Scopus

Documents

Hamad Zubi, Z.B., Hamad Alfarisi, H.A.

Hyperlipidemia and male infertility

(2021) *Egyptian Journal of Basic and Applied Sciences*, 8 (1), pp. 385-396.

DOI: 10.1080/2314808X.2021.1977080

Department of Nutrition Sciences, Kulliyyah of Allied Health Sciences, International Islamic University Malaysia, Kuantan, Pahang, Malaysia

Abstract
Hyperlipidemia is a common disease affecting 25% of adults in developed nations. Approximately 50% of the middle-aged adult population have been reported to have total cholesterol level above the normal range. Worldwide, the incidence of dyslipidaemia is increasing in both low and high income countries. It is a major risk factor for the prevalence and severity of ischemic heart disease. Less recognized but growing in importance are the effects of dyslipidaemia on reproductive functions. A growing evidence has linked dyslipidaemia and abnormal lipid metabolism with alteration of male fertility. The purpose of this review is to summarize the data gathered from both experimental animal models and human studies on the effects of hyperlipidemia on semen parameters, spermatogenesis, male reproductive organs, hormones and fertility. © 2021 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group.

Author Keywords
erectile dysfunction; hypercholesterolemia; Hyperlipidemia; organs histology; reproductive hormones; semen quality

References

- Pragya, M., Nesar, A., Tarique, M.
  Effect of Terminalia bellerica against high fat diet induced hyperlipidemia and obesity
  (2016) *World J Pharm Sci*, 4 (4), pp. 33-37.
- Song, X., Liu, H., Wang, X.
  Atorvastatin combined with poly-unsaturated fatty acid confers better improvement of dyslipidemia and endothelium function
  (2014) *Lipids Health Dis*, 13 (186), pp. 1-5.
- Han, J.-M., Lee, J.-S., Kim, H.-G.
  Synergistic effects of Artemisia iwayomogi and Curcuma longa radix on high-fat diet-induced hyperlipidemia in a mouse model
  (2015) *J Ethnopharmacol*, 173, pp. 217-224.
- Pushpendra, A., Jain, G.C.
  Hyper-lipidemia and male fertility: a critical review of literature
  (2015) *Androl Open Access*, 4 (2), pp. 1-12.
- Shen, K.-P., Hao, C.-L., Yen, H.-W.
  Pre-germinated brown rice prevented high fat diet induced hyperlipidemia through ameliorating lipid synthesis and metabolism in C57BL/6J mice
  (2016) *J Clin Biochem Nutr*, 15 (117), pp. 1-6.
- Ouvrier, A., Alves, G., Damon-Soubeyrand, C.
  Dietary cholesterol-induced post-testicular infertility
  (2011) *Plos One*, 6 (11), pp. 1-13.

- Ferramosca, A., Conte, A., Moscatelli, N.
  A high-fat diet negatively affects rat sperm mitochondrial respiration
  (2016) *Andrology*, 2016 (4), pp. 520-525.

- Frenoux, J.-M., Vernet, P., Volle, D.H.
  Nuclear oxysterol receptors, LXRs, are involved in the maintenance of mouse caput epididymidis structure and functions
  (2004) *J Mol Endocrinol*, 332, pp. 361-375.

- He, L., Hao, L., Fu, X.
  Severe hypertriglyceridemia and hypercholesterolemia accelerating renal injury: a novel model of type 1 diabetic hamsters induced by short-term high-fat/high-cholesterol diet and low-dose streptozotocin
  (2015) *BMC Nephrol*, 16 (1), p. 51.

- Mani, D.N., Bawankule, D., Saroj, B.K.
  Hyperlipidemic model: studying lipid profile in small experimental animal
  (2012) *Int J Pharm Pharm Sci*, 4 (3), pp. 337-340.

- Otunola, G.A., Oloyede, O.B., Oladiji, A.T.
  Effects of diet-induced hypercholesterolemia on the lipid profile and some enzyme activities in female Wistar rats
  (2010) *Afr J Biochem Res*, 4 (6), pp. 149-154.

- Chade, A.R., Mushin, O.P., Zhu, X.
  Pathways of renal fibrosis and modulation of matrix turnover in experimental hypercholesterolemia
  (2005) *Hypertention*, 46 (November), pp. 772-779.

- Maqdasy, S., Baptissart, M., Vega, A.
  Cholesterol and male fertility: what about orphans and adopted?
  (2013) *Mol Cell Endocrinol*, 368 (1-2), pp. 30-46.

- Safdar, A.H.A.
  Andrology and male infertility
  (2017) *Austin Androl*, 2 (1), p. 1014.

- Mohamed, Z.B.H., Hamad Alfarisi, H.A., Abdul Wahab, A.Y.
  Trihoney improves testicular weight change and histopathological alterations in hypercholesterolemic rabbits
  (2020) *Asia Pac J Mol Biol Biotechnol*, 28 (3), pp. 75-87.

- Mohamed, Z.B.H., Ibrahim, M., Alfarisi, H.A.H.
  Trihoney ameliorates hypercholesterolemia-induced epididymal histopathological changes in male rabbits
  (2020) *AsPac J Mol Biol Biotechnol*, 28 (1), pp. 90-100.

- (2010) *WHO laboratory manual for the Examination and processing of human semen*, Fifth, Geneva Switzerland: WHO Press, ed

- Coppola, G., Caprio, G.D., Wilding, M.
  Digital holographic microscopy for the evaluation of human sperm structure
  (2013) *Zygote*, pp. 1-9.
  March

- Sherwood, L.
(2010) *Human physiology from cells to systems*,
seventh, USA, Brooks/Cole, ed

- Esteves, S.C., Miyaoka, R., Agarwal, A.
An update on the clinical assessment of the infertile male
(2011) *Clinics*, 66 (4), pp. 691-700.

- Rato, L., Alves, M.G., Cavaco, J.E.
High-energy diets: a threat for male fertility?
(2014) *Obesity Rev*, 15 (12), pp. 996-1007.

- Bataineh, H.N., Nusier, M.K.
Effect of cholesterol diet on reproductive function in male albino rats
(2005) *Saudi Med J*, 26 (3), pp. 398-404.

- Samir Bashandy, A.
Effect of fixed oil of nigella sativa on male fertility in normal and hyperlipidemic rats
(2007) *Int J Pharm*, 3 (1), pp. 27-33.

- Rato, L., Alves, M.G., Dias, T.R.
High-energy diets may induce a pre-diabetic state altering testicular glycolytic metabolic profile and male reproductive parameters
(2013) *Andrology*, 2013 (1), pp. 495-504.

- Soltani, Y., Aklil, B., Mokrani, Z.
Effects of diet induced obesity on the gonadal axis in the male rabbit: impact of leptin
(2013) *USTHB-FBS-4th International Congress of the Populations & Animal Communities "Dynamics & Biodiversity of the Terrestrial & Aquatic Ecosystems""CIPCA4"TAGHIT (Bechar)*, pp. 478-487.
ALGERIA

- Louei Monfared, A.
Correlation of serum lipid profile with histological and seminal parameters of testis in the goat
(2013) *Int J Fertil Sterility*, 7 (2), pp. 122-129.

- Mortazavi, M., Salehi, I., Alizadeh, Z.
Protective effects of antioxidants on sperm parameters and seminiferous tubules epithelium in high fat-fed rats Motahareh
(2014) *J Reprod Infertil*, 15 (1), pp. 22-28.

- Al-Kushi, A., El Sawy, N.A., Hijazi, M.M.
Therapeutic effect of Vitamin E on testicular tissue damage caused by obesity
(2016) *J Obesity Weight Loss Ther*, 6 (5), pp. 1-5.

- Ergün, A., Köse, S.K., Aydos, K.
Correlation of seminal parameters with serum lipid profile and sex hormones
(2007) *Arch Androl*, 53 (1), pp. 21-23.

- Jensen, T.K., Heitmann, B.L., Jensen, M.B.
High dietary intake of saturated fat is associated with reduced semen quality among 701 young Danish men from the general population

(2013) *Am J Clin Nutr*, 97 (2), pp. 411-418.

- Liu, C.-Y., Chou, Y.-C., Chao, -J.C.-J.
  The association between dietary patterns and semen quality in a general Asian population of 7282 males
  (2015) *PLOS ONE*, 10 (7).

- Hammoud, A.O., Gibson, M., Peterson, C.M.
  Obesity and male reproductive potential
  (2006) *J Andrology*, 27 (5), pp. 619-626.

- Nikoobakht, M., Nasseh, H., Pourkasmaee, M.
  The relationship between lipid profile and erectile dysfunction
  (2005) *Int J Impot Res*, 17 (6), pp. 523-526.

- Rao, K., Du, G.-H., Yang, W.-M.
  Correlation between abnormal serum lipid and erectile dysfunction]
  (2005) *Nat J Androl*, 11 (2), pp. 112-115.

- Nunes, K.P., Webb, R.C.
  (2012) *Mechanisms in erectile function and dysfunction: an overview, erectile dysfunction - disease-associated mechanisms and novel insights into therapy*,
  Nunes K., (ed), InTech,; Croatia:,. Available from

- Ponholzer, A., Temml, C., Rauchenwald, M.
  Vascular risk factors and erectile dysfunction in a cohort of healthy men
  (2006) *Int J Impot Res*, 18 (5), pp. 489-493.

- Yamamoto, Y., Shimamoto, K., Sofikitis, N.
  Effects of hypercholesterolaemia on Leydig and Sertoli cell secretory function and the overall sperm fertilizing capacity in the rabbit
  (1999) *Hum Reprod*, 14 (6), pp. 1516-1521.

- Ashrafi, H., Ghabili, K., Alihemmati, A.
  The effect of quince leaf (Cydonia oblonga miller) decoction on testes in hypercholesterolemic rabbits: a pilot study
  (2013) *Afr J Traditional Complementary Altern Med*, 10 (2), pp. 277-282.

- Shalaby, M.
  Effect of alpha-tocopherol and simvastatin on male fertility in hypercholesterolemic rats
  (2004) *Pharmacol Res*, 50 (2), pp. 137-142.

- Saez Lancellotti, T.E., Boarelli, P.V., Monclus, M.A.
  Hypercholesterolemia impaired sperm functionality in rabbits
  (2010) *PLoS ONE*, 5 (10).

- Saez Lancellotti, T.E., Boarelli, P.V., Romero, A.A.
  Semen quality and sperm function loss by hypercholesterolemic diet was recovered by addition of olive oil to diet in rabbit
  (2013) *PLoS ONE*, 8 (1:e52386), pp. 1-8.

- Mohamed, Z.B.H., Ibrahim, M.B., Alfarisi, H.A.H.
  Honey improves sperm parameters in high cholesterol diet-fed male rabbits
  (2021) *ASM Sci J*, 15, pp. 1-10.

- Schisterman, E.F., Mumford, S.L., Chen, Z.
Lipid concentrations and semen quality: the LIFE study
(2014) *Andrology*, 2 (3), pp. 408-415.

- Martínez, P., Morros, A.
Membrane lipid dynamics during human sperm capacitation
(1996) *Front Biosci*, 1 (1), pp. d103-d117.

- Travis, A.J., Merdiushev, T., Vargas, L.A.
Expression and localization of caveolin-1, and the presence of membrane rafts, in mouse and Guinea pig spermatozoa
(2001) *Dev Biol*, 240 (2), pp. 599-610.

- Visconti, P.E., Ning, X., Fornes, M.W.
Cholesterol efflux-mediated signal transduction in mammalian sperm: cholesterol release signals an increase in protein tyrosine phosphorylation during mouse sperm capacitation phosphorylation and capacitation
(1999) *Dev Biol*, 214 (2), pp. 429-443.

- Travis, A.J., Kopf, G.S.
The role of cholesterol efflux in regulating the fertilization potential of mammalian spermatozoa
(2002) *J Clin Investig*, 110 (6), pp. 731-736.

- Whitfield, M., Pollet-Villard, X., Levy, R.
Post-testicular sperm maturation, infertility and hypercholesterolaemia
(2015) *Asian J Androl*, 17, pp. 742-748.

- Saez, F., Ouvrier, A., Drevet, J.R.
Epididymis cholesterol homeostasis and sperm fertilizing ability
(2011) *Asian J Androl*, 13 (1), pp. 11-17.

- Zarei, A., Ashtiyani, S.C., Vaezi, G.H.
A study on the effects of the hydroalcholic extract of the aerial parts of Alhagi camelorum on prolactin and pituitary-gonadal activity in rats with hypercholesterolemia
(2014) *Arch Ital Urol Andrologia*, 86 (3), pp. 188-192.

- Zarei, A., Changizi-ashtiyani, S., Rezaei, A.
The effect of chelidonium majus extract on the lipid profile and activity of pituitary-gonadal axis in hypercholesterolemic rats
(2014) *Zahedan J Res Med Sci*, 16 (10), pp. 18-22.

- Mu, Y., Yan, W., Yin, T.
Curcumin ameliorates high-fat diet-induced.pdf
(2016) *Mol Med Rep*, 14 (4), pp. 3588-3594.

- Mu, Y., Yan, W., Yin, T.
Diet-induced obesity impairs spermatogenesis: a potential role for autophagy
(2017) *Sci Rep*, 7 (43475), pp. 1-13.

- Hamad Mohamed, Z., Ibrahim, M., Hamad Alfarisi, H.
Effect of trihoney (A mixture of Trigona, Mellifera and Tualang) on male reproductive hormones and insulin resistance in hypercholesterolaemic rabbits.pdf

(2020) *IMJM*, 19 (3), pp. 21-29.

- Wagner, H., Cheng, J.W., Ko, E.Y.
  Role of reactive oxygen species in male infertility : an updated review of literature
  (2019) *Arab J Urol*, 16 (1), pp. 35-43.

- Makker, K., Agarwal, A., Sharma, R.
  Oxidative stress & male infertility
  (2009) *Indian J Med Res*, 129 (4), pp. 357-367.

- Aitken, R.J., Jones, K.T., Robertson, S.A.
  Reactive oxygen species and sperm function-in sickness and in health
  (2012) *J Andrology*, 33 (6), pp. 1096-1106.

- Saleh, R.A., Agarwal, A.
  Oxidative stress and male infertility: from research bench to clinical practice
  (2002) *J Andrology*, 23 (6), pp. 737-752.

- Lobascio, A.M., De Felici, M., Anibaldi, M.
  Involvement of seminal leukocytes, reactive oxygen species, and sperm mitochondrial membrane potential in the DNA damage of the human spermatozoa
  (2015) *Andrology*, 3 (2), pp. 265-270.

- Agarwal, A., Majzoub, A.
  Free radicals in andrology
  (2017) *Trends in andrology and sexual medicine*, 1, pp. 1-21.
  Balercia G., Gandini L., Lenzi A., (eds), Cham: Springer International Publishing,. In:,., editors.,.,. p

- Bansal, A.K., Bilaspuri, G.S.
  Impacts of oxidative stress and antioxidants on semen functions
  (2011) *Vet Med Int*, 2011, pp. 1-7.

- Iommiello, V.M., Albani, E., Di Rosa, A.
  Ejaculate oxidative stress is related with sperm DNA fragmentation and round cells
  (2015) *Int J Endocrinol*, 2015, pp. 1-6.

- Du Plessis, S.S., McAllister, D.A., Luu, A.
  Effects of H₂O₂ exposure on human sperm motility parameters, reactive oxygen species levels and nitric oxide levels
  (2010) *Andrologia*, 42 (3), pp. 206-210.

- Tremellen, K.
  Oxidative stress and male infertility — a clinical perspective
  (2008) *Hum Reprod Update*, 14 (3), pp. 243-258.

- Talevi, R., Barbato, V., Fiorentino, I.
  Protective effects of in vitro treatment with zinc, d-aspartate and coenzyme q10 on human sperm motility, lipid peroxidation and DNA fragmentation
  (2013) *Reprod Biol Endocrinol RB&E*, 11 (81), pp. 1-10.

- Wang, X., Sharma, R.K., Sikka, S.C.
  Oxidative stress is associated with increased apoptosis leading to spermatozoa DNA damage in patients with male factor infertility
  (2003) *Fertil Steril*, 80 (3), pp. 531-535.

- Agarwal, A., Sharma, R.K., Nallella, K.P.
Reactive oxygen species as an independent marker of male factor infertility
(2006) *Fertil Steril*, 86 (4), pp. 878-885.

- Aziz, N., Saleh, R.A., Sharma, R.K.
Novel association between sperm reactive oxygen species production, sperm morphological defects, and the sperm deformity index
(2004) *Fertil Steril*, 2 (81), pp. 349-354.

- Chen, X., Gong, L., Xu, J.
Probiotics attenuate sperm damage induced by oxidative stress in rats
(2012) *Int Conf Biomed Eng Biotechnol*, 314, pp. 446-448.

- Galaly, S.R., Hozayen, W.G., Amin, K.A.
Effects of Orlistat and herbal mixture extract on brain, testes functions and oxidative stress biomarkers in a rat model of high fat diet
(2014) *Beni-Suef Univ J Basic Appl Sci*, 3 (2), pp. 93-105.

- Hamad Mohamed, Z., Hamad Alfarisi, H., Abdul Wahab, A.
Male Infertility : evaluation and Treatment
(2020) *IMJM*, 19 (3), pp. 92-98.

- Zhang, K., Lv, Z., Jia, X.
Melatonin prevents testicular damage in hyperlipidaemic mice
(2012) *Andrologia*, 44 (4), pp. 230-236.

- Saez, F., Chabory, E., Cadet, R.
Liver X receptors and epididymal epithelium physiology
(2007) *Asian J Androl*, 9 (4), pp. 574-582.

- Whitfield, M., Ouvrier, A., Cadet, R.
Liver X receptors (LXRs) alpha and beta play distinct roles in the mouse epididymis
(2016) *Biol Reprod*, 94 (3), pp. 1-11.

- Annicotte, J.-S., Schoonjans, K., Auwerx, J.
Expression of the liver X receptor α and β in embryonic and adult mice
(2004) *Anat Rec*, 277A (2), pp. 312-316.

- Robertson, K.M., Schuster, G.U., Steffensen, K.R.
The liver X receptor-β is essential for maintaining cholesterol homeostasis in the testis
(2005) *Endocrinology*, 146 (6), pp. 2519-2530.

- Volle, D.H., Mouzat, K., Duggavathi, R.
Multiple roles of the nuclear receptors for oxysterols Liver X receptor to maintain male fertility
(2007) *Mol Endocrinol*, 21 (5), pp. 1014-1027.

- Ouvrier, A., Cadet, R., Vernet, P.
LXR and ABCA1 control cholesterol homeostasis in the proximal mouse epididymis in a cell-specific manner
(2009) *J Lipid Res*, 50 (9), pp. 1766-1775.

Correspondence Address
Hamad Zubi Z.B.; Department of Nutrition Sciences, Malaysia; email: zenab.B.zoubi@gmail.com

Publisher: UBM Exhibition Singapore PTE LTD

ISSN: 2314808X
Language of Original Document: English
Abbreviated Source Title: Egypt. J. Basic. Appl. Sci.
2-s2.0-85120399626
Document Type: Article
Publication Stage: Final
Source: Scopus