarta. Terjemahan dari The Science of Animal Husbandry.
- [BSN] Badan Standardisasi Nasional. 2020. Bibit Sapi Potong-Bagian 8: Simmental Indonesia. SNI 7651-42020.
- [BSN] Badan Standardisasi Nasional. 2021. SNI 4869-1:2021 Semen Beku-bagian 1: Sapi.

- Burton, G. W., and M. G. Traber. 1990. Vitamin E: Antioxidant Activity, Biokinetics, and Bioavailability. *Annu Rev Nutr.* 10: 357–382. <https://doi.org/10.1146/annurev.nu.10.070190.002041>.
- Campos, A. J., P. J. S. Meneses, S. Francisca, E. Niza, C. A. Moreno, M. A. Moreira, O. Garc. 2021. Vitamin E Delivery Systems Increase Resistance to Oxidative Stress in Red Deer Sperm Cells : Hydrogel and Nanoemulsion Carriers. *Antioxidants.* 10: 1-20. <https://doi.org/https://doi.org/10.3390/antiox10111780>.
- Chenoweth, P. J. 2005. Genetic Sperm Defects. *Theriogenology.* 64: 457–468. <https://doi.org/10.1016/j.theriogenology.2005.05.005>.
- Daramola, J. O., E. O. Adekunle, O. E. Oke, O. Ogundele, E. O. A. Saanu, and A. J. Odeyemi. 2016. Effect of Vitamin E on Sperm and Oxidative Stress Parameters of West African Dwarf Goat Bucks. *Trop. Subtrop. Agroecosystems.* 19: 151–158. <https://doi.org/10.56369/tsaes.2159>.
- David, I., P. Kohnke, G. Lagriffoul, O. Praud, F. Plouarboué, P. Degond, and X. Druart. 2015. Mass Sperm Motility is Associated With Fertility in Sheep. *Anim. Reprod. Sci.* 161: 75–81. <https://doi.org/10.1016/j.anireprosci.2015.08.006>.
- Dementieva, N. V., A. P. Dysin, Y. S. Shcherbakov, E. V. Nikitkina, A. A. Musidray, A. V. Petrova, O. V. Mitrofanova, K. V. Plemyashov, A. I. Azovtseva, D. K. Griffin, and M. N. Romanov. 2024. Risk of Sperm Disorders and Impaired Fertility in Frozen-Thawed Bull Semen : A Genome-Wide Association Study. *Animals.* 14 (2): 1–19. <https://doi.org/10.3390/ani14020251>.
- Dewry, R. K., B. C. Deka, D. Bhuyan, R. K. Biswas, S. Sinha, Z. Hussain, A. Das, P. Borah, and S. B. Hazarika. 2018. Effect of Vitamin E on the Quality of Frozen Ram Semen. *Indian J. Small Ruminants.* 21: 39-43. <https://doi.org/10.5958/0973-9718.2015.00060.4>.
- Diansyah, A. M., M. Yusuf, A. L. Toleng, and M. I. A. Dagong. 2022. Characteristic and Kinematics of Bali-Polled Bull Sperms. *Adv. Anim. Vet. Sci.* 10: 1787–1796. <https://doi.org/10.17582/journal.aavs/2022/10.8.1787.1796>.
- Diaz, J., S. Cenadelli, V. Bornaghi, G. Bongioni, S. M. Montedoro, A. Achilli, C. Capelli, J. C. Rincon, M. Milanesi, M. M. Passamonti, L. Colli, M. Barbato, J. L. Williams, and P. A. Marsan. 2023. Identification of Genomic Regions Associated with Total and Progressive Sperm Motility in Italian Holstein Bulls. *J. Dairy Sci.* 106: 407–420. <https://doi.org/10.3168/jds.2021-21700>.
- Donnelly, E. T., S. E. M. Lewis, J. A. McNally, and W. Thompson. 1998. In Vitro Fertilization and Pregnancy Rates: The Influence of Sperm Motility and Morphology on IVF outcome. *Fertility and Sterility.* 70: 305–314. [https://doi.org/10.1016/S0015-0282\(98\)001460](https://doi.org/10.1016/S0015-0282(98)001460).

- Eitenmiller, R., and J. Lee. 2004. Vitamin E Food Chemistry, Composition and Analysis. Marcel Dekker Inc, New York.
- El-Sheshtawy, R. I., and W. S. El-Nattat. 2020. Effect of Addition of Moringa Oleifera Extract to Tris Extender on the Preservability of Cattle Bull Semen. *Int. J. Vet. Sci.* 9: 417–420. <https://doi.org/10.37422/IJVS/034>.
- Ertmer, F., H. Oldenhof, S. Schütze, K. Rohn, W. F. Wolkers, and H. Sieme. 2017. Induced Sublethal Oxidative Damage Affects Osmotic Tolerance and Cryosurvival of Spermatozoa. *Reprod. Fertil. Dev.* 29: 1739–1750. <https://doi.org/10.1071/RD16183>.
- Feradis. 2009. Peran Antioksidan dalam Pembekuan Semen. *J. Peternak.* 6: 63-70. <http://dx.doi.org/10.24014/jupet.v6i2.379>.
- Fernandes, N. D. S., C. G. D. Silva, G. P. Panizzon, P. M. A. Cerialle, V. C. M. Câmara, M. R. Radaelli, and C. G. Almodin. 2023. Comparative Sperm Recovery Rate after Density Gradient Centrifugation With Two Media for in Vitro Fertilization. *J. Bras. Reprod. Assist.* 27: 25-28. <https://doi.org/10.5935/1518-0557.20220008>.
- Forrester, S.J., D. S. Kikuchi, M. S. Hernandez, Q. Xu, and K. K. Griendling. 2018. Reactive Oxygen Species in Metabolic and Inflammatory Signaling. *Circ. Res.* 122: 877–902. <https://doi.org/10.1161/CIRCRESAHA.117.311401>.
- Frau, P. A. J. P., M. Soler, A. I. Cuerda, I. M. Maestro, D. A. S. Ajofrín, M. R. M. Chávez, O. F. Santos, A. G. Alvarez, V. M. Morales, V. Montoro, and J. J. Garde. 2020. Sperm Cryodamage in Ruminants: Understanding the Molecular Changes induced by the Cryopreservation Process to Optimize Sperm Quality. *International Journal of Molecular Sciences.* 21(8): 1–22. <https://doi.org/10.3390/ijms21082781>.
- García, L. N. E., F. G. V. Deras, R. A. D. González, L. R. G. Alemán, J. L. M. Cruz, D. I. C. Moreno, J. M. Martínez, and K. Arvind. 2023. Effect of Adding α -Tocopherol on Fertility Parameters in Bovine Semen Cryopreservation. *Agric. Sci. Dig.* 43: 113–117. <https://doi.org/https://arccjournals.com/doi10.18805/ag.DF.461>.
- Ghirardosi, M. S., M. L. Fischman, A. E. Jorge, and D. C. H. Cisale. 2018. Relationship Between Morphological Abnormalities in Commercial Bull Frozen Semen Doses and Conception Rate. *Andrologia.* 50(3): 1-5. <https://doi.org/10.1111/and.12884>.
- Gjorgovska, N., K. Filev, and B. Chuleva. 2011. Enriched Eggs with Vitamin E and Selenium. *Lucr. Stintifice.* 55: 319–323. https://www.uaiasi.ro/firaa/Pdf/Pdf_Vol_55/Natasha_Gjorgovska.pdf. [diakses 27 Agustus 2024].
- Gordon, I. 2017. Reproductive Technologies in Farm Animals. 2nd ed. Livestock Science. CABI, Boston. <https://doi.org/10.1016/j.livsci.2006.04.019>.

- Goswami, M. K., S. Sinha, B. C. Deka, M. Bhuyan, and R. K. Biswas. 2021. Effect of Addition of Vitamin E and Caffeine on Quality of Frozen Goat Semen. *The Pharma Innovation*. 10(7): 01-04. https://www.researchgate.net/publication/377437799_Effect_of_addition_of_vitamin_E_and_caffeine_on_quality_of_frozen_goat_semen. [diakses 27 Agustus 2024].
- Haris, F. Z., Y. S. Ondho, and D. Samsudewa. 2020. Effect of Vitamin E Addition to Frozen Simmental Bull Semen Extender on Post-Thawing Quality. In: *E3S Web of Conferences*. EDP Sciences. <https://doi.org/10.1051/e3sconf/202014202002>.
- Harsa, D. F., S. D. Rasad, dan I. Setiawan. 2023. The Effect of Egg Yolk Levels in Tris Diluents on Abnormality and Plasma Membran Integrity of Semen Muscovy Duck (*Cairina moschata*). *J. Produksi Ternak Terap*. Vol. 4(01): 01–11. doi: 10.24198/jptt.v4i1.40972.
- Hasbi, H., M. I. A. Dagong, Z. Zulkharnain, S. Baba, H. Sonjaya, S. Baco, S. Gustina, T. Maulana, M. Gunawan, P. P. Agung, N. Herlina, N. D. Yanthi, E. M. Kaiin, and S. Said. 2023. Comparison of Fresh and Cryopreserved Semen Quality of Polled and Horned Bali Bulls. *Iranian Journal of Applied Animal Science*. 13(1): 33-41. <https://repository.unhas.ac.id/id/eprint/26288/>. [diakses 28 September 2023].
- Hendri, Jaswandi, R. Indriastuti, and Ananda. 2024. Sperm Kinematics of Pesisir Bull Thawed at Different Temperatures and Times. *Buletin Peternakan*. 48 (4): 233–241. <https://doi.org/10.21059/buletinpeternak.v48i4.96459>.
- Hopper, R. M. 2021. *Bovine Reproduction*. Second Ed. John Wiley & Sons, Inc, New Jersey.
- Houshaimy, K., D. Tögoe, T. Constantin, C. Micşa, and A. Şonea. 2018. Preliminary Study Regarding the Additional Effect of Adding Antioxidants on Bull Frozen Semen. *Agriculture for Life, Life for Agriculture, Conference Proceedings*. 1: 440–444. <https://doi.org/10.2478/alife-2018-0067>.
- Hu, J. H., X. L. Zhao, W. Q. Fian, L. S. Zan, and Q. W. Li. 2011. Effects of Vitamin E Supplementation in the Extender on Frozen-Thawed Bovine Semen Preservation. *Animals*. 5: 107–112. <https://doi.org/10.1017/S1751731110001679>.
- Hussain, M., M. K. Kalita, and K. Ahmed. 2018. Additives Used in Semen Preservation in Animals: A Short Review. *Int. J. Chem. Stud*. 6(5): 354–361. <https://www.chemijournal.com/archives/?year=2018&vol=6&issue=5&ArticleId=3571&si=false> [diakses 2 November 2023].
- Ibrahim, M. A. 2024. Bull Sperm Cryopreservation: An Overview on the Current Status and Future Perspectives. *Ger. J. Vet. Res*. 4: 9–22. <https://doi.org/10.51585/gjvr.2024.1.0071>.

- Insani, K., S. Rahayu, A. Pramana, dan A. Soewondo. 2014. Kadar MDA Spermatozoa Setelah Proses Pembekuan. *J. Biotropika*. 2: 142–147. [diakses 25 Desember 2023].
- Irwin, J. W. and N. Hedges. 2004. Measuring Lipid Oxidation, in *Understanding and Measuring the Shelf-Life of Food*. Woodhead Publishing Limited. 289-316. doi: 10.1533/9781855739024.2.289.
- Iskandari, N. N., S. P. Madyawati, P. A. Wibawati, T. W. Suprayogi, R. A. Prastiya, and B. Agustono. 2020. The Difference of Tris Egg Yolk and Skim Milk Egg Yolk Diluent on the Percentage of Motility, Viability and Plasma Membrane Integrity of Spermatozoa Sapera Goat on Storage of 5°C Temperature. *Jurnal Medik Veteriner*. 3(2): 196–202. <https://doi.org/10.20473/jmv.vol3.iss2.2020.196-202>.
- Kang, S. S., U. H. Kim, M. S. Lee, S. D. Lee, S. R. Cho. 2020. Spermatozoa Motility, Viability, Acrosome Integrity, Mitochondrial Membrane Potential and Plasma Membrane Integrity in 0.25 mL and 0.5 mL Straw after Frozen Thawing in Hanwoo Bull. *J. Anim. Reprod. Biotechnol*. 35: 307–314. <https://doi.org/10.12750/jarb.35.4.307>.
- Khalek, E. A. A., Y. Dowidar, H. El-Nagar, W. Wafa, I. T. El-Ratel, and A. Mousbah. 2022. A Review on Various Antioxidants Utilized in Bovine Semen Extenders. *J. Appl. Vet. Sci*. 7: 13-24. <https://doi.org/10.21608/javs.20>.
- [Kementan] Kementerian Pertanian. 2016. Berita Negara. Peraturan Menteri Pertanian Nomor 10/Permentan/PK.210/3/2016 Tahun 2016 tentang Penyediaan dan Peredaran Semen Beku Ternak Ruminansia. <https://peraturan.bpk.go.id/Details/199094/permentan-no-10permentanpk21032016-tahun-2016>.
- Kewilaa, A.I., Y. S. Ondho, dan E. T. Setiatin. 2013. Pengaruh Berbagai Jenis Pengencer Air Kelapa Muda dengan Penambahan Kuning Telur yang Berbeda terhadap Kualitas Spermatozoa Semen Cair Domba Ekor Tipis (DET). *Agrinimal*. 3: 1–9. https://ejournal.unpatti.ac.id/ppr_paperinfo_ink.php?id=440 [diakses 23 Juli 2024].
- Khalil, W. A., M. A. El-Harairy, A. E. B. Zeidan, M. A. E. Hassan, and O. Mohey-Elsaeed. 2018. Evaluation of Bull Spermatozoa during and after Cryopreservation: Structural and Ultrastructural Insights. *Int. J. Vet. Sci. Med*. 6: S49–S56. <https://doi.org/10.1016/j.ijvsm.2017.11.001>.
- Khan, I. M., Z. Cao, A. Khan, dan S. U. Rahman. 2021. Addition of L-Cysteine and Vitamin E to Semen Diluent Enhances Freeze-thawed Spermatozoa Characteristics in Crossbred Cattle Bulls under Subtropical Environment. *Pakistan J. Zool*. 1–11. <https://dx.doi.org/10.17582/journal.pjz/20191006091046>.

- Ko, E. Y., E. S. Sabanegh, and A. Agarwal. 2014. Male Infertility Testing: Reactive Oxygen Species and Antioxidant Capacity. *Fertility and Sterility*. 102(6): 1518–1527. <https://doi.org/10.1016/j.fertnstert.2014.10.020>.
- Komariah, R. I. Arifiantini, M. Aun, dan E. Sukmawati. 2020. Kualitas Semen Segar dan Produksi Semen Beku Sapi Pejantan Madura pada Musim yang Berbeda. *J. Ilmu Produksi dan Teknol. Has. Peternak*. 8: 15–21. <https://doi.org/10.29244/jipthp.8.1.15-21>.
- Křížková J., V. Čoudková, and M. Maršálek. 2017. Computer-Assisted Sperm Analysis of Head Morphometry and Kinematic Parameters in Warmblood Stallions Spermatozoa. *Journal of Equine Veterinary Science*. 57: 8-17. <https://doi.org/10.1016/j.jevs.2017.05.012>.
- Kumaresan, A., M. R. Ansari, A. Garg, and M. Kataria. 2006. Effect of Oviductal Proteins on Sperm Functions and Lipid Peroxidation Levels During Cryopreservation in Buffaloes. *Anim. Reprod. Sci.* 93: 246-257. <https://doi.org/10.1016/j.anireprosci.2005.06.030>.
- Lone, S.A., J. K. Prasad, S. K. Ghosh, G. K. Das, B. Balamurugan, and M. R. Verma. 2018. Study on Correlation of Sperm Quality Parameters with Antioxidant and Oxidant Status of Buffalo Bull Semen During Various Stages of Cryopreservation. *Andrologia*. 50: 1–8. <https://doi.org/10.1111/and.12970>.
- Losano, J. D. A., D. S. R. Angriman, A. Dalmazzo, C. C. Rocha, M. M. Brito, E. G. A. Perez, R. H. Tsunoda, P. A. A. Góes, C. M. Mendes, M. E. O. A. Assumpção, V. H. Barnabe, M. Nichi. 2018. Effect of Vitamin E and Polyunsaturated Fatty Acids on Cryopreserved Sperm Quality in *Bos taurus* Bulls Under Testicular Heat Stress. *Anim. Biotechnol.* 29: 100–109. <https://doi.org/10.1080/10495398.2017.1322973>.
- Lukman, H. Y., W. Busono, S. Wahyuningsih, dan S. Suyadi. 2014. Sperm Motility and Viability after α -Tocopherol Dilution in Tris Aminomethane-Base Extender During Cold Storage in Bali Bull. *Int. J. Research*. 6 (14): 5726–5732. [https://sphinx.sai.com/2014/ch_vol6_no14/57265732\)%20014.pdf](https://sphinx.sai.com/2014/ch_vol6_no14/57265732)%20014.pdf) [diakses 16 Januari 2025].
- Maleki, K., H. Ayen, A. Khaki, and A. Soleimanzadeh. 2023. Comparison of Sperm Characteristics and Antioxidant and Oxidant Levels in Bull Semen Frozen with Four Widely Used Extenders. *Vet. Res. Forum*. 14: 373–379. <https://doi.org/10.30466/vrf.2023.562594.3631>.
- Mardian, B. A., Zurmani, A. E. Harahap. 2017. Kualitas Semen Cair Sapi Simmental Larutan Isotonis Komersial pada Konsentrasi dan Lama Penyimpanan Berbeda. *J. Peternakan*. 14: 70–79. <http://dx.doi.org/10.24014/jupet.v14i2.3676>.
- Maulana, T., dan S. Said. 2019. Kinematics Motility of Frozen-Thawed X and Y Sperm of Sumba Ongole Bull. *IOP Conf. Ser. Earth Environ. Sci.* 387:1-5. <https://doi.org/10.1088/1755-1315/387/1/012030>.

- Maulana, T., P. P. Agung, M. Gunawan, and S. Said. 2022. Computer Aided Semen Analysis (CASA) to Determine the Quality and Fertility of Frozen Thawed Sumba Ongole Sperm Supplemented with Amino Acids. *Livest. Anim. Res.* 20: 194-201. <https://doi.org/10.20961/lar.v20i2.58754>.
- Maxwell, W. M. C. and P. F. Watson. 1996. Recent Progress in the Preservation of Ram Semen. *Anim. Reprod. Sci.* 42: 55–65. [https://doi.org/10.1016/0378-4320\(96\)01544-8](https://doi.org/10.1016/0378-4320(96)01544-8).
- Merati, Z., and A. Farshad. 2021. Supplementary Role of Vitamin E and Amino acids Added to Diluent on Goat Sperm Freezability. *Cryobiology*. 100: 151-157. <https://doi.org/10.1016/j.cryobiol.2021.02.004>
- Moreno, A. Q., J. R. Guillén, D. G. Villalobos, J. C. Gutierrez, N. M. Bury, J. Julián, G. L. Brea. 2011. Identification of Cryodamage on Plasma Membrane Integrity in Bull Spermatozoa and its Relationship with Field Fertility. *Rev. Científica*. XXI: 403–407. <https://digital.csic.es/bitstream/10261/143845/1/espermatoro.pdf> [diakses 15 Februari 2025].
- Motemani, M., M. Chamani, M. Sharafi, and R. Masoudi. 2017. Alpha-Tocopherol Improves Frozen-Thawed Sperm Quality by Reducing Hydrogen Peroxide During Cryopreservation of Bull Semen. *Spanish J. Agric. Res.* 15: 1-7. <https://doi.org/10.5424/sjar/2017151-9761>.
- Mousavi, S. M., A. Towhidi, M. Zhandi, G. Amoabediny, A. M. Sangcheshmeh, M. Sharafi, S.M.H. Hussaini. 2019. Comparison of Two Different Antioxidants in A Nano Lecithin-Based Extender For Bull Sperm Cryopreservation. *Anim. Reprod. Sci.* 209: 1-9. <https://doi.org/10.1016/j.anireprosci.2019.106171>.
- Muzafer, A. B., M. M. Rao, A. Sanjay, A. K. Pandey, P. K. Verma, and M. Sultana. 2012. Effect of Anti-oxidant Supplementation on Post-thaw Sperm Characteristics, Membrane Integrity, Migration Capability and Lipid Peroxidation in Bull Semen. *Indian J. Anim. Sci.* 82: 457–460. <https://www.researchgate.net/publication/224959976> [diakses 25 April 2025].
- Nabilla, A., R. I. Arifiantini, dan B. Purwantara. 2018. Kualitas Semen Segar Sapi Bali Umur Produktif dan non-produktif serta Penentuan Konsentrasi Krioprotektan dalam Pengencer Tris Kuning Telur. *J. Vet.* 19, 242-250. <https://doi.org/10.19087/jveteriner.2018.19.2.242>.
- Nagata, M. P. B., J. Egashira, N. Katafuchi, K. Endo, K. Ogata, K. Yamanaka, T. Yamanouchi, H. Matsuda, Y. Hashiyada, K. Yamashita. 2019. Bovine Sperm Selection Procedure Prior to Cryopreservation for Improvement of Post-Thawed Semen Quality and Fertility. *J. Anim. Sci. Biotechnol.* 10: 1–14. <https://doi.org/10.1186/s40104-019-0395-9>.
- Nam, T. G. 2011. Lipid Peroxidation and its Toxicological Implications. *Toxicol. Res.* 27: 1–6. <https://doi.org/10.5487/TR.2011.27.1.001>.

- Nurkhasanah, M. S. Bachri, dan S. Yuliani. 2023. *Antioksidan dan Stres Oksidatif*. UAD Press, Yogyakarta.
- Nuroimi, H. Z., E. Rokhana, dan N. Rahmawati. 2023. Efektifitas Metode Thawing dan Durasi Waktu Post Thawing Terhadap Kualitas Semen Beku Sapi Limousin. In *Prosiding Seminar Nasional Cendekia Peternakan Vol. 2*: 197–204. <https://prosiding.fp.uniska-kediri.ac.id/index.php/senacenter/article/view/65/63>. [diakses 15 Februari 2025].
- O'Flaherty, C., M. Beconi, and N. Beorlegui. 1997. Effect of Natural Antioxidants, Superoxide Dismutase and Hydrogen Peroxide on Capacitation of Frozen-Thawed Bull Spermatozoa. *Andrologia*. 29: 269–275. <https://doi.org/10.1111/j.1439-0272.1997.tb00481.x>
- Pamungkas, F. A., V. Wulandari, I. Darussalam, R. Widaningsih, D.N. Hadi, D.A. Kusumaningrum, U. Adiati, Z. Muttaqin, T. Maulana, Santoso, N. Solihati, A.F. Arrazy, E. Koswara, and Asepriyadi. 2024. Recovery Ability of Sperm after Freezing of Pasundan Bull Semen. *IOP Conf. Ser. Earth Environ. Sci.* 1341:1-4. <https://doi.org/10.1088/1755-1315/1341/1/012002>.
- Pardede, B. P., I. Supriatna, Y. Yudi, dan M. Agil. 2020. Decreased Bull Fertility: Age-Related Changes in Sperm Motility and DNA Fragmentation. *E3S Web Conf.* 151 (1), 1-3. <https://doi.org/10.1051/e3sconf/202015101010>.
- Prastika, Z., S. Susilowati, B. Agustono, E. Safitri, F. Fikri, dan R. A. Prastiya. 2018. Motilitas dan Viabilitas Spermatozoa Sapi Rambon di Desa Kemiren Banyuwangi. *J. Med. Vet.* 1, 38-42. <https://doi.org/10.20473/jmv.voll.iss2.2018.38-42>.
- Prihantoko, K. D., F. Yulastuti, H. Haniarti, A. Kusumawati, D. T. Widayati, and A. Budiyanto. 2020. The Acrosome Integrity Examination of Post-thawed Spermatozoa of Several Ongole Grade Bull in Indonesia using Giemsa Staining Method. *IOP Conference Series: Earth and Environmental Science* 478(1): 1–9. <https://doi.org/10.1088/1755-1315/478/1/012042>.
- Radek, F., Z. Rečková, V. Pešan, O. Konoval, and T. Kopecký. 2023. Evaluation of Semen Parameters From Fleckvieh-Simmental Bulls and the Influence of Age and Season of Collection. *Arch. Anim. Breed.* 66: 113–120. <https://doi.org/10.5194/aab-66-113-2023>.
- Raeeszadeh, B. Shokrollahi, N. Khademi, and A. Akbari. 2022. Superior Effect of Broccoli Methanolic Extract on Control of Oxidative Damage of Sperm Cryopreservation and Reproductive Performance in Rats: A Comparison with Vitamin C and E Antioxidant. *Theriogenology*. 181: 50–58. <https://doi.org/10.1016/J.THERIOGENOLOGY.2022.01.010>.
- Raheja, N., S. Grewal, N. Sharma, N. Kumar, and S. Choudhary. 2018. A Review on Semen Extenders and Additives used in Cattle and Buffalo Bull Semen Preservation. *J. Entomol. Zool. Stud.* 6, 239–245. <https://www.researchgate.net/profile/Nitin-Raheja/publication/325180253>. [diakses 2 November 2023].

- Ramazani, N., F. G. A. M. Soleimanzadeh, H. O. Arslan, E. Keles, D. G. G. Yanakieva, D. A. Acaröz, M. Zhandi, A. Baran, E. Ayen, and D.A. Dinç. 2023. Reducing Oxidative Stress by κ -carrageenan and C60HyFn: The Post-Thaw Quality and Antioxidant Status of Azari Water Buffalo Bull Semen. *Cryobiology*. 111: 104–112. <https://doi.org/10.1016/j.cryobiol.2023.04.003>.
- Ratnani, H., T. W. W. Suprayogi, T. Sardjito, S. Susilowati, and S. Azura. 2020. Alpha-Tocopherol Improves Sperm Quality by Regulate Intracellular Ca^{2+} Intensity (influx/efflux) of Simmental Bull Cattle Sperm. *Infect. Dis. Rep.* 12(s1): 21-25. <https://doi.org/10.4081/idr.2020>.
- Ratnawati, D., N. Isnaini, dan T. Susilawati. 2017. Pemanfaatan CASA dalam Observasi Motilitas Spermatozoa Semen Cair Sapi Madura dalam Pengencer Berbeda. *J. Ilmu-Ilmu Peternak*. 27(1): 80–95. doi:10.21776/ub.jiip.2017.027.01.07.
- Ratnawati, D., N. Isnaini, dan T. Susilawati. 2019. Faktor-Faktor yang Mempengaruhi Analisis Motilitas Spermatozoa dengan Menggunakan CASA. *Indones. Bull. Anim. Vet. Sci.* 29: 145-152. DOI: <http://dx.doi.org/10.14334/wartazoa.v29i3.2012>.
- Rensburg, S. V., dan N. Starke. 1949. The Examination Of Bull Semen. *J. S. Afr. Vet. Assoc.* 20: 70–79. https://journals.co.za/doi/pdf/10.10520/AJA00382809_203.
- Saili, T., Nafiu, L.O., Pagala, M.A., Bain, A., Aku, A.S., Rahadi, S., Rusdin, M., Lopulalan, F., 2023. Sperm Quality of Bali Bull Following Sexing and Freezing using Different Cryoprotectants. *IOP Conf. Ser. Earth Environ. Sci.* 1241 (1): 1-8. <https://doi.org/10.1088/1755-1315/1241/1/012137> [diakses 14 Desember 2024].
- Sarastina, T. Susilawati, dan G. Ciptadi. 2007. Analisa Beberapa Parameter Motilitas Spermatozoa pada Berbagai Bangsa Sapi menggunakan Computer Assisted Semen Analysis (CASA). *J. Ternak Trop.* 6, 1–12. <https://ternaktropika.ub.ac.id/index.php/tropika/article/download/146/154> [diakses 13 Maret 2025].
- Sathe, S. 2021. Cryopreservation of Semen. In: *Bovine Reproduction*. John Wiley & Sons, Inc. Published, New Jersey. 986–999. <https://doi.org/10.1002/9781119602484.ch78>.
- Savitri, F. K., S. Suharyati, dan Siswanto. 2014. Kualitas Semen Beku Sapi Bali dengan Penambahan Berbagai Dosis Vitamin C pada Bahan Pengencer Skim Kuning Telur. *J. Ilm. Terpadu Peternak*. 2: 30–36. <https://doi.org/10.23960/jipt.v2i3.p%25p>.
- Sharafi, M., S. M. Borghei-Rad, M. Hezavehei, A. Shahverdi, and J. D. Benson. 2022. Cryopreservation of Semen in Domestic Animals: A Review of Current Challenges, Applications, and Prospective Strategies. *Animals*. 12: 1–24. <https://doi.org/10.3390/ani12233271>.

- Sinaga, F. A. 2016. Stress Oksidatif dan Status Antioksidan pada Aktivitas Fisik Maksimal. *J. Gener. Kampus*. 9: 176–189. <https://jurnal.unimed.ac.id/2012/index.php/gk/article/view/7823>. [diakses 23 Juli 2024].
- Singh, N., R. Cheema, A. Kumar, M. Kaur, and G. Dhaliwal. 2016. Detrimental Impact of Cryopreservation on Buffalo Bull Sperm Motility, Viability and Membrane Integrity due to Efflux of Membrane Cholesterol. *Indian J. Anim. Reprod.* 37(2): 50-51. <https://www.researchgate.net/publication/341151428>. [diakses 20 februari 2025].
- Singh, W. L., S. Sinha, K. Ahmed, and L. Buragohain. 2025. IGF-1 Outperforms Vitamin E and Crocin in Improving Semen Quality, Antioxidant Profile and Fertility Gene Expression in Cryopreserved Goat (*Capra hircus*) Semen. *Anim. Reprod. Sci.* 274: 1-15. <https://doi.org/10.1016/j.anireprosci.2025.107791>.
- Slimer, I. B., T. Najar, A. Ghram, H. Dabbebi, B. Mrad, and M. Abdrabbah. 2014. Reactive Oxygen Species, Heat Stress and Oxidative induced Mitochondrial Damage. A review. *International Journal of Hyperthermia* 30(7). 513–523. <https://doi.org/10.3109/02656736.2014.971446>.
- Steel, R. G. D. dan J. H. Torrie. 1995. Prinsip dan Prosedur Statistika: Suatu Pendekatan Biometrik. Penerjemah Bambang S. Edisi ke-2. Gramedia Pustaka Utama, Jakarta.
- Štiavnická, M., P. Hošek, L. A. Parreño, D. A. Kenny, P. Lonergan, and S. Fair. 2023. Membrane Remodulation and Hyperactivation are Impaired in Frozen-Thawed Sperm of Low-Fertility Bulls. *Theriogenology*. 195: 115–121. <https://doi.org/10.1016/j.theriogenology.2022.10.021>.
- Soni, M. G., T. S. Thurmond, E. R. Miller, T. Spriggs, A. Bendich, and S. T. Omaye. 2010. Safety of Vitamins and Minerals: Controversies and Perspective. *Toxicological Sciences*. 118(2): 348–355. <https://doi.org/10.1093/toxsci/kfq293>.
- Suherlan, N. E., Soeparna, dan K. Hidajat. 2015. Pengaruh penambahan berbagai Tingkat DMF (Dimethylformamide) sebagai Agen Krioprotektan terhadap Keutuhan Membran Plasma dan Recovery Rate Semen Beku Domba Lokal. *J. Ilmu-Ilmu Peternak*. 4: 1–12. <https://jurnal.unpad.ac.id/ejournal/article/download/8087/3670> [diakses 23 Desember 2024].
- Sun, L., M. He, C. Wu, S. Zhang, J. Dai, and D. Zhang. 2021. Beneficial Influence of Soybean Lecithin Nanoparticles on Rooster Frozen–Thawed Semen Quality and Fertility. *Animals*. 11: 1–12. <https://doi.org/10.3390/ani11061769>.
- Suretno, N. D., I. Supriyatna, B. Purwanto, and R. Priyanto. 2018. Reproductive Performance of Peranakan Ongole (PO) Bull at Different Altitudes Areas in Lampung Province. *IOP Conf. Ser. Earth Environ. Sci.* 102 (1), 1-8. <https://doi.org/10.1088/1755-1315/102/1/012020>

- Susilawati, T. 2011. *Spermatozoatology*. Universitas Brawijaya Press. Malang.
- Sutarno dan A. D. Setyawan. 2015. Review: Genetic Diversity Of Local And Exotic Cattle and Their Crossbreeding Impact on The Quality Of Indonesian Cattle. *Biodiversitas* 16, 327–354. <https://doi.org/10.13057/biodiv/d160230>
- Sutarno dan A. D. Setyawan. 2016. The Diversity of Local Cattle in Indonesia and The Efforts to Develop Superior Indigenous Cattle Breeds. *Biodiversitas* 17, 275–295. <https://doi.org/10.13057/biodiv/d170139>
- Suzuki, K., M. Geshi, N. Yamauchi, and T. Nagai. 2003. Functional Changes and Motility Characteristics of Japanese Black Bull Spermatozoa Separated by Percoll. *Anim. Reprod. Sci.* 77, 157–172. [https://doi.org/10.1016/S0378-4320\(03\)00035-6](https://doi.org/10.1016/S0378-4320(03)00035-6)
- Syaifulah, F., Khairuddin, Agus, A. Mangalisu, R. Faridah, S. Farida, dan Junaedi. 2022. Viabilitas Post Ekuilibrasi Dan Recovery Rate Spermatozoa Sapi Simmental Dengan Penambahan Laktosa Dan Sukrosa Dalam Pengencer Andromed. *Journal of Animal Husbandry Science* 7(1), 38–48. <https://doi.org/https://doi.org/10.52434/janhus.v7i1.2221>
- Syarifuddin, A. N., A. L. Toleng, dan D. P. Rahardja. 2018. Analisis Semen Berbasis Komputerisasi (CASA) Untuk Memprediksi Fertilitas Sperma Sapi Bali. *Pros. Semin. Nas. Lingkung. Lahan Basah* 3, 80–85. <http://snllb.ulm.ac.id/prosiding/index.php/snllb-lit/article/view/22> [diakses 13 Maret 2025]
- Takahashi, T., S. Kudo, M. Kobayhashi, and N. Saito. 1992. *Artificial Insemination Manual for Cattle*. Japan Livest. Technol. Assoc. 472.
- Takimoto, E. and D. A. Kass. 2007. Role of Oxidative Stress in Cardiac Hypertrophy and Remodeling. *Hypertension*. 49: 241–248. <https://doi.org/10.1161/01.HYP.0000254415.31362.a7>.
- Tamargo, C., F. Garriga, M. Yeste, M. T. Carbajo, and C. O. Hidalgo. 2024. Predictive Indicators of Cryotolerance and Fertility in Bovine Sperm: Evaluating Fresh Semen Quality to Improve AI Outcomes With Frozen–Thawed Sperm. *Reprod. Domest. Anim.* 59 (11): 1–9. <https://doi.org/10.1111/rda.14742>.
- Tanga, B. M., A. K. Qamar, S. Raza, and S. Bang. 2021. Semen Evaluation: Methodological Advancements in Sperm Quality-Specific Fertility Assessment: A Review. *J. Animal Bioscience*. 34 (8): 1253–1270. <https://doi.org/10.5713/ab.21.0072>.
- Tethool, A. N., G. Ciptadi, S. Wahjuningsih, dan T. Susilawati. 2022. Karakteristik dan Jenis Pengencer Semen Sapi Bali: Suatu Review. *J. Ilmu Peternak. dan Vet. Trop. Journal Trop. Anim. Vet. Sci.* 12 (1): 45–27. <https://doi.org/10.46549/jipvet.v12i1.214>.

- Thundathil, J. C., A. L. Dance, and J. P. Kastelic. 2014. Bovine Sperm Abnormalities: Prevalence, Etiology and Mechanisms Leading to Infertility. *Clin. Theriogenology*. 4 (6): 525-532. <https://clinicaltheriogenology.net/index.php/CT/article/view/11238> [diakses 15 februari 2025].
- Thuwanut, P. K. Chatdarong, M. Techakumphu, and E. Axné. 2008. The effect of Antioxidants on Motility, Viability, Acrosome Integrity and DNA Integrity of Frozen-Thawed Epididymal Cat Spermatozoa. *Theriogenology*. 70(2): 233–240. <https://doi.org/10.1016/j.theriogenology.2008.04.005>.
- Toelihere, M. R. 1993. *Inseminasi Buatan pada Ternak*. Angkasa, Bandung.
- Tosi, W. A., Diana, N., Eoen, F. K., and Gama, C. D. 2021. Pengaruh Penambahan Kuning Telur Ayam Ras dalam Bahan Pengencer Alami Air Buah Lontar terhadap Kualitas Semen Babi Landrace pada Suhu Preservasi 5°C. *J. Vet. Nusantara*. 4: 1–10. <https://doi.org/10.35508/jvn.v4i1.6048>.
- Tvrda, E., E. Tuáimová, K. Zbynovská, T. Jambor, and N. Lukáč. 2016. Protective Effects of α -Tocopherol on the Activity and Antioxidant Profile of Bovine Spermatozoa Subjected to Ferrous Ascorbate-induced Oxidative Stress. *Acta Univ. Agric. Silv. Mendelianae Brun.* 64: 1245–1255. <https://doi.org/10.11118/actaun201664041245>.
- Ullah, Z., H. Khan, S. M. Hussain, M. T. Tunio, S. M. R. Dilshad, A. Gohar, H. Zahid, and A. Ali. 2019. Enhancement of Extender Excellence of Frozen Bull Semen Using α -Tocopherol as an Antioxidant. *Acta Sci. Vet.* 47: 1–6. <https://doi.org/10.22456/1679-9216.90447>.
- Upadhyay, V. R., V. Ramesh, R. K. Dewry, D. K. Yadav, and P. Ponraj. 2022. Bimodal Interplay of Reactive Oxygen and Nitrogen Species in Physiology and Pathophysiology of Bovine Sperm Function. *Theriogenology*. 187: 82–94. <https://doi.org/10.1016/j.theriogenology.2022.04.024>.
- UPTD BPTSD Buah Sakato. 2024. *Laporan Produksi Semen Beku*. Seksi Laboratorium UPTD BPTSD Buah Sakato [Laporan Tidak dipublikasikan].
- Valcácia, S., A. Trindade, A. Mariano, F. Costa, J. Ferreira, C. Alves, M. Madalena, and P. Guerra. 2013. Vitamin E (Trolox) Addition to Tris-Egg Yolk Extender Preserves Ram Spermatozoon Structure and Kinematics after Cryopreservation. *Animal Reproduction Science*. 137(1): 37–44. <https://doi.org/10.1016/j.anireprosci.2012.12.002>.
- Vijayalakshmy, K., M. Virmani, D. Kumar, P. Kumar, and H. Rahman. 2018. Different Methods of Assessing Semen Quality. *Indian Farmer* 5(12): 1383–1387. https://www.researchgate.net/publication/332012835_Different_Methods_of_Assessing_Semen_Quality [diakses 16 Mei 2025].
- Viquez, L., V. Barquero, C. Soler, E. R. S. Roldan, and A. Valverde. 2020. Kinematic sub-Populations in Bull Spermatozoa: A Comparison of Classical and Bayesian Approaches. *Biology (Basel)*. 9: 1–16. <https://doi.org/10.3390/biology9060138>.

- Vishwanath, R., and P. Shannon. 2000. Storage of Bovine Semen in Liquid and Frozen State. *Anim. Reprod. Sci.* 62: 23–53. [https://doi.org/10.1016/S0378-4320\(00\)00153-6](https://doi.org/10.1016/S0378-4320(00)00153-6).
- Waluyo, S. T. 2019. *Reproduksi Aplikatif dalam Budidaya Sapi*. Revisi. ed. Srikandi Empat Widya Utama, Bandung.
- Wang, X., and P. Quinn. 1999. Vitamin E and Its Functions in Biological Membranes. *Progress in Lipid Research*, 38, 309–336. <https://www.sciencedirect.com/science/article/abs/pii/S0163782799000089>. [diakses 29 Maret 2024].
- Wang, H., P. Lu, C. Yuan, J. Zhao, H. Liu, W. Lu, and J. Wang. 2021. Effects of Apigenin and Astragalus Polysaccharide on the Cryopreservation of Bull Semen. *Animals*. 11(6): 1-14. <https://doi.org/10.3390/ani11061506>.
- [WHO] World Health Organization. 2021. *WHO Laboratory Manual for the Examination and Processing of Human Semen*. Sixed Edition. L. Bjorndahl, Ed. World Health Organization. 292 p. <https://doi.org/10.4103/aja2021118>.
- Widyas, N., T. S. M. Widi, S. Prastowo, I. Sumantri, B. J. Hayes, and H. M. Burrow. 2022. Promoting Sustainable Utilization and Genetic Improvement of Indonesian Local Beef Cattle Breeds: A Review. *Agric.* 12: 1-25. <https://doi.org/10.3390/agriculture12101566>.
- Yata, V. K. 2022. *Sperm Sexing and its Role in Livestock Production*. Springer Nature Singapore Pte Ltd., Haryana. <https://doi.org/10.1007/978-981-19-1790-5>.
- Yekti, A. P. A., A. R. N. Umamah, F. Safa, N. M. Andriani, N. Febrianto, dan T. Susilawati. 2024. Kualitas Spermatozoa dan Tudung Akrosom Utuh pada Semen Beku Sapi Friesian Holstein dengan Mutu Genetik yang Berbeda. *Jurnal Agripet*. 24(1): 89–95. <https://doi.org/10.17969/agripet.v24i1.29097>.
- Yendraliza, P. Anwar, dan M. Rodiallah. 2015. *Bioteknologi Reproduksi*. Aswaja Pressindo, Sleman.
- Yuan, C., K. Zhang, Z. Wang, X. Ma, H. Liu, J. Zhao, W. Lu, and J. Wang. 2023. Dietary Flaxseed Oil and Vitamin E improve Semen Quality via Propionic Acid Metabolism. *Front. Endocrinol. (Lausanne)*. 14: 1-17. <https://doi.org/10.3389/fendo.2023.1139725>.
- Yulnawati, Y., M. C. Abraham, D. Laskowski, A. Johannisson, and J. M. Morrell. 2014. Changes in Bull Sperm Kinematics after Single Layer Centrifugation. *Reprod. Domest. Anim.* 49: 954–956. <https://doi.org/10.1111/rda.12412>.
- Yuniati, H. dan Almasyhuri. 2012. Kandungan Vitamin B6, B9, B12 dan E Beberapa Jenis Daging, Telur, Ikan, dan Udang Laut di Bogor dan sekitarnya. *Penelit. Gizi dan Makanan*. 35: 78–89. <https://pgm.persagi.org/index.php/pgm/article/view/635> [diakses 7 September 2024].

Zhang, R., X. Wang, R. Liu, Y. Mei, X. Miao, J. Ma, L. Zou, Q. Zhao, X. Bai, and Y. Dong. 2025. Proteomics and Metabolomics Analyses of Mechanism Underlying Bovine Sperm Cryoinjury. *BMC Genomics*. 26 (1): 1-16. <https://doi.org/10.1186/s12864-025-11258-w>.

Zhang, X., Y. Zhou, W. Xia, H. Wu, K. Yao, H. Liu, and C. Xiong. 2012. Effect of Pre-Freezing Conditions on the Progressive Motility Recovery Rate of Human Frozen Spermatozoa. *Andrologia*. 44: 343–348. <https://doi.org/10.1111/j.1439-0272.2012.01289.x>.

Zhao, X. L., Y. K. Li, S. J. Cao, J. H. Hu, W. H. Wang, R. J. Hao, L. S. Gui, and L. S. Zan. 2015. Protective Effects of Ascorbic Acid and Vitamin E on Antioxidant Enzyme Activity of Freeze-Thawed Semen of Qinchuan Bulls. *Genet. Mol. Res.* 14: 2572–2581. <https://doi.org/10.4238/2015.March.30.16>.



