

**DAFTAR PUSTAKA**

- Abdollahzadeh Soreshjani S, Ashrafizadeh M. The Effects of the Exercise on the Testosterone Level, Heat Shock Proteins and Fertility Potential. *Rev Clin Med.* 2018;5:12-15.
- Agarwal A, Emily Qiu and Rakesh Sharma, 2018. Laboratory assessment of oxidative stress in semen. *Arab Journal of Urologi*, 16. 77-86
- Agarwal A, Ahmad G, Sharma R, 2015. Reference values of reactive oxygen species in seminal ejaculates using chemiluminescence assay. *J Assist Reprod Genet* , 32: 1721-9
- Agarwal, A., and Sekhon, H.L., 2010. The role of antioxidant therapy in treatment of male infertility. *Human Fertility* .Vol 13, No. 4, pp. 217-225
- Agarwal, A., Makker, K., Sharma, R., 2008. Clinical relevance of oxidative stress in male infertility: an update. *Am. J Reprod Immunol.* Vol. 59, No. 1, pp. 2-11.
- Agarwal, A., Prabakaran, S.A., Sikka, C., 2007. Clinical relevance of oxidative stress in patient with male factor infertility: Evidence based analysis. *American Urological Association Update Ser.* Vol. 26, pp. 1-11
- Agarwal, A., Prabakaran, S.A., Said, T.M., 2003, Prevention of Oxidative Stress Injury to Sperm, *J Androl* 26 (6): 654-660
- Agustinus, Reny I'tshom, MPB Dyah Pramesti, 2018. *Biologi Reproduksi Pria*. Airlangga University Press, hal. 88.
- Aitken RJ. Free radicals, lipid peroxidation and sperm function. *Reprod Fertil Dev.* 1995; 7: 659-668.
- Aitken RJ. DNA damage in human spermatozoa; important contributor to mutagenesis in the offspring. *Transl Androl Urol.* 2017;6:S761–4. [PMC free article] [PubMed] [Google Scholar]
- Alahmar A. Effect of Vitamin C, Vitamin E, zinc, selenium, and coenzyme Q10 in infertile men with idiopathic oligoasthenozoospermia. *Int J Infertil Fetal Med.* 2017;8:45–9. [Google Scholar]
- Alahmar AT. The effects of oral antioxidants on the semen of men with idiopathic oligoasthenoteratozoospermia. *Clin Exp Reprod Med.* 2018;45:57–66. [PMC free article] [PubMed] [Google Scholar]
- Alahmar AT, 2019. Role of Oxidative Stress in Male infertility: An Updated Review. *J Human Reprod Sci.* 12(1): 4-18.
- Alcolado, J.C., and A.E. Thomas, 1995. Maternally Inherited Diabeter-Mellitus,- the Role of Mitochondrial-DNA Defects. *Diabetic Medicine.* No. 12, pp 102-1081

Ambati, R.R.; Phang, S.M.; Ravi, S.; Aswathanarayana, R.G. Astaxanthin: Sources, extraction, stability, biological activities and its commercial applications—A review. *Mar. Drugs* 2014, 12, 128–152. [CrossRef] [PubMed]

Amed T Alahmar. Role Of Oxidative Stress in Male infertility: An Updated Review. *J Human Reprod Sci.* 2019 Jan-Mar; 12(1);4-18. doi: 10.4103/jhrs.JHRS\_150\_18

Atmadja, Radius Kusuma, Freddy Dinata. Pemeriksaan Laboratorium untuk Membedakan Infeksi Bakteri dan Infeksi Virus. *CDK-241/ vol. 43 no. 6 th. 2016*

Ariawan I, 2005. Sample size and sample design for nutritional research. Course material for International Course on Applied Epidemiology with Special Reference to Nutrition. SEAMEO-TROPMED-RCCN, University of Indonesia. Jakarta, 25 April-3 May 2005

Ashrafizadeh , Ahmadi , 2019. Effect of Astaxanthin treatment on the Sperm Quality of the Mice Treated with Nicotine. *Rev Clin Med* vol. 6. No. 1

Attardi, G., 1985. Animal mitochondrial DNA: an extreme example of genetic economy. *Int. Rev. Cytol.* No. 93., pp. 93-145

ASRM. Definitions of infertility and recurrent pregnancy loss: a committee opinion. *Fertil Steril.* 2013;Jan 99(1):63

Bahmanzadeh M, Vahidinia A, Mehdinejadi S, Shokri S, Alizadeh Z. Dietary supplementation with astaxanthin may ameliorate sperm parameters and DNA integrity in streptozotocin-induced diabetic rats. *Clin Exp Reprod Med.* 2016;43:90–6.

Bain BJ, Bates I, Laffan MA, Lewis SM. Supplementary techniques including blood parasite diagnosis. *Dacie & Lewis practical hematology.* London: Churchill Livingstone; 2011. P.102-5.

Bansal, A. K. ; Bilaspuri, G. S. Antioxidant effect of vitamin E on motility, viability and lipid peroxidation of cattle spermatozoa under oxidative stress. *Animal Science Papers and Reports* 2009 Vol.27 No.1 pp.5-14 ref.19

Behra Johan Mattsson Olivier J. Cayre Eric S. J. Robles Haiqiu Tang Timothy N. Hunter. Characterization of Sodium Carboxymethyl Cellulose Aqueous Solutions to Support Complex Product Formulation: A Rheology and Light Scattering Study. *ACS Appl. Polym. Mater.* 2019 13344-358. Publication Date: February 14, 2019. <https://doi.org/10.1021/acsapm.8b00110>

Boussiba S, Cohen Z, Richmond A, Vonshak A. Procedure for large scale production of Astaxanthin from *Haemotococcus* . Google Patents 2000.

Brajadenta GS, Sumaerah DS, 2019. Therapeutic Effect of Anti Tuberculosis Drugs on Erythrocyte Sedimentation Rate: Study of Childhood Tuberculosis. *Jurnal Ilmiah Ilmu Kesehatan: Wawasan Kesehatan*, p-ISSN 2087-4995, e-ISSN 2598-4004 111. Volume 5, Nomor 2 Januari 2019 DOI: 10.33485/jiik-wk.v5i2.96

Brandt Justin S, Mayra A. Cruz Ithier|Todd Rosen|Elena Ashkinadze, 2018. REVIEW Advanced paternal age, infertility, and reproductive risks: A review of the literature. Wiley Prenatal Diagnosis. Received: 28 September 2018 Revised: 18 November 2018 Accepted: 30 November 2018 DOI: 10.1002/pd.5402 (Brandt, et al 2018)

Bregani ER, Valcarengi C, et al, 2013. Suggestive criteria for pulmonary tuberculosis in developing countries. *International Journal of Mycobacteriology*. Volume 2, Issue 4, December 2013, Pages 211-213. <https://doi.org/10.1016/j.ijmyco.2013.08.004>

Bui AD, R. Sharma, R. Henkel and A Agarwal, 2018. Reactive oxygen species impact on Sperm DNA and its role In male infertility. *Andrologia*, 2018, 50: 13012

Burgers, Graham W., 1995. Teknologi Elisa dalam Diagnosis dan Penelitian (Alih bahasa: Artama, T., Wayan). Gajah Mada University Press, Yogyakarta.

Capelli, 2017. The World's Strongest and Highest Quality Natural Antioxidant: Astaxanthin. Algae Health Sciences BCG North America.

Capelli, Bob and Cysewski, Gerald; 2018. Natural Astaxanthin: King of carotenoids (natural astaxanthin concentrate in Haemotococcus microalgae. Cyanotech corporation, Cyanotech University.

Cavalcante M.B., Rochma M.P., Dias M.L.C.M, Dias O.J.O, Souza D.O.A., Roberto I.G. 2008. Interferência da idade sobre a qualidade seminal Rev. Bras. Ginecol. Obstet. 30: 561-565.

Cha CH, MD, Chan-Jeoung Park, MD, Young Joo Cha, MD, Hyun Kyung Kim, MD, Duck Hee Kim, Honghoon, Jae Hoon Bae, Jae-Seol Jung, Seongsoo Jang, MD, Hyun-Sook Chi, MD, 2009. Erythrocyte Sedimentation Rate Measurements by TEST 1 Better Reflect Inflammation Than Do Those by the Westergren Method in Patients With Malignancy, Autoimmune Disease, or Infection. *American Journal of Clinical Pathology*, Volume 131, Issue 2, February 2009, Pages 189–194, <https://doi.org/10.1309/AJCP0U1ASTLRANIJ>

Check, J.H., Adelson, H.G., Schubert, B.R., Bollendorf, A., 1992. Evaluation of Sperm Morphology using Kruger's Strict Criteria. *International journal of Andrology*. Vol.28, No. 1, pp. 15-71

Clarkson, M.Priscilla and Thompson, S.Heather., 2000. Antioxidants; what role do they play in physical activity and health. *The American Journal of Clinical Nutrition*. No. 72 (suppl.), pp. 637S – 646S.

Clayton, D.A., 2000. Transcription and replication of mitochondrial DNA. *Human Reprod* 15 (suppl), pp. 11-17.

Comhaire, F. Ahmoud, A. M., Depuyt, C. E., Zalata, A. A., and Christophe, A.B. 2006. Mechanisms and Effect of Male Genital Tract Infection on Sperm Quality and Fertilizing Potential, The Andrologist's viewpoint, *Human Reproduction Update*, vol 5, No. 5, 393-398

Comhaire FH, Christophe AB, Zalata AA, et al., The effects of combined conventional treatment, oral antioxidant and essential fatty acids on sperm biology in subfertile men. *Prostaglandins Leukot Essent Fatty Acids*, 2000, 63: 159-65

Comhaire FH, Ahmed M.A.Mahmoud, Frank Schoonjans. Sperm quality, birth rates and the environment in Flanders (Belgium). *Reproductive Toxicology Volume 23, Issue 2, February 2007, Pages 133-137*

Converse, R.H. and R.R. Martin., 1990. ELISA methods for plant viruses. In Hampton, R., E. Ball, and S. De Boer (Eds), *Serological Method for Detection and Identification of Viral and Bacterial Plant Patogens*. APS Press, St. Paul, Minn, pp. 179-196

Cooper, T.G., 2010. WHO reference values for human semen characteristics. *Hum. Reprod. Update*. 16(5), p. 559.

Cooper, TG et al. WHO reference values for human semen characteristics. *Human Reproduction Update*. 2010. Volume 16 Issue 3 pp. 231-245

Crowther, J.R., 1995. *ELISA Theory and Practice*,. Human Press Inc, Totowa, New Jersey

Dahlan MS, 2009. *Besar sampel dan cara pengambilan sampel dalam penelitian kedokteran dan kesehatan*. Ed. 2, Jakarta: Penerbit Salemba Medika.

Delves PJ., et al. *Innate immunity. Roitt's essential immunology*. Massachusets: Blackwell Publishing; 2006. p.1-18. Delves PJ., et al. *Innate immunity. Roitt's essential immunology*. Massachusets: Blackwell Publishing; 2006. p.1-18.

Development Bureau for Global Health office of Population and Reproductive Health.

Djuwantono, Tono. 2008. *Hanya 7 Hari Memahami Infertilitas*. Bandung : PT Refika Aditama

Dohle, Colpi, Hargreave, Papp, Jungwirth, Weidner, The EAU Working Group on Infertility. *EAU Guidelines on Male Infertility*. *European Urology* 48 (2005) 703-711

Donà G , Alessandra Andrisani , Elena Tibaldi , Anna Maria Brunati , Chiara Sabbadin , Decio Armanini , Guido Ambrosini , Eugenio Ragazzi and Luciana Bordin, 2018. *Astaxanthin Prevents Human Papillomavirus L1 Protein Binding in Human Sperm Membranes*. *Mar. Drugs* 2018, 16, 427; doi:10.3390/md16110427 [www.mdpi.com/journal/marinedrugs](http://www.mdpi.com/journal/marinedrugs)

Doroftei B, Ditton H, Zimmer J, Kamp C, Rajpert-de Meyts E, Vogt P, 2015. The AZFa gene *DBY (DDX3Y)* is widely transcribed but the protein is limited to the male germ cells by translation control. *Hum. Mol. Gen.* 13, 2333-2341, (2004);

Du Plessis, S.S.; Agarwal, A.; Mohanty, G.; van der Linde, M. Oxidative phosphorylation versus glycolysis: What fuel do spermatozoa use? *Asian J. Androl.* 2015, 17, 230–235. [CrossRef] [PubMed]

Edwards JA, Bellion P, Rumbelia R, Schier J, 2016. Review of genotoxicity and rat carcinogenicity investigations with astaxanthin. *Regulatory Toxicology and Pharmacology Elsevier Volume 75, March 2016, Pages 5-19*. <https://doi.org/10.1016/j.yrtph.2015.12.009>

- Edyson, 2002. Pengaruh pemberian kombinasi Vit C dan Eterhadap aktivitas. superoxide dismutase (SOD) dan kadar malondialdehyde (MDA) pada eritrosit rattus norvegicus galur winstar yang diinduksiL-Tiroksin. Tesis, Universitas Airlangga. Surabaya
- Engelmann, U., Krassnigg, F., Schill, W.B., 2012. Sperm motility under weightlessness Texas Flights 19 & 26. Department of Dermatology and Andrology, Justus Liebig University Giessen, Gaffkystrasse 14, D-35392 Giessen, Germany
- European Association of Urology (EAU) Guidelines on male infertility EAU;2010
- Fatchiyah, 2006, PCR: Dasar teknik Amplifikasi DNA dan Aplikasinya. Universitas Brawijaya
- Fakhri S, Abbaszadeh F, Dargahi I., Jorjani M. Astaxanthin: A mechanistic review on its biological activities and health benefits. *Pharmacological research* 2018
- Fang Y, Zhong R, Chen L, Feng C, Sun H, Zhou D, 2015. Effects of astaxanthin supplementation on the sperm quality and antioxidant capacity of ram semen during liquid storage. *Small Ruminant Research*. Elsevier, Volume 130, September 2015, Pages 178-182. Volume 130, September 2015, Pages 178-182
- Fasset, R.G., Healy, H., Driver, R., Robertson, I.K., Geraghty, D.P., Sharman, J.E., Coomers, J.S., 2008. Astaxanthin vs placebo on arterial stiffness, oxidative stress and inflammation in renal transplant patients (Xanthin): a randomised controlled trial. *Bmc Nephrol*. No. 9, p. 17.
- Fassett, R.G. and Coombes, J.S. 2011. Astaxanthin: A Potential Therapeutic Agent in Cardiovascular Disease. *Mar. Drugs*, 9: 447-465
- Fiedor J and Květoslava Burda, 2014. Potential Role of Carotenoids as Antioxidants in Human Health and Disease. *Nutrients* 2014, 6(2), 466-488; <https://doi.org/10.3390/nu6020466>
- Finsterer, J., 2007. Genetics, pathogenetic and phenotype implication of the mitochondrial A3243G tRNA (UUR) mutation. *Acta Neyrikigucs Scandunavica*. Vol. 116, pp. 383-399.
- Folgero, T., Bertheussen, K., Lindal, K., Torbergsen, T., Olan, P., 1993. Mitochondrial disease and reduced sperm motility. *Hum Reprod*. No. 8, pp. 1863-1868.
- Foley, G.L., 2001. Overview of male reproductive pathology. *Toxicologic Pathology* , 29, 49-63. doi:10.1080/019262301301418856
- Ganong, W. F. 2008. Buku Ajar Fisiologi Kedokteran Ganong. Edisi 22,. Jakarta:EGC Penerbit Buku Kedokteran
- Kursunluoglu G, Dilek Taskiran and hulya Kayali, 2018. The Investigation of the Antitumor Agent Toxicity an Capsaicin Effect on the Electron Transport Chain Enzymes, Catalase Activities and Lipid Peroxidation Levels in Lung, Heart and Brain Tissues of Rats. *Moleculs*, 2018,23, 3267.
- Gráinne S. Gorman, Patrick F. Chinnery, Salvatore DiMauro, Michio Hirano, Yasutoshi Koga, Robert McFarland, Anu Suomalainen, David R. Thorburn, Massimo Zeviani & Douglass M. Turnbull . Mitochondrial diseases. *Nature Reviews Disease Primers* volume 2, Article number: 16080 (2016) |

Goto, S.; Kogure, K.; Abe, K.; Kimata, Y.; Yamashita, E.; Terada, H. Efficient radical trapping at the surface and inside the phospholipid membrane is responsible for highly potent antiperoxidative activity of the carotenoid astaxanthin. *Biochim. Biophys. Acta* 2001, 1512, 251–258. [Google Scholar]

Gorman GS, Patrick F. Chinnery, Salvatore Di Mauro, Michio Hirano, Yasutoshi Koga, Robert McFarland, Anu Suomalainen, David R. Thorburn, Massimo Zeviani & Douglass M. Turnbull, 2016. Mitochondrial diseases. *Nature Reviews Disease Primers* **volume 2**, Published: 20 October 2016 Article number: 16080 (2016)

Gryus E, Toussaint MJM, Niewold TA, Koopmans SJ. Acute phase reaction and acute phase proteins. *J Zhejiang Univ Sci.* 2005; 6B(11):1045-56.

Guessan MF N, FA Coulibaly, Konan Kouassi, Y Guillaume, N Coulibaly, E Ayekoue. Lipid peroxidation and total antioxidant capacity in azoospermic semen. *Annals of Medical and Biomedical Sciences*, 2016. Vol 2, No 1

Guyton ,A.C., Hall, 2007. *Textbook of medical Physiology*. Thirteenth edition

Guyton, A.C., 1990. *Human Physiology and Mechanism of Disease*. EGC, Jakarta

Guyton, J. H., 2008, *Buku Ajar Fisiologi Kedokteran*, edisi 0, EGC, Jakarta

Hafez, E.S.E., 1980. *Human reproduction: Conception And Contraception*, Ed. 2nd, Harper and Row publisher., London. P. 91, 109

Halliwell B, Gutteridge JMC. *Free radicals in biology and medicine*. 2nd ed., Oxford, UK: Clarendon Press, 1989

Halliwell, B., and Gutteridge, J. M. C., 2007. *Free Radicals in Biology and Medicine*. New York : Oxford University Press. pp. 619-633.

Halliwell, B. And Whiteman, M., 2004, *Measuring reactive species and oxidative damage in vivo and in cell culture: how should you do it and what do the result mean?*. *British Journal of Pharmacology*. Vol. 142. Issue 2. Pages 231- 255

Harraway, Nathan G. Berger, Norman H. Dubin, 2000. Semen pH in patients with normal versus abnormal sperm characteristics. *American Journal of Obstetrics and Gynecology*. Volume 182, Issue 5, pp. 1045-1047

Hashemi R,1 Alireza Majidi, Hassan Motamed, Afshin Amini, Fares Najari, and Ali Tabatabaey, 2015. Erythrocyte Sedimentation Rate Measurement Using as a Rapid Alternative to the Westergren Method. *Emerg (Tehran)*. 2015 Spring; 3(2): 50–53. PMID: PMC4614602. PMID: 26495381

Hassan A, Abo-Azma SM, Fayed SM, Mostafa T. Seminal plasma cotinine and insulin-like growth factor-I in idiopathic oligoasthenoteratozoospermic smokers. *BJU international*. 2009;103(1):108-1011

Haugen TB, Grotmol T, 1998. pH of Human Semen. *International Journal of Andrology* 21(2):105-108.

Herlianto, Harijati. 1971. *Fertilitas (Kelahiran) dalam Pengantar Demografi*. Jakarta: PT Lembaga Demografi UI.

Hidalgo DM, Maria Julia Bragado, Ana R. Batista, Pedro FmOliviera and Marco G. Males, 2019. *Antioxidants and Male Infertility: From Molecular Studies to Clinical Evidence*. *Antioxidants*, 2019. 8, 89

HIFERI, PERFITRI, IAUI, POGI, 2013. *Konsensus Penanganan Infertilitas di Indonesia*

Hinting A, 1996. Perkembangan teknik rekayasa reproduksi. Seminar penanganan Andrologik pada infertilitas dan impotensi. Poli andrologi RSUD Dr. Soetomo Lab Biomedik FK Unair, Surabaya

Hinting A, 2006. Standarized management of maleinfertility, Post Graduatecourse of Andrology I : Comprehensive Management of male infertility, Surabaya, 6-8 April 2006

Hogarth CA, Griswold MD. The key role of Vitamin A in spermatogenesis. *J Clin Invest*. 2010;120:956–62. [PMC free article] [PubMed] [Google Scholar]

Holstein, Wolfgang Schulze and Michail Davidoff, 2003. Understanding spermatogenesis is a prerequisite for treatment. *Reproductive Biology and Endocrinology* 1:107 DOI: 10.1186/1477-7827-1-107© Holstein et al; licensee BioMed Central Ltd. 2003

Hosokawa, M.; Yasui, Y. Chemopreventive effects of astaxanthin on inflammatory bowel disease and inflammation-related colon carcinogenesis. In *Carotenoids and Vitamin A in Translational Medicine*; Sommerburg, O., Siems, W., Kraemer, K., Eds.; CRC Press: Boca Raton, FL, USA, 2013; pp. 289–304.

Irie, Shinji., Nakamura, Junko., Miyagawa, Yasushi.,Tsujiyama, Akira., Okuda, Hidenobu., Yamamoto, Keisuke., Fukuhara, Schinichiro., Yoshioka, Iwao., Hiroshi, Kiuchi., Matsuoka, Yashuhiro., Takao, Tetsuya., Nonomura, Norio., Ikawa, Masahito., Tokuhira, Keizo., Okabe, Masaru., Shibata, Tomomi., Fujimoto, Kyoko., Wada, Morimasa and Tanakaa, Hiromitsu, 2011. Primary Screening of Single Nucleotida Polymorphisms in Human Calreticulin (CALR3). *The Open Andrology Journal*. Vol. 3. Pp. 30-35

Jagtap Richa, Mariah Banker, Ritu Hinduja, Snesha Sathe and Sulba Arora, 2019. *Infertility and Assisted Reproductive Technology*. Jaypee Brothers Medical Publisher.

Jedrzejowska RW., Wolski JK., Hilczer JS., 2013. The role of oxidative stress and antioxidants in male fertility. *Cent European J Urol*. Vol.66., No. 1, pp: 60-67

Jin Zhang, Junhong Guo, Wanghui Fang, Qili Jun, Kaili Shi, 2015. Original Article: Clinical features of MELAS and its relation with A3243G gene point mutation. *Int J Clin Exp Pathol* 2015;8(10):13411-13415. www.ijcep.com /ISSN:1936-2625/IJCEP0012056

- Kamath, B.S.; Srikanta, B.M.; Dharmesh, S.M.; Sarada, R.; Ravishankar, G.A. Ulcer preventive and antioxidative properties of astaxanthin from *Haematococcus pluvialis*. *Eur. J. Pharmacol.* 2008, 590, 387–395. [Google Scholar] [CrossRef]
- Kamath M, Bhattacharya S. *Best Practice & Research Clinical Obstetrics and Gynaecology.* 2012. p. 729-38.
- Kao, S., Chao, H.T., Wei, YH., 1995. Mitochondrial deoxyribonucleic acid 4977 bp deletion is associated with diminished fertility and motility of human sperm. *Biol Reprod*, Vol. 52, pp. 729-736
- Kao SH, Chao HT, Wei YH. 1998. Multiple deletions of mitochondrial DNA are associated with the decline of motility and fertility of human spermatozoa. *Mol Hum Reprod* 4(7):657- 666.
- Kemal Duru, N., Morshedi, M., Oehninger, S., 2000. Effects of hydrogen peroxide on DNA and plasma membrane integrity of human spermatozoa. *Fertility and Sterility* No. 74, pp. 1200-1207.
- Kementerian Kesehatan Republik Indonesia, 2011. *Pedoman Interpretasi Data Klinik*, hal. 24
- Khaidir, M., 2006. *Penilaian Tingkat Fertilitas dan Penatalaksanaannya pada pria*. [www.jurnalkesmas.com/index.php/kesmas/article/view/20/15](http://www.jurnalkesmas.com/index.php/kesmas/article/view/20/15). Diakses tanggal 16 Agustus 2016.
- Khan Ikhlas A, Abourashed Ehab A, 2011. *Leung's Encyclopedia of Common Natural Ingredients used in Food, Drugs, and Cosmetics, Third Edition*. Published by John Wiley & Sons.
- Kidd P. Astaxanthin, cell membrane nutrient with diverse clinical benefits and anti-aging potential. *Altern Med Rev.* 2011 Dec;16(4):355-64. Review
- Kim KH, Joo KJ, Park HJ, Kwon CH, Jang MH, Kim CJ, 2005. Nicotine induces apoptosis in TM3 mouse Leydig cells. *Fertility and sterility*, 83(4): 1093-1099.
- Kishimoto Y, Yoshida H, Kondo K. Potential anti-atherosclerotic properties of astaxanthin. *Mar Drugs.* 2016;14. pii:E35.
- Kochi, T.; Shimizu, M.; Sumi, T.; Kubota, M.; Shirakami, Y.; Tanaka, T.; Moriwaki, H. Inhibitory effects of astaxanthin on azoxymethane-induced colonic preneoplastic lesions in C57/BL/KsJdb/db mice. *BMC Gastroenterol.* 2014, 14, 212. [CrossRef] [PubMed]
- Koppers, A.J.; De Iuliis, G.N.; Finnie, J.M.; McLaughlin, E.A.; Aitken, R.J. Significance of mitochondrial reactive oxygen species in the generation of oxidative stress in spermatozoa. *J. Clin. Endocrinol. Metab.* 2008, 93, 3199–3207. [CrossRef];
- Kumalic Imamovic S, Pinter B, 2014. Review of clinical trials on effects of oral antioxidants on basic semen and other parameters in idiopathic oligoasthenoteratozoospermia. *Biomed Res Int;* 426951.
- Kumar D. Prabhu, N. Sangeetha, 2009. Mitochondrial DNA mutations and male infertility. *India Indian Journal of Human Genetics* Volume 15 Issue 3



Kumar V., et al. Acute inflammation. Robbins and Cotran pathologic basis of disease. 8th ed. Philadelphia: Saunders; 2010.

Kurashige, M. E. et al. 1990. Inhibition of oxidative injury of biological membranes by astaxanthin. *Physiol. Chem. Phys. Med. NMR*, 22, 27.

Kursunluoglu G, Dilek Taskiran, and Hulya Ayar Kayali, 2018. The Investigation of the Antitumor Agent Toxicity and Capsaicin Effect on the Electron Transport Chain Enzymes, Catalase Activities and Lipid Peroxidation Levels in Lung, Heart and Brain Tissues of Rats. *Molecules* 2018, 23(12), 3267; <https://doi.org/10.3390/molecules2312326>

Laleethambika N, Venugopal Anila, Chandran Manojkumar, Ishvarya Muruganandam, Bupesh Giridharan, Thangarasu Ravimanickam and Vellingiri Balachandar, 2019. Diabetes and Sperm DNA Damage: Efficacy of Antioxidants. *SN Comprehensive Clinical Medicine* (2019) 1:49–59.

Lamirande, Gagnon C, 1992, Reactive oxygen species and human spermatozoa. *J Androl* 13 Lewis, S.E.M., Aitken, R.J., 2005. DNA damage to spermatozoa has impact on fertilization and pregnancy. *Cell tissue Res* 322: 33-41

Lazarovits, G., 1990. The dot immunobinding assay (DIA)-Bacteria, In Hampton, R.,E. Ball, and S. De boer (Eds), *Serological Method for Detection and Identification of Viral and Bacterial Plant Patogens*, APS Press, St. Paul, Minn, pp. 248-261

Lazzarino Giacomo, Listorti H, Bilotta G, Capozzolo T, Amorini AM, Longo S, Caruso G, Lazzarino G, Tavazzi B and Bilotta P. Water and Fat-Soluble Antioxidants in Human Seminal Plasma and Serum of Fertile Males. *Antioxidants* 2019; 8: 96

Lee, S.J.; Bai, S.K.; Lee, K.S.; Namkoong, S.; Na, H.J.; Ha, K.S.; Han, J.A.; Yim, S.V.; Chang, K.; Kwon, Y.G.; et al. Astaxanthin inhibits nitric oxide production and inflammatory gene expression by suppressing IB kinase-dependent NF- $\kappa$ B activation. *Mol. Cells* 2003, 16, 97–105. [PubMed]

Lehtonen, M., 2002. Mitochondrial DNA sequence variation in patients with sensori-neural hearing impairment and in the Finnish population. Dissertation. Faculty of Medicine, University of Oulu

Lodish H, Berk A, Zipursky SL, et al. 2000. *Molecular Cell Biology*. 4th edition. New York: W. H. Freeman

Lopez, A.Rangel., Medina, MEP., Reyes, M., Arredondo, MC., Aguilar, CA., Meza, JL., Zarzosa, AO., Lindholm, B., Lopez, EG., Paniagua, JR., 2013. Genetic damage in patients with chronic kidney disease, peritoneal dialysis and haemodialysis: a comparative study. *Oxford Journals*. Vol. 28, No. 2., pp. 219-225.

MDA Saldana, SI Martinez-Monteguado, 2013. Oxidative Stability of Fats and Oils Measured by Differential Scanning Calorimetry for Food and Industrial Applications. DOI: 10.5772/54486

MacKenzie SB, Williams JL. Hematology procedures. *Clinical laboratory hematology*. 2nd ed. New Jersey: Pearson; 2010. P.777-8.

- Majamaa, K., 1998. Epidemiology of A3243G, the mutation for mitochondrial encephalomyopathy, lactic acidosis, and stroke-like episodes: prevalence of the mutation in an adult population. *Am J Human genet.* Vol. 63, pp. 447-454.
- Majzoub A, Agarwal A. Antioxidant therapy in idiopathic oligoasthenozoospermia. *Indian J Urol* 2017;33:207-14.
- Makkouk, K.M and S.G. Kumari., 2002. Low-cost paper can be used in tissue-blot immunoassay for detection of cereal and legume viruses. *Phytopathol. Mediterr.* 41, pp. 275-278.
- Maksum, Sriwidodo, Suprijana, Natadisastra, Nuswantara dan Noer., 2010. Identifikasi mutasi heteroplasmia A3243G DNA mitokondria dan studi pewarisan maternal pada pasien Diabetes melitus tipe-2. *Bionatura - Jurnal Ilmu-Ilmu Hayati dan Fisik*, Vol. 12. No. 2, hal: 78 – 85
- Maksum, P.I., Farhani, Athiyah., Rachman, D.S and Ngili, Yohanis., 2013. Making of the A3243G Mutant Template Through Site Directed Mutagenesis as Positive Control in PASA-Mismatch Three Bases. *International Journal of Pharm tech Research.* Vol.5, No. 2, pp. 441-450
- Mann T, Mann C , 1981. *Male Reproduction Function and Semen.* Springer-Verlag Berlin heidelberg; New York
- Marco Spinazzi, Enrico Radaelli, Katrien Horré, Amaia M. Arranz, Natalia V. Gounko, Patrizia Agostinis, Teresa Mendes Maia, Francis Impens, Vanessa Alexandra Morais, Guillermo Lopez-Lluch, Lutgarde Serneels, Placido Navas, and Bart De Strooper. PARL deficiency in mouse causes Complex III defects, coenzyme Q depletion, and Leigh-like syndrome. *PNAS* January 2, 2019 116 (1) 277-286; <https://doi.org/10.1073/pnas.1811938116>
- Martin HD, Ruck C, Schmidt M, Sell S, Beutner S, Mayer B, Walsh R. Chemistry of carotenoid oxidation and free radical reactions. *Pure & Appl Chem* 1999; 71: 2253-2262.
- May Panloup P, Chretien MF, Savagner F, Vasseur C, Jean M, Malthiery Y, Reynier P. 2003. Increased sperm mitochondrial DNA content in male infertility. *Hum Reprod* 18(3):550- 556.
- Mayorga-Torres BJ, Camargo M, Cadavid AP, du Plessis SS, Cardona Maya WD. Are oxidative stress markers associated with unexplained male infertility? *Andrologia.* 2017; 49(5)
- Mc-Nulty, HP., Byun, J., Lockwood, SF., Jacob, RF., Mason, RP., 2007. Differential effects of carotenoids on lipid peroxidation due to membrane interactions: X-ray diffraction analysis. *Biochim Biophys Acta.* Vol. 176; pp. 167-174
- McPherson RA, Pincus MR. Hematology, coagulation, and transfusion medicine. Henry's clinical diagnosis and management by laboratory method. 22nd ed. Philadelphia: Elsevier Saunders; 2011. p.519-21.
- Mettlera AD, Mirudhubashini Govindarajan, Sapna Srinivasa, Sridurga Mithraprabhub, Donald Evenson and Tara Mahendrane, 2019. Male age is associated with sperm DNA/chromatin integrity. *The Aging Male*, Taylor & Francis Group. <https://doi.org/10.1080/13685538.2019.1600496>.

- Metz CE, 1978. Basic Principles of ROC Analysis. *Semin Nucl Med.* 1978 Oct;8(4):283-98.
- Middleton, Angela M. Patterson, Lucy Gardner, Caroline Schmutz and Brian A. Ashton *Blood* 2002 100:3853-3860; doi: <https://doi.org/10.1182/blood.V100.12.3853>
- Moeloek, N, 1994. System Reproduksi jantan/pria. Dalam: Syahrums, MH, Kamaludin, Tjokronegoro, 1994. Reproduksi dan embriologi; dari satu sel menjadi organisme. Balai Penerbit FKUI, Jakarta: 9-16
- Mordechai, E., 1999. Application of PCR The methodologies in Molecular Diagnostic. Burlington Country, USA.
- Mortazavi, M., Salehi, I., Alizadeh, Z., Vahabian, M. and Roushandeh, A.M. 2014. Protective effects of Antioxidants on sperm parameters and seminiferous tubules epithelium in high fat-fed rats. *J. Reprod. Infertil.*, 15: 22-28
- Muladno, 2006. Aplikasi Teknologi Molekuler dalam Upaya Peningkatan Produktivitas Hewan. Pelatihan Teknik Diasnognik molekuler untuk Peningkatan Produksi Peternakan dan Perikanan di Kawasan Timur Indonesia. Kerjasama Pusat Studi Ilmu Hayati, Lembaga Penelitian dan Pemberdayaan Masyarakat Institut Pertanian Bogor dan Direktorat Pendidikan Tinggi Depdiknas, Bogor.
- Murphy, R., 2008. Clinical features, diagnosis and management of maternally inherited diabetes and deafness (MIDD) associated with the A3243G mitochondrial points mutations. *Diabetic Medicine*, No. 25, pp. 383-399.
- Naguib, Y.M.A. 2000. Antioksidant Activities Astaxanthin and Related Carotenoids. *Journal of Agricultural Chemicals.* , 2000, 48 (4), pp 1150–1154. DOI: 10.1021/jf991106k
- Nallella; K.P., Rakesh, K. Sharma., Shyam S. R. Allamaneni; Ashok Agarwal, 2005. Identification of male factor infertility using a novel semen quality score and reactive oxygen species levels. Center for Advanced Research in Human Reproduction, Infertility, and Sexual Function, Glickman Urological Institute and Department of Obstetrics-Gynecology, Cleveland Clinic Foundation - Cleveland, Ohio
- Nasir, M., 2002. Bioteknologi Potensi Dan Keberhasilannya Dalam Bidang Pertanian. PT. Raja Grafindo Persada. Jakarta.
- Nishida Y, Yamashita E, Miki W, Institute for Food Science Research Japan, 2007. Antioxidant: Quenching Activities of Common Hydrphillic and Lipophillic Antioxidants againts Singlet Oxygen using Chemiluminescence Detection System. *Carotenoid Science*, Vol 11, p. 16-20
- M. C. Y. Ng, V. T. F. Yeung, C. C. Chow, J. K. Y. Li, P. R. Smith, C. H. Mijovic, J. A. J. H. Critchley, A. H. Barnett, C. S. Cockram, J. C. N. Chan, 2003. Mitochondrial DNA A3243G mutation in patients with early- or late-onset type 2 diabetes mellitus in Hong Kong Chinese. *Clinical Endocrinology* May 2000 Volume52, Issue 5, Pages 557-564. <https://doi.org/10.1046/j.1365-2265.2000.00989.x>

- Odeberg, M.J.; Lignell, A.; Pettersson, A.; Hoglund, P. Oral bioavailability of the antioxidant astaxanthin in humans is enhanced by incorporation of lipid based formulations. *Eur. J. Pharm. Sci.* 2003, 19, 299–304. [Google Scholar] [CrossRef] 138
- Ohgami, K. et al. 2003. Effects of astaxanthin on lipopolysaccharide-induced inflammation in vitro and in vivo. *Invest. Ophthalmol. Vis. Sci.* 44, 2694.
- Osterlie, M., Bjerken, B., Liaen-Jensen, S., 2000. Plasma appearance and distribution of astaxanthin E/Z and R/S isomers in plasma lipoproteins of men after single dose administration of astaxanthin. *J. Nutr. Biochem.* Vol. 11, pp. 482-490.
- Ozawa, T., 1995. Mechanism of somatic mitochondrial DNA mutations associated with age and diseases. *Biochim Biophys. Acta* 1272, pp. 177-189
- Ozawa, T., 1997. Genetic and functional changes in mitochondrial associated with aging. *Physiol Rev.* No. 77, pp. 425-464.
- Pandin, S.D., 2010. Penanda DNA untuk pemuliaan tanaman kelapa (*Cocos nucifera* L). *ejurnal.litbang.pertanian.go.id. Perspektif.* Vol. 9, No. 1, hal. 21-35.
- Pangkahila, W. 2007. Memperlambat Penuaan, Meningkatkan Kualitas Hidup. *Anti Aging Medicine.* Cetakan ke-1. Jakarta : Penerbit Buku Kompas.hal.133-144
- Permadi, 2008. Mengatasi Infertilitas. Bandung: PT Grafindo
- Pramesti, D, MPB, 2009. Konsultan Pribadi, Instalasi Rawat Jalan Klinik Andrologi. Rumah Sakit Umum Daerah Dr. Soetomo, Surabaya
- Pratiknyo AW, 2007. Dasar-dasar metodologi penelitian kedokteran & kesehatan. Jakarta: PT Raja Grafindo Persada.
- Prianggara Rostu Prayoga, 2015. The Effect if Tomato (*Lycopersicum esculentum* Mill) to Amount, Motility and Morphology of Spermatozoa in Cigarettes-induced Infertility Patients. *J Mojority* Vol 4.No.5. hal 60-66
- Rajender, Singh., Rahul, Pandey., Mahdi, Ali Abas., 2010. Mitochondria, Spermatogenesis and male infertility. *Journal of Mitochondrion.* Vol. 10, pp. 419-428.
- Ramzan MH, Ramzan M, Ramzan F, Ramzan M, Ramzan MA, Shah M, 2015. Insight into the serum kisspeptin levels in infertile males. *Archives of Iranian Medicine* 18(1): 12-17.
- Rao Ranga, A.; Sarada, R.; Baskaran, V.; Ravishankar, G.A. Identification of carotenoids from green alga *Haematococcus pluvialis* by HPLC and LC-MS (APCI) and their antioxidant properties. *J. Microbiol. Biotechnol.* 2009, 19, 1333–1341. [Google Scholar]
- Rao Ranga, A.; Raghunath Reddy, R.L.; Baskaran, V.; Sarada, R.; Ravishankar, G.A. Characterization of microalgal carotenoids by mass spectrometry and their bioavailability and antioxidant properties elucidated in rat model. *J. Agric. Food Chem.* 2010, 58, 8553–8559. [Google Scholar] [CrossRef]

Ranga Rao, A.; Sindhuja, H.N.; Dharmesh, S.M.; Sankar, K.U.; Sarada, R.; Ravishankar, G.A. Effective inhibition of skin cancer, tyrosinase, and antioxidative properties by astaxanthin and astaxanthin esters from the green alga *Haematococcus pluvialis*. *J. Agric. Food Chem.* 2013, 61, 3842–3851. [Google Scholar]

Rao JCB, Martin S. 1989. Lipid peroxidation in human spermatozoa are related to midpiece abnormalities and motility. *Gamete Res* 24:127-134.

Razzak, A.H. & Wais, S.A., (2002). The infertile couple: a cohort study in Duhok, Iraq. *EMHJ - Eastern Mediterranean Health Journal*, 8 (2-3), 234-238, 2002 <https://apps.who.int/iris/handle/10665/119155>

Sabeti P, Pourmasumi S, Rahiminia T, Akyash F, Talebi AR. Etiologies of sperm oxidative stress. *Int J Reprod Biomed (Yazd)* 2016;14:231–40. [PMC free article] [PubMed] [Google Scholar]

Sadek Kadry Mohamed, 2012. Antioxidant and Immunostimulant Effect of *Carica Papaya* Linn. Aqueous Extract in Acrylamide Intoxicated Rats. *Acta Inform Med Sep*; 20(3): 180–185. doi: 10.5455/aim.2012.20.180-185. PMID: 23322975

Mortazavi, M., Salehi, I., Alizadeh, Z., Vahabian, M. and Roushandeh, A.M. 2014. Protective effects of Antioxidants on sperm parameters and seminiferous tubules epithelium in high fat-fed rats. *J. Reprod. Infertil.*, 15: 22-

Salehi MH, Houshmand M, Bidmeshkipour A, Shafa M, Panahi S, 2006. Low sperm motility due to mitochondrial DNA multiple deletions. *Journal of Chinese Clinical Medicine* September 2006, Vol. 1, Number 4 page 181-187

Sanocka D, dan Kurpisz M, 2004. Reactive oxygen species and sperm cells. *Reproductive Biology and Endocrinology* 2(12): 1–7.

Sariozkan, S., Bucak, M.N., Tuncer, P.B., Buyukleblebici, S. and Canturk, F. 2014. Influence of various antioxidants added to TCM-199 on postthaw bovine sperm parameters, DNA integrity and fertilizing ability. *Cryobiol.*, 68:129-133

Schill, Wolf-Bernhard et al., 2006. *Andrology for the Clinician*. Springer. p. 41

Schon, E.A., Bonilla, E., DiMauro, S., 1997. Mitochondrial DNA mutations and pathogenesis. *J Bioenerg Biomembr.* 29. Pp. 131-149

Setiati, Sri, 2003. Radikal bebas, antioksidan dan proses menua. *Jurnal Kedokteran Farmasi* No. 6 Th. XXIX. P. 366 – 369.

Setiawan, I Made., 2007. Pemeriksaan Enzyme Linked Immunosorbent Assay (ELISA) untuk Diagnosis Leptospirosis, Ebers Papyrus.

Shanske, S., 2004. Varying loads of the mitochondrial DNA A3243G mutation in different tissues: Implications for diagnosis. *American Journal of Medical Genetics. Part A*, 130A, pp. 134-137.

- Shamsi MB, Rakesh Kumar, Audesh Bhatt, R. N. K. Bamezai, Rajeev Kumar, Narmada P. Gupta, T. K. Das, and Rima Dada, 2018. Mitochondrial DNA Mutations in etiopathogenesis of male infertility. *Indian J Urol*. 2008 Apr-Jun; 24(2): 150–154. doi: 10.4103/0970-1591.40606.
- Sharma, R.K., Pasqualotto, F.F., Nelso, D.R., Thomas, A.J., Agarwal A., 1999. The reactive oxygen species total antioxidant capacity score is a new measure of oxidative stress to predict male infertility. *Human Reprod*. Vol. 14, pp. 2801-2807.
- Sharma R, Garu U, 2011. Effects of lead toxicity on developing testes in Swiss mice. *Univ J Environ Res Technol* 1:390–398 Google Scholar
- Shukla Govind, Nagalakshmi Yaparthy, Jyothika Vanamali, C.J. Sampath Kumar. Astaxanthin capsules: An excellent choice to improve sperm parameter and fertility. *Medico Research Chronicles* , 2016. 3 (5), 328-332.
- Sikka, S.C., 2004. Role of Oxidative Stress and antioxidant in andrology and asisted reproductive technology. *J. Androl*. Vol. 25, pp. 5-18.
- Sikka SC, Champion HC, Bivalacqua TJ, Estrada LS, Wang R, Rajasekaran M, Agarwal BT, and Hellstrom WJG, 2001. Role of genitourinary inflammation in infertility: synergistic effect of lipopolysaccharide and interferon on human spermatozoa, *Int. J of Andrology*, 24: 136-141.
- Sinha Annika, Sajal Gupta S, 2018. Lipid peroxidation and its impact on fertility. *Women's Health and Gynecolog* 4: 82-92.
- Slade P, O'Neill C, Simpson AJ, Lashen H, 2007. The relationship between perceived stigma, disclosure patterns, support and distress in new attendees at an infertility clinic. *Hum Reprod*; 22: 2309-17
- Sobhani B, Sahar Roomiani, Milad Ashrafizadeh. Histopathological Analysis of Testis: Effects of Astaxanthin Treatment against Nicotine Toxicity. *Iranian Journal of Toxicology* Volume 13, No. 1, February 2019
- Spinazzi M, Enrico Radaelli, Katrien Horr , Amaia M. Arranz, Natalia V. Gounko, Patrizia Agostinis, et al, 2019. PARL deficiency in mouse causes Complex III defects, coenzyme Q depletion, and Leigh-like syndrome *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* January 2, 2019 116 (1) 277-286; first published December 21, 2018 <https://doi.org/10.1073/pnas.1811938116>
- Spiropoulos, J., Turnbull, D.M., Chinnery, P.F., 2002. Can Mitochondrial DNA mutations cause sperm dysfunction. *Mol Hum Reprod*. Vol. 8, pp. 719-748.
- St. John, J.C., Cooke I., Barratt CLR., 1997. Mitochondrial mutations and male infertility. *Nat Med*, Vol. 3, pp. 124-124
- St. John J.C., Jokhi R.P., Barratt CLR. 2005. The impact of mitochondrial genetics on male infertility. *Int. J. Androl* 28:65-73.

- Sudjarwo, Hinting A, Sudoyo H, Marzuki S., 2001. Analysis of Asian mtDNA haplogroups in low and normal sperm motility. Proceeding of the VIIth International Congress Andrology, June 15-19. Medimond Inc. 53.
- Sudjarwo A., 2000, Pengaruh Pemberian Monosodium Glutamat Per Oral terhadap Spermatogenesis dan Jumlah Anak Tikus Putih Jantan Dewasa. Jurnal Kedokteran YARSI, Volume VIII No. 3, Jakarta, 80-86. Dalam <http://lib.atmajaya.ac.id/default.aspx?tabID=61&id=151843&src=a>, Diakses tanggal 31 Oktober 2011.
- Sudjarwo, 2003, Peran Superoksid Dismutase Pada evaluasi kualitas sperma Manusia, Jurnal Farmasi Universitas Airlangga, Surabaya, Hal. 53-56
- Sukarjati, Doddy M.S., Aucky Hinting, Sudjarwo, 2011. Pengaruh Escherichia coli dan leukosit terhadap kualitas spermatozoa manusia secara in vitro, JBP, vol : 13, 3
- Suleiman SA, Ali M, Zaki ZMS, EL-Malik EMA and Nasar MA; 1996. Lipid of Peroxidation and human sperm motility: Protective role of Vitamin E; J. Androl; 17; 5; 530-537
- Suseela, M.R., Toppo, K. 2006. Haemotococcus pluvialis-a Green Algae, Richest Natural Source of Astaxanthin. Current Science.Vol 90, No.12, pp. 1602-1603.
- Tanagho, Jack W. McAninch, 2008.Smith's General Urology: Urologic Diseases. Lange Medical Books. Mc Graw- Hill. New York
- Thangaraj, K., Joshi, M.B., Reddy, A.G., Rasalkar, A.A., Singh, L., 2003. Sperm mitochondrial mutations as a cause of low sperm motility. J. Androl 24 (3). Pp. 388-392.
- Thomas, J.E., W.C. Wong and D.H. Goanlock., 1989. Modern Method for the detection of plant pathogens., Queensland Agric. J., pp. 49-53.
- Thusty, M. and Hyland, C. 2005. Astyaxanthin deposition in the cuticle of juvenile American lobster (*Homarus americanus*): implications for phenotypic and genotypic coloration. Mar. Biol. 147, 113.
- Toha, A. H., 2001. Deoksi Nukleac Acid Ekspresi, Rekayasa, Keanekaragaman, Efek Pemanfaatannya, Alfabeta, Bandung
- Tremellen K, 2008. Oxidative stress and male infertility- a clinical perspective. Human Reproduction Update. Vol. 14, No. 3, pp. 243-258.
- Trilaksani W. 2003. Antioksidan:jenis, sumber, mekanisme kerja dan peran Terhadap Kesehatan. TermPaper Introductory Science Philosophy (PPS702). Institut Pertanian Bogor.
- Tuppen, HAL., Blakely, E.L., Turnbull, D.M., Taylor, R.W., 2010. Mitochondria DNA mutation and human disease. Biochimica et biophysica Acta 97. Pp. 113-128.
- Ursoniu Sorin, Amirhossein Sahebkar, Maria-Corina Serbain, Macie Banach. Lipid profile and glucose changes after supplementation with astaxanthin: a systematic review and meta-analysis of randomized controlled trials. Arch Med Sci , 2015; 11, 2: 253-266.

Valko M, Leibfritz D, Moncol J, Cronin MT, Mazur M, Telser J. Free radicals and antioxidants in normal physiological functions and human disease. *Int. J Biotech Cell Biol.* 2007; 39; 44-84

Venkatesh , S., Deecaraman M., Kumar, R., Shamshi, M.B., Dada, R., 2009. Role of Reactive Oxygen Species in the pathogenesis of mitochondrial DNA (mtDNA) mutation in male infertility. *Indian J Med Res.* Vol. 139, pp. 127-137.

Vincent, W. 2007. Terapi dan Pencegahan Penyakit dengan Astaxanthin. *Jurnal Simposia* Vol.6, No.12.

Wael, S., Watuguly, T.W. & Winarto. 2014. Pemberian Minyak Jintan Hitam (*Nigella Sativa*) Terhadap Motilitas dan Jumlah Spermatozoa Tikus Sprague Dawley yang Dipapar Minuman Tradisional Arak Ambon (Sopi). *Molucca Medica* 4(2), pp.132-36.

Wagner H, Cheng JW, Ko EY. Role of reactive oxygen species in male infertility, 2018. *Arab J urol*, 16: 35-43

Wayama, M., Ota, S., Matsuura, H., Nango, N., Hirata, A and Kawano, S. 2013. Three-dimensional ultrastructural study of oil and astaxanthin accumulation during encystment in the green alga *Haematococcus pluvialis*. *PLoS One*, 8:e53618. Doi: 10.1371/Journal.pone, 0053618.

Winarsi, Henry, 2007, *Antioksidan Alami & Radikal Bebas*, Kanisius, Yogyakarta

Wirawan Riadi, 2011. *Pemeriksaan Laboratorium Hematologi*, FKUI, Jakarta

Wood, V and Yamashita, E. 2009. *Antioxidant Symposium 2009: An Update on Clinical Research*, Jakarta. Available at: <http://blog.perriconemd.com/astaxanthin-side-effects>. Accessed 1 September 2016.

World Health Organization. 2010. *WHO Laboratory Manual for Examination of Human Semen and Sperm-Cervical Mucus Interaction*, Five Edition. Cambridge University Press, New York.

Yamashita, 2-6-3-12F, Shibakoen, Minato-ku, Tokyo 105-0011, Astaxanthin as a Medical Food Japan Submission date: April 28, 2013; Acceptance date: July 3, 2013; Publication date: July 3, 2013. Department of Research & Development, Medical Nutrition Division, AstaReal Co., Ltd., Tokyo, Japan

Yamashita, Eiji., 2015. Let astaxanthin be thy medicine. *Pharma Nutrition*. Vol. 3, pp. 115-122

Yan T, Zhao Y, Zhang X, et al. Astaxanthin inhibits acetaldehyde-induced cytotoxicity in SH-SY5Y cells by modulating Akt/CREB and p38MAPK/ERK signaling pathways. *Mar Drugs*. 2016 10;14. pii: E56.

Yousuf M, Salih S, Al Jahani S, Alothman A, 2012. Erythrocyte sedimentation rate at diagnosis in culture positive cases of active tuberculosis. *Pak J Med Sci*, January-March 2012. Vol. 28 No. 1. P 87-90



Yuan JP, Peng J, Yin K, Wang JH. Potential health-promoting effects of astaxanthin: A high-value carotenoid mostly from microalgae. *Mol Nutr Food Res*. 2010; 55(1): 150-165.

Zelen Ivankaa, Mitrovi Marinaa, Juriši-Škevin Aleksandrab, Arsenijevi Slobodanc, 2010. Activity of superoxide dismutase and catalase and content of Malondialdehyde in seminal plasma.

Zhao ZW, Cai W, Lin YL., Lin QF, Jiang Q, Lin Z., et al. Ameliorative effect of astaxanthin on endothelial dysfunction in streptozotocin-induced diabetes in male rats. *Arzneimittelforschung*, 2011; 6. (04); 239-246.

Zhou XY, Zhang F, Hu XT, et al. Depression can be prevented by astaxanthin through inhibition of hippocampal inflammation in diabetic mice. *Brain Res*. 2017; 1657: 262-268.

Zini A, San Gabriel M, Baazeem A. Antioxidants and sperm DNA damage: A clinical perspective. *J Assist Reprod Genet*. 2009;26:427–32. [PMC free article] [PubMed] [Google Scholar]