

- Lundby C, Montero D. CrossTalk opposing view: Diffusion limitation of O_2 from microvessels into muscle does not contribute to the limitation of VO_2 max. *J Physiol*. 2015;593(17):3759–3761.
- Otto-Yanez M, Sarmiento da Nobrega AJ, Torres-Castro R, et al. Maximal voluntary ventilation should not be estimated from the forced expiratory volume in the first second in healthy people and COPD patients. *Front Physiol*. 2020;11:537.
- Torres-Tamayo N, Garcia-Martinez D, Lois Zlolniski S, Torres-Sanchez I, Garcia-Rio F, Baştir M. 3D analysis of sexual dimorphism in size, shape and breathing kinematics of human lungs. *J Anat*. 2018;232(2):227–237.
- Sheel AW, Guenette JA, Yuan R, et al. Evidence for dysanapsis using computed tomographic imaging of the airways in older ex-smokers. *J Appl Physiol*. 2009;107(5):1622–1628.
- Molgat-Seon Y, Dominelli PB, Ramsook AH, et al. The effects of age and sex on mechanical ventilatory constraint and dyspnea during exercise in healthy humans. *J Appl Physiol*. 2018;124(4):1092–1106.
- Dominelli PB, Molgat-Seon Y, Bingham D, et al. Dysanapsis and the resistive work of breathing during exercise in healthy men and women. *J Appl Physiol*. 2015;119(10):1105–1113.
- Miller JD, Hemauer SJ, Smith CA, Stickland MK, Dempsey JA. Expiratory threshold loading impairs cardiovascular function in health and chronic heart failure during submaximal exercise. *J Appl*. 2006;101(1):213–227.
- Lundby C, Robach P. Performance enhancement: What are the physiological limits? *Physiology (Bethesda)*. 2015;30(4):282–292.
- Dominelli PB, Archiza B, Ramsook AH, et al. Effects of respiratory muscle work on respiratory and locomotor blood flow during exercise. *Exp Physiol*. 2017;102(11):1535–1547.
- Dominelli PB, Render JN, Molgat-Seon Y, Foster GE, Romer LM, Sheel AW. Oxygen cost of exercise hyperpnoea is greater in women compared with men. *J Physiol*. 2015;593(8):1965–1979.
- Lundby C, Montero D, Gehrig S, et al. Physiological, biochemical, anthropometric, and biomechanical influences on exercise economy in humans. *Scand J Med Sci Sports*. 2017;27(12):1627–1637.
- Lundby C, Montero D, Joyner M. Biology of VO_2 max: Looking under the physiology lamp. *Acta Physiol (Oxf)*. 2017;220(2):218–228.
- Dempsey JA, La Gerche A, Hull JH. Is the healthy respiratory system built just right, overbuilt, or underbuilt to meet the demands imposed by exercise? *J Appl Physiol*. 2020;129(6):1235–1256.
- Amann M, Eldridge MW, Lovering AT, Stickland MK, Pegelow DF, Dempsey JA. Arterial oxygenation influences central motor output and exercise performance via effects on peripheral locomotor muscle fatigue in humans. *J Physiol*. 2006;575(Pt 3):937–952.
- Diaz-Caneiro C, Siebenmann C, Montero D. Blood oxygen carrying capacity determines cardiorespiratory fitness in middle-age and older women and men. *Med Sci Sports Exerc*. 2021;53(11):2274–2282.
- Guenette JA, Sheel AW. Exercise-induced arterial hypoxaemia in active young women. *Appl Physiol Nutr Metab*. 2007;32(6):1263–1273.
- Dominelli PB, Sheel AW. Exercise-induced arterial hypoxemia; some answers, more questions. *Appl Physiol Nutr Metab*. 2019;44(6):571–579.
- Dominelli PB, Foster GE, Dominelli GS, et al. Exercise-induced arterial hypoxaemia and the mechanics of breathing in healthy young women. *J Physiol*. 2013;591(12):3017–3034.
- Skattebo O, Calbet JAL, Rud B, Capelli C, Hallen J. Contribution of oxygen extraction fraction to maximal oxygen uptake in healthy young men. *Acta Physiol (Oxf)*. 2020;230(2):e13486.
- Whitwam JG, Duffin J, Triscott A, Lewin K. Stimulation of the peripheral chemoreceptors with sodium bicarbonate. *Br J Anaesth*. 1976;48(9):853–857.
- Goldberg S, Buhbut E, Mimouni FB, Joseph L, Picard E. Effect of moderate elevation above sea level on blood oxygen saturation in healthy young adults. *Respiration*. 2012;84(3):207–211.
- Gore CJ, Little SC, Hahn AG, et al. Reduced performance of male and female athletes at 580 m altitude. *Eur J Appl Physiol Occup Physiol*. 1997;75(2):136–143.
- Chapman RF, Stickford JL, Levine BD. Altitude training considerations for the winter sport athlete. *Exp Physiol*. 2010;95(3):411–421.
- Hamlin MJ, Hopkins WG, Hollings SC. Effects of altitude on performance of elite track-and-field athletes. *Int J Sports Physiol Perform*. 2015;10(7):881–887.

- Muza SR, Rock PB, Fulco CS, et al. Women at altitude: Ventilatory acclimatization at 4,300 m. *J Appl Physiol*. 2001;91(4):1791–1799.
- Hou YP, Wu JL, Tan C, Chen Y, Guo R, Luo YJ. Sex-based differences in the prevalence of acute mountain sickness: A meta-analysis. *Mil Med Res*. 2019;6(1):38.
- Guo M, Montero D. Women consume less oxygen than men per muscular work: role of lean body mass. *Mayo Clinic Proceedings*. 2024 (accepted June 2024).

منابع

- Billroth T. *Handbuch der allgemeinen und speciellen Chirurgie: mit einschluß der topographischen anatomie, operations- und verbandlehre*. Ferdinand Enke Verlag; 1882:63–164.
- Henderson J. *A life of Ernest Starling*. Academic Press; 2005.
- Henriksen JH. Ernest Henry Starling (1866–1927): The scientist and the man. *J Med Biogr*. 2005;13(1):22–30.
- Anderson RM, Fritz JM, O'Hare JE. The mechanical nature of the heart as a pump. *Am Heart J*. 1967;73(1):92–105.
- Katz AM. Ernest Henry Starling, his predecessors, and the 'Law of the Heart'. *Circulation*. 2002;106(23):2986–2992.
- Patterson SW, Piper H, Starling EH. The regulation of the heart beat. *J Physiol*. 1914;48(6):465–513.
- Molina DK, DiMaio VJ. Normal organ weights in men: Part I—the heart. *Am J Forensic Med Pathol*. 2012;33(4):362–367.
- Molina DK, DiMaio VJ. Normal organ weights in women: Part I—the heart. *Am J Forensic Med Pathol*. 2015;36(3):176–181.
- Roß R. The athlete's heart. Historical perspectives—solved and unsolved problems. *Cardiol Clin*. 1997;15(3):493–512.
- Pfaffenberger S, Bartko P, Graf A, et al. Size matters! Impact of age, sex, height, and weight on the normal heart size. *Circ Cardiovasc Imaging*. 2013;6(6):1073–1079.
- Rowland T, Roti M. Influence of sex on the 'Athlete's Heart' in trained cyclists. *J Sci Med Sport*. 2010;13(5):475–478.
- Patel HN, Miyoshi T, Addetia K, et al. Normal values of cardiac output and stroke volume according to measurement technique, age, sex, and ethnicity: Results of the world alliance of societies of echocardiography study. *J Am Soc Echocardiogr*. 2021.
- Bundgaard-Nielsen M, Sørensen H, Dalsgaard M, Rasmussen P, Secher NH. Relationship between stroke volume, cardiac output and filling of the heart during tilt. *Acta Anaesthesiol. Scand*. 2009;53(10):1324–1328.
- Uhríkova I, Lačnakova A, Tandlerova K, et al. Haematological and biochemical variations among eight sight-hound breeds. *Aust Vet J*. 2013;91(11):452–459.
- Hammond HK, White FC, Bhargava V, Shabetai R. Heart size and maximal cardiac output are limited by the pericardium. *Am J Physiol*. 1992;263(6 Pt 2):H1675–H1681.
- Stray-Gundersen J, Musch TI, Haidet GC, Swain DP, Ordway GA, Mitchell JH. The effect of pericardiectomy on maximal oxygen consumption and maximal cardiac output in untrained dogs. *Circ Res*. 1986;58(4):523–530.
- Shah AB, Kronzon I. Congenital defects of the pericardium: A review. *Eur Heart J Cardiovasc Imaging*. 2015;16(8):821–827.
- Borlaug BA, Schaff HV, Pochettino A, et al. Pericardiectomy enhances left ventricular diastolic reserve with volume loading in humans. *Circulation*. 2018;138(20):2295–2297.
- Borlaug BA, Reddy YNV. The role of the pericardium in heart failure: Implications for pathophysiology and treatment. *JACC Heart Fail*. 2019;7(7):574–585.
- Regitz-Zagrosek V, Kararigas G. Mechanistic pathways of sex differences in cardiovascular disease. *Physiol Rev*. 2017;97(1):1–37.
- Diaz-Caneštro C, Montero D. Female sex-specific curtailment of left ventricular volume and mass in HFpEF patients with high end-diastolic filling pressure. *J Hum Hypertens*. 2021;35(3):296–299.
- Scantlebury DC, Borlaug BA. Why are women more likely than men to develop heart failure with preserved ejection fraction? *Curr Opin Cardiol*. 2011;26(6):562–568.
- Diaz-Caneštro C, Montero D. The impact of sex on left ventricular cardiac adaptations to endurance training: A systematic review and meta-analysis. *Sports Med*. 2020;50(8):1501–1513.
- Guo M, Diaz-Caneštro C, Montero D. The Frank-Starling mechanism is not enough: Blood volume expansion

prominently decreases pulmonary O_2 uptake. *Mil Med Res.* 2024;11(1):43.

Wills AK, Lawlor DA, Matthews FE, et al. Life course trajectories of systolic blood pressure using longitudinal data from eight UK cohorts. *PLoS Med.* 2011;8(6):e1000440.

Diaz-Caneiro C, Pentz B, Sehgal A, Montero D. Sex differences in cardiorespiratory fitness are explained by blood volume and oxygen carrying capacity. *Cardiovasc Res.* 2021;118(1):334–343.

Rusinaru D, Bohbot Y, Djelaili F, et al. Normative reference values of cardiac output by pulsed-wave Doppler echocardiography in adults. *Am J Cardiol.* 2021;140:128–133.

Lundby C, Robach P. Performance enhancement: What are the physiological limits? *Physiology (Bethesda).* 2015;30(4):282–292.

Diaz-Caneiro C, Pentz B, Sehgal A, Montero D. Sex differences in cardiorespiratory fitness are explained by blood volume and oxygen carrying capacity. *Cardiovasc Res.* 2022;118(1):334–343.

Diaz-Caneiro C, Pentz B, Sehgal A, Yang R, Xu A, Montero D. Lean body mass and the cardiovascular system constitute a female-specific relationship. *Sci Transl Med.* 2022;14(667):eab02641.

Diaz-Caneiro C, Ng HF, Yiu KH, Montero D. Reduced lean body mass: A potential modifiable contributor to the pathophysiology of heart failure. *Eur Heart J.* 2023;44(16):1386–1388.

Poiseuille J. Recherches expérimentales sur le mouvement des liquides dans les tubes de très petits diamètres. In: *Mémoires présentés par Divers Savants à l'Académie Royale des sciences de l'Institut de France.* Imprimerie Royal, Paris, 1846:433–544.

Mao SS, Ahmadi N, Shah B, et al. Normal thoracic aorta diameter on cardiac computed tomography in healthy asymptomatic adults: Impact of age and gender. *Acad Radiol.* 2008;15(7):827–834.

Boraita A, Heras ME, Morales F, et al. Reference values of aortic root in male and female white elite athletes according to sport. *Circ Cardiovasc Imaging.* 2016;9(10):e005292.

Sandgren T, Sonesson B, Ahlgren R, Lanne T. The diameter of the common femoral artery in healthy human: Influence of sex, age, and body size. *J Vasc Surg.* 1999;29(3):503–510.

van der Heijden-Spek JJ, Staessen JA, Fagard RH, Hoeks AP, Boudier HA, van Bortel LM. Effect of age on brachial artery wall properties differs from the aorta and is gender dependent: A population study. *Hypertension.* 2000;35(2):637–642.

Hiteshi AK, Li D, Gao Y, et al. Gender differences in coronary artery diameter are not related to body habitus or left ventricular mass. *Clin Cardiol.* 2014;37(10):605–609.

MacDougall JD, Tuxen D, Sale DG, Moroz JR, Sutton JR. Arterial blood pressure response to heavy resistance exercise. *J Appl Physiol.* 1985;58(3):785–790.

Ji H, Niiranen TJ, Rader F, et al. Sex differences in blood pressure associations with cardiovascular outcomes. *Circulation.* 2021;143(7):761–763.

منابع

Diaz-Caneiro C, Pentz B, Sehgal A, Montero D. Sex differences in cardiorespiratory fitness are explained by blood volume and oxygen carrying capacity. *Cardiovasc Res.* 2021;118(1):334–343.

Hellsten Y, Nyberg M. Cardiovascular adaptations to exercise training. *Compr Physiol* 2015;6(1):1–32.

Montero D, Lundby C. Red cell volume response to exercise training: Association with aging. *Scand J Med Sci Sports* 2017;27(7):674–683.

Lundby C, Robach P. Performance enhancement: What are the physiological limits? *Physiology (Bethesda)* 2015;30(4):282–292.

Kjellberg SR, Rudhe U, Sjöstrand T. Increase of the amount of hemoglobin and blood volume in connection with physical training. *Acta Physiol Scand* 1949;19(2–3):146–151.

Dill DB, Braithwaite K, Adams WC, Bernauer EM. Blood volume of middle-distance runners: Effect of 2,300-m altitude and comparison with non-athletes. *Med Sci Sports* 1974;6(1):1–7.

Brotherhood J, Brozovic B, Pugh LG. Haematological status of middle-and long-distance runners. *Clin Sci Mol Med* 1975;48(2):139–145.

Heinicke K, Wolfarth B, Winchenbach P, et al. Blood volume and hemoglobin mass in elite athletes of different disciplines. *Int J Sports Med* 2001;22(7):504–512.

Karpovich PV, Millman N. Athletes as blood donors. *Res Q Am Assoc Health Phys Educ Recreat* 1941;13(2):166–168.

- Howell ML, Coupe K. Effect of blood loss upon performance in the balke-ware treadmill test. *Res Q* 1964;35:156–165.
- Hollmann W, Chirdel K, Forsberg S, Speer K. Studies on the effect of blood donation on cardiopulmonary performance. *Med Welt* 1969;20:1158–1161.
- Ekblom B, Goldbarg AN, Gullbring B. Response to exercise after blood loss and reinfusion. *J Appl Physiol* 1972;33(2):175–180.
- Williams MH, Lindhjem M, Schuster R. The effect of blood infusion upon endurance capacity and ratings of perceived exertion. *Med Sci Sports* 1978;10(2):113–118.
- Markiewicz K, Cholewa M, Gorski L, Jaszczuk J, Chmura J, Bartniczak Z. Effect of 400 ml blood loss on adaptation of certain functions of the organism to exercise. *Acta Physiol Pol* 1981;32(6):613–621.
- Fritsch J, Winter UJ, Reupke I, Gitt AK, Berge PG, Hilger HH. Effect of a single blood donation on ergo-spirometrically determined cardiopulmonary performance capacity of young healthy probands. *Z Kardiol* 1993;82(7):425–431.
- Krip B, Gledhill N, Jamnik V, Warburton D. Effect of alterations in blood volume on cardiac function during maximal exercise. *Med Sci Sports Exerc* 1997;29(11):1469–1476.
- Janetzko K, Bocher R, Klotz KF, Kirchner H, Kluter H. Effects of blood donation on the physical fitness and hemorheology of healthy elderly donors. *Vox Sang* 1998;75(1):7–11.
- Duda K, Zoladz JA, Majerczak J, Kolodziejski L, Konturek SJ. The effect of exercise performed before and 24 hours after blood withdrawal on serum erythropoietin and growth hormone concentrations in humans. *Int J Sports Med* 2003;24(5):326–331.
- Birnbaum L, Dahl T, Boone T. Effect of blood donation on maximal oxygen consumption. *J Sports Med Phys Fitness* 2006;46(4):535–539.
- Burnley M, Roberts CL, Thatcher R, Doust JH, Jones AM. Influence of blood donation on O_2 uptake on-kinetics, peak O_2 uptake and time to exhaustion during severe-intensity cycle exercise in humans. *Exp Physiol* 2006;91(3):499–509.
- Dellweg D, Siemon K, Mahler F, Appelhans P, Klauke M, Kohler D. Cardiopulmonary exercise testing before and after blood donation. *Pneumologie* 2008;62:372–377.
- Foster C, Porcari JP, Anderson J, et al. The talk test as a marker of exercise training intensity. *J Cardiopulm Rehabil Prev* 2008;28(1):24–30; quiz 31–22.
- Gordon D, Marshall K, Connell A, Barnes RJ. Influence of blood donation on oxygen uptake kinetics during moderate and heavy intensity cycle exercise. *Int J Sports Med* 2010;31(5):298–303.
- Judd TB, Cornish SM, Barss TS, Oroz I, Chilibeck PD. Time course for recovery of peak aerobic power after blood donation. *J Strength Cond Res* 2011;25(11):3035–3038.
- Mora-Rodriguez R, Aguado-Jimenez R, Del Coso J, Estevez E. A standard blood bank donation alters the thermal and cardiovascular responses during subsequent exercise. *Transfusion* 2012;52(11):2339–2347.
- Hill DW, Vingren JL, Burdette SD. Effect of plasma donation and blood donation on aerobic and anaerobic responses in exhaustive, severe-intensity exercise. *Appl Physiol Nutr Metab* 2013;38(5):551–557.
- Strandenes G, Skogrand H, Spinella PC, Hervig T, Rein EB. Donor performance of combat readiness skills of special forces soldiers are maintained immediately after whole blood donation: A study to support the development of a prehospital fresh whole blood transfusion program. *Transfusion* 2013;53(3):526–530.
- Gordon D, Wood M, Porter A, et al. Influence of blood donation on the incidence of plateau at VO_{2max} . *Eur J Appl Physiol* 2014;114(1):21–27.
- Ziegler AK, Grand J, Stangerup I, et al. Time course for the recovery of physical performance, blood hemoglobin, and ferritin content after blood donation. *Transfusion* 2015;55(4):898–905.
- Meurrens J, Steiner T, Ponette J, et al. Effect of repeated whole blood donations on aerobic capacity and hemoglobin mass in moderately trained male subjects: A randomized controlled trial. *Sports Med Open* 2016;2(1):43.
- Panbianco RA, Stachenfeld N, Coplan NL, Gleim GW. Effects of blood donation on exercise performance in competitive cyclists. *Am Heart J* 1995;130(4):838–840.
- Diaz Caneŝtro C, Pentz B, Sehgal A, Montero D. Blood withdrawal acutely impairs cardiac filling, output and aerobic capacity in proportion to induced hypovolemia in middle-aged and older women. *Appl Physiol Nutr Metab*. 2021;47(1):75–82.
- American College of Sport Medicine (ACSM). ACSM's Guidelines for Exercise Testing and Prescription, 10th Edition. Philadelphia, PA: LWW; 2017.
- Munoz M, Acheson AG, Bisbe E, et al. An international consensus statement on the management of postoper-

- ative anaemia after major surgical procedures. *Anaesthesia* 2018;73(11):1418–1431.
- Diaz-Caneiro C, Pentz B, Sehgal A, Montero D. Differences in cardiac output and aerobic capacity between sexes are explained by blood volume and oxygen carrying capacity. *Front Physiol* 2022;13:747903.
- Montero D, Madsen K, Meinild-Lundby AK, Edin F, Lundby C. Sexual dimorphism of substrate utilization: Differences in skeletal muscle mitochondrial volume density and function. *Exp Physiol* 2018;103(6):851–859.
- Diaz-Caneiro C, Montero D. Unveiling women’s powerhouse. *Exp Physiol* 2020;105(7):1060–1062.
- Sheel AW, Dominelli PB, Molgat-Seon Y. Revisiting dysanapsis: Sex-based differences in airways and the mechanics of breathing during exercise. *Exp Physiol* 2016;101(2):213–218.
- Montero D, Lundby C. Regulation of red blood cell volume with exercise training. *Compr Physiol* 2018;9(1):149–164.
- Lundby C, Robach P, Saltin B. The evolving science of detection of ‘blood doping’. *Br J Pharmacol* 2012;165(5):1306–1315.
- Patterson SW, Starling EH. On the mechanical factors which determine the output of the ventricles. *J Physiol* 1914;48(5):357–379.
- Bundgaard-Nielsen M, Sørensen H, Dalsgaard M, Rasmussen P, Secher NH. Relationship between stroke volume, cardiac output and filling of the heart during tilt. *Acta Anaesthesiol Scand* 2009;53(10):1324–1328.
- Gregersen M, Rawson RA. Blood volume. *Physiol Rev* 1959(39):307–342.
- Montero D, Cathomen A, Jacobs RA, et al. Haematological rather than skeletal muscle adaptations contribute to the increase in peak oxygen uptake induced by moderate endurance training. *J Physiol* 2015;593(20):4677–4688.
- Munch GD, Svendsen JH, Damsgaard R, Secher NH, Gonzalez-Alonso J, Mortensen SP. Maximal heart rate does not limit cardiovascular capacity in healthy humans: Insight from right atrial pacing during maximal exercise. *J Physiol* 2014;592(2):377–390.
- Montero D, Lundby C, Ruschitzka F, Flammer AJ. True anemia-red blood cell volume deficit-in heart failure: A systematic review. *Circ Heart Fail*. 2017;10(5):e003610.
- Seymour WB, Pritchard WH, Longley LP, Hayman JM. Cardiac output, blood and interstitial fluid volumes, total circulating serum protein, and kidney function during cardiac failure and after improvement. *J Clin Invest* 1942;21(2):229–240.
- Kaplan E, Puestow RC, Baker LA, Kruger S. Blood volume in congestive heart failure as determined with iodinated human serum albumin. *Am Heart J* 1954;47(5):824–838.
- Watson RD, Gibbs CR, Lip GY. ABC of heart failure. Clinical features and complications. *BMJ* 2000;320(7229):236–239.
- Parisotto R. *Blood Sports: The Inside Dope on Drugs in Sport*. Self; 2010.
- Solheim SA, Bejder J, Breenfeldt Andersen A, Morkeberg J, Nordsborg NB. Autologous blood transfusion enhances exercise performance-strength of the evidence and physiological mechanisms. *Sports Med Open* 2019;5(1):30.
- Sottas PE, Robinson N, Saugy M. The athlete’s biological passport and indirect markers of blood doping. *Handb Exp Pharmacol* 2010(195):305–326.
- Faiss R, Saugy J, Zollinger A, et al. Prevalence estimate of blood doping in elite track and field athletes during two major international events. *Front Physiol*. 2020;11:160.
- Ulrich R, Pope HG, Jr., Cleret L, et al. Doping in two elite athletics competitions assessed by randomized-response surveys. *Sports Med* 2018;48(1):211–219.
- Malm CB, Khoo NS, Granlund I, Lindstedt E, Hult A. Autologous doping with cryopreserved red blood cells - effects on physical performance and detection by multivariate statistics. *PLOS ONE* 2016;11(6):e0156157.
- Sorensen EA. Debunking the myth of pregnancy doping. *J Intercollegiate Sport* 2009;2:269–285.
- Paulev PE. *Textbook in Medical Physiology and Pathophysiology, Essentials and Clinical Problems*. 1999.
- Wolff A, O’Brien R. Pregnancy doping. *Sports Illustrated* 1994;81(23):16.
- <https://www.si.com/olympics/2017/06/06/sanya-richards-ross-opens-about-abortion>. 2017.
- Pritchard JA. Changes in the blood volume during pregnancy and delivery. *Anesthesiology* 1965;26:393–399.
- Kjellberg SR, Lonroth H, Rudhe U, Sjöstrand T. Blood volume and heart volume during pregnancy and the puerperium. *Acta Med Scand* 1950;138(6):421–429.
- Bonne TC, Doucende G, Fluck D, et al. Phlebotomy eliminates the maximal cardiac output response to six weeks of exercise training. *Am J Physiol Regul Integr Comp Physiol* 2014;306(10):R752–R760.
- Mandic M, Eriksson LMJ, Melin M, et al. Increased maximal oxygen uptake after sprint-interval training is mediated by central haemodynamic factors as determined by right heart catheterization. *J Physiol* 2023;601(12):2359–2370.
- Montero D, Lundby C. Refuting the myth of non-response to exercise training: ‘non-responders’ do respond

- to higher dose of training. *J Physiol* 2017;595(11):3377–3387.
- Eklblom B, Åstrand PO, Saltin B, Stenberg J, Wallström B. Effect of training on circulatory response to exercise. *J Appl Physiol* 1968;24(4):518–528.
- Tanaka H, Bassett DR, Jr., Turner MJ. Exaggerated blood pressure response to maximal exercise in endurance-trained individuals. *Am J Hypertens* 1996;9(11):1099–1103.
- de la Chapelle A, Traskelin AL, Juvonen E. Truncated erythropoietin receptor causes dominantly inherited benign human erythrocytosis. *Proc Natl Acad Sci U S A* 1993;90(10):4495–4499.
- Thomsen JJ, Rentsch RL, Robach P, et al. Prolonged administration of recombinant human erythropoietin increases submaximal performance more than maximal aerobic capacity. *Eur J Appl Physiol* 2007;101(4):481–486.
- USADA. Report on proceedings under the world anti-doping code and the USADA protocol United States anti-doping agency, claimant, v. Lance Armstrong, respondent. Reasoned decision of the USADA. 2012.
- Hamilton T, Coyle D. *The secret race. Inside the hidden world of the Tour de France.* New York: Bantam (reprint ed.);2013.
- Schuler B, Arras M, Keller S, et al. Optimal hematocrit for maximal exercise performance in acute and chronic erythropoietin-treated mice. *Proc Natl Acad Sci U S A* 2010;107(1):419–423.
- Uhrikova I, Lacnakova A, Tandlerova K, et al. Haematological and biochemical variations among eight sight-hound breeds. *Aust Vet J* 2013;91(11):452–459.
- Prommer N, Ehrmann U, Schmidt W, Steinacker JM, Radermacher P, Muth CM. Total haemoglobin mass and spleen contraction: A study on competitive apnea divers, non-diving athletes and untrained control subjects. *Eur J Appl Physiol* 2007;101(6):753–759.
- Shepherd RJ. Responses of the human spleen to exercise. *J Sports Sci* 2016;34(10):929–936.
- Engan HK, Lodin-Sundström A, Schagatay F, Schagatay E. The effect of climbing Mount Everest on spleen contraction and increase in hemoglobin concentration during breath holding and exercise. *High Alt Med Biol* 2014;15(1):52–57.
- Lopez B. The invention of a ‘drug of mass destruction’: Deconstructing the EPO myth. *Sport in History*. 2011;31(1):84–109.
- Moller V. *The Ethics of Doping and Anti-doping.* 2010.
- Lundby C, Montero D. Did you know-why does maximal oxygen uptake increase in humans following endurance exercise training? *Acta Physiol (Oxf)* 2019;227(4):e13371.
- Pickering TR, Bunn HT. The endurance running hypothesis and hunting and scavenging in savanna-woodlands. *J Hum Evol* 2007;53(4):434–438.
- Knight PK, Sinha AK, Rose RJ. Effects of training intensity on maximum oxygen uptake. Davis, CA: ICEEP Publications; 1991.
- Musch TI, Haidet GC, Ordway GA, Longhurst JC, Mitchell JH. Dynamic exercise training in foxhounds. I. Oxygen consumption and hemodynamic responses. *J Appl Physiol* 1985;59(1):183–189.
- Sender R, Fuchs S, Milo R. Revised estimates for the number of human and bacteria cells in the body. *PLoS Biol* 2016;14(8):e1002533.
- Murphy WG. The sex difference in haemoglobin levels in adults—mechanisms, causes, and consequences. *Blood Rev* 2014;28(2):41–47.
- Diaz-Caneiro C, Siebenmann C, Montero D. Blood oxygen carrying capacity determines cardiorespiratory fitness in middle-age and older women and men. *Med Sci Sports Exerc.* 2021;53(11):2274–2282.
- Schumacher YO, Jankovits R, Bultermann D, Schmid A, Berg A. Hematological indices in elite cyclists. *Scand J Med Sci Sports* 2002;12(5):301–308.
- Montero D, Diaz-Caneiro C, Flammer A, Lundby C. Unexplained anemia in the elderly: Potential role of arterial stiffness. *Front Physiol* 2016;7:485.
- Diaz-Caneiro C, Montero D. Female sex-specific curtailment of left ventricular volume and mass in HFpEF patients with high end-diastolic filling pressure. *J Hum Hypertens* 2020.
- Morkeberg J, Lundby C, Nissen-Lie G, Nielsen TK, Hemmersbach P, Damsgaard R. Detection of darbepoetin alfa misuse in urine and blood: A preliminary investigation. *Med Sci Sports Exerc* 2007;39(10):1742–1747.
- Beall CM, Brittenham GM, Strohl KP, et al. Hemoglobin concentration of high-altitude Tibetans and Bolivian Aymara. *Am J Phys Anthropol* 1998;106(3):385–400.
- Rosenfeld CS. Sex-dependent differences in voluntary physical activity. *J Neurosci Res* 2017;95(1–2):279–290.
- Kane JD, Steinbach TJ, Sturdivant RX, Burks RE. Sex-associated effects on hematologic and serum chemistry analytes in sand rats (*Psammomys obesus*). *J Am Assoc Lab Anim Sci* 2012;51(6):769–774.
- Gromov VS. Daytime activities and social interactions in a colony of the fat sand rats, *Psammomys obesus*,

- at the Negev Highlands, Israel. *Mammalia* 2001;65(1):13–21.
- Mortensen SP, Damsgaard R, Dawson EA, Secher NH, Gonzalez-Alonso J. Restrictions in systemic and locomotor skeletal muscle perfusion, oxygen supply and $\dot{V}O_2$ during high-intensity whole-body exercise in humans. *J Physiol* 2008;586(10):2621–2635.
- Lundby C, Montero D, Joyner M. Biology of $\dot{V}O_2$ max: Looking under the physiology lamp. *Acta Physiol (Oxf)* 2017;220(2):218–228.
- Helgerud J. Maximal oxygen uptake, anaerobic threshold and running economy in women and men with similar performances level in marathons. *Eur J Appl Physiol Occup Physiol* 1994;68(2):155–161.
- Di Luca C. *Cycliste infiltré*. CITY;2017.
- Millar D. *Racing Through the Dark: The Fall and Rise of David Millar*. Orion; 2011.

منابع

- Young TR, Duncan BT, Cook SB. Evaluation of muscle thickness of the vastus lateralis by ultrasound imaging following blood flow restricted resistance exercise. *Clin Physiol Funct Imaging*. 2021;41(4):376–384.
- Garg K, Corona BT, Walters TJ. Losartan administration reduces fibrosis but hinders functional recovery after volumetric muscle loss injury. *J Appl Physiol*. 2014;117(10):1120–1131.
- Saltin B, Henriksson J, Nygaard E, Andersen P, Jansson E. Fiber types and metabolic potentials of skeletal muscles in sedentary man and endurance runners. *Ann N Y Acad Sci*. 1977;301:3–29.
- Xu R, Andres-Mateos E, Mejias R, et al. Hibernating squirrel muscle activates the endurance exercise pathway despite prolonged immobilization. *Exp Neurol*. 2013;247:392–401.
- Knight PK, Sinha AK, Rose RJ. Effects of Training Intensity on Maximum Oxygen Uptake. Davis, CA: ICEEP Publications; 1991.
- Musch TI, Haidet GC, Ordway GA, Longhurst JC, Mitchell JH. Dynamic exercise training in foxhounds. I. Oxygen consumption and hemodynamic responses. *J Appl Physiol*. 1985;59(1):183–189.
- Lundby C, Montero D, Joyner M. Biology of $\dot{V}O_2$ max: Looking under the physiology lamp. *Acta Physiol (Oxf)*. 2017;220(2):218–228.
- Fink WJ, Costill DL, Pollock ML. Submaximal and maximal working capacity of elite distance runners. Part II. Muscle fiber composition and enzyme activities. *Ann N Y Acad Sci*. 1977;301:323–327.
- Morales-Alamo D, Losa-Reyna J, Torres-Peralta R, et al. What limits performance during whole-body incremental exercise to exhaustion in humans? *J Physiol*. 2015;593(20):4631–4648.
- Morton RW, Sonne MW, Farias Zuniga A, et al. Muscle fibre activation is unaffected by load and repetition duration when resistance exercise is performed to task failure. *J Physiol*. 2019;597(17):4601–4613.
- Lexell J, Henriksson-Larsen K, Sjöström M. Distribution of different fibre types in human skeletal muscles. 2. A study of cross-sections of whole m. vastus lateralis. *Acta Physiol Scand*. 1983;117(1):115–122.
- Serrano N, Colenso-Semple LM, Lazauskas KK, et al. Extraordinary fast-twitch fiber abundance in elite weightlifters. *PLOS ONE*. 2019;14(3):e0207975.
- Gundersen K. Determination of muscle contractile properties: The importance of the nerve. *Acta Physiol Scand*. 1998;162(3):333–341.
- Bottinelli R, Reggiani C. Human skeletal muscle fibres: Molecular and functional diversity. *Prog Biophys Mol Biol*. 2000;73(2–4):195–262.
- Lexell J, Sjöström M, Nordlund AS, Taylor CC. Growth and development of human muscle: A quantitative morphological study of whole vastus lateralis from childhood to adult age. *Muscle Nerve*. 1992;15(3):404–409.
- Lexell J, Downham D, Sjöström M. Distribution of different fibre types in human skeletal muscles. Fibre type arrangement in m. vastus lateralis from three groups of healthy men between 15 and 83 years. *J Neurol Sci*. 1986;72(2–3):211–222.
- MacDougall JD, Sale DG, Alway SE, Sutton JR. Muscle fiber number in biceps brachii in bodybuilders and

- control subjects. *J Appl Physiol Respir Environ Exerc Physiol.* 1984;57(5):1399–1403.
- Gonyea W, Ericson GC, Bonde-Petersen F. Skeletal muscle fiber splitting induced by weight-lifting exercise in cats. *Acta Physiol Scand.* 1977;99(1):105–109.
- Wilson JM, Loenneke JP, Jo E, Wilson GJ, Zourdos MC, Kim JS. The effects of endurance, strength, and power training on muscle fiber type shifting. *J Strength Cond Res.* 2012;26(6):1724–1729.
- Bathgate KE, Bagley JR, Jo E, et al. Muscle health and performance in monozygotic twins with 30 years of discordant exercise habits. *Eur J Appl Physiol.* 2018;118(10):2097–2110.
- McNeil CJ, Vandervoort AA, Rice CL. Peripheral impairments cause a progressive age-related loss of strength and velocity-dependent power in the dorsiflexors. *J Appl Physiol.* 2007;102(5):1962–1968.
- Graves JA. Evolution of vertebrate sex chromosomes and dosage compensation. *Nat Rev Genet.* 2016;17(1):33–46.
- Nowak MA, Boerlijst MC, Cooke J, Smith JM. Evolution of genetic redundancy. *Nature.* 1997;388(6638):167–171.
- Haizlip KM, Harrison BC, Leinwand LA. Sex-based differences in skeletal muscle kinetics and fiber-type composition. *Physiology (Bethesda).* 2015;30(1):30–39.
- Alway SE, Grumbt WH, Gonyea WJ, Stray-Gundersen J. Contrasts in muscle and myofibers of elite male and female bodybuilders. *J Appl Physiol.* 1989;67(1):24–31.
- Miller AE, MacDougall JD, Tarnopolsky MA, Sale DG. Gender differences in strength and muscle fiber characteristics. *Eur J Appl Physiol Occup Physiol.* 1993;66(3):254–262.
- Blood donation: What to expect. <https://www.mayoclinic.org/TESTS-procedures/blood-donation/about/pac-20385144>. Accessed 13.12.2019, 2019.
- <https://www.sciencedaily.com/releases/2019/03/190327142058.htm>, 2019.
- Almog T, Almog O. *Academia: All the Lies: What Went Wrong in the University Model and What Will Come in its Place.* Independently Published; 2020.
- Broad W, Wade N. *Betrayers of the Truth: Fraud and Deceit in the Halls of Science.* New York:Simon & Schuster; 1983.
- Montero D, Madsen K, Meinild-Lundby AK, Edin F, Lundby C. Sexual dimorphism of substrate utilization: Differences in skeletal muscle mitochondrial volume density and function. *Exp Physiol.* 2018;103(6):851–859.
- Cardinale DA, Larsen FJ, Schiffer TA, et al. Superior intrinsic mitochondrial respiration in women than in men. *Front Physiol.* 2018;9:1133.
- Montero D, Cathomen A, Jacobs RA, et al. Haematological rather than skeletal muscle adaptations contribute to the increase in peak oxygen uptake induced by moderate endurance training. *J Physiol.* 2015;593(20):4677–4688.
- Roepstorff C, Schjerling P, Višisen B, et al. Regulation of oxidative enzyme activity and eukaryotic elongation factor 2 in human skeletal muscle: Influence of gender and exercise. *Acta Physiol Scand.* 2005;184(3):215–224.
- Diaz-Canestro C, Montero D. Sex dimorphism of $\text{VO}_{2\text{max}}$ trainability: A systematic review and meta-analysis. *Sports Med.* 2019;49(12):1949–1956.
- Diaz-Canestro C, Montero D. The impact of sex on left ventricular cardiac adaptations to endurance training: A systematic review and meta-analysis. *Sports Med.* 2020;50(8):1501–1513.
- Ofenheimer A, Breyer-Kohansal R, Hartl S, et al. Reference values of body composition parameters and visceral adipose tissue (VAT) by DXA in adults aged 18–81 years-results from the LEAD cohort. *Eur J Clin Nutr.* 2020;74(8):1181–1191.
- Colom B, Alcolea MP, Valle A, Oliver J, Roca P, Garcia-Palmer FJ. Skeletal muscle of female rats exhibit higher mitochondrial mass and oxidative-phosphorylative capacities compared to males. *Cell Physiol Biochem.* 2007;19(1–4):205–212.
- Sandoval DA, Ryan KK, de Kloet AD, Woods SC, Seeley RJ. Female rats are relatively more sensitive to reduced lipid versus reduced carbohydrate availability. *Nutr Diabetes.* 2012;2:e27.
- Hoppeler H. The different relationship of $\text{VO}_{2\text{max}}$ to muscle mitochondria in humans and quadrupedal animals. *Respir Physiol.* 1990;80(2–3):137–145.
- Rius R, Cowley MJ, Riley L, Puttick C, Thorburn DR, Christodoulou J. Biparental inheritance of mitochondrial DNA in humans is not a common phenomenon. *Genet Med.* 2019;21(12):2823–2826.
- Bennett E, Peters SAE, Woodward M. Sex differences in macronutrient intake and adherence to dietary recommendations: Findings from the UK Biobank. *BMJ Open.* 2018;8(4):e020017.
- Lundsgaard AM, Kiens B. Gender differences in skeletal muscle substrate metabolism – molecular mecha-

- nisms and insulin sensitivity. *Front Endocrinol (Lausanne)*. 2014;5:195.
- Varlamov O, Bethea CL, Roberts CT, Jr. Sex-specific differences in lipid and glucose metabolism. *Front Endocrinol (Lausanne)*. 2014;5:241.
- Davies KJ, Maguire JJ, Brooks GA, Dallman PR, Packer L. Muscle mitochondrial bioenergetics, oxygen supply, and work capacity during dietary iron deficiency and repletion. *Am J Physiol*. 1982;242(6):E418–427.
- Lundby C, Jacobs RA. Adaptations of skeletal muscle mitochondria to exercise training. *Exp Physiol*. 2016;101(1):17–22.
- Davies KJ, Maquire JJ, Brooks GA, Dallman PR, Packer L. Muscle mitochondrial bioenergetics, oxygen supply, and work capacity during dietary iron deficiency and repletion. *Am J Physiol*. 1982;242(6):418–427.
- Diaz-Caneštro C, Pentz B, Sehgal A, Montero D. Blood withdrawal acutely impairs cardiac filling, output and aerobic capacity in proportion to induced hypovolemia in middle-aged and older women. *Appl Physiol Nutr Metab*. 2021;[in print].
- Diaz-Caneštro C, Pentz B, Sehgal A, Montero D. Sex differences in cardiorespiratory fitness are explained by blood volume and oxygen carrying capacity. *Cardiovasc Res*. 2021;118(1):334–343.
- Diaz-Caneštro C, Siebenmann C, Montero D. Blood oxygen carrying capacity determines cardiorespiratory fitness in middle-age and older women and men. *Med Sci Sports Exerc*. 2021;53(11):2274–2282.
- Pentz B, Diaz-Caneštro C, Sehgal A, Montero D. Effects of blood withdrawal on cardiac, hemodynamic, and pulmonary responses to a moderate acute workload in healthy middle-aged and older females. *J Sci Med Sport*. 2021;25(3):198–203.
- Andsell P, Brownstein CG, Skarabot J, et al. Sex differences in fatigability and recovery relative to the intensity-duration relationship. *J Physiol*. 2019;597(23):5577–5595.
- Hunter SK. Sex differences in fatigability of dynamic contractions. *Exp Physiol*. 2016;101(2):250–255.

منابع

- Cederbaum AI. Alcohol metabolism. *Clin Liver Dis*. 2012;16(4):667–685.
- Coggan AR, Coyle EF. Reversal of fatigue during prolonged exercise by carbohydrate infusion or ingestion. *J Appl Physiol*. 1987;63(6):2388–2395.
- Montero D, Madsen K, Meinild-Lundby AK, Edin F, Lundby C. Sexual dimorphism of substrate utilization: Differences in skeletal muscle mitochondrial volume density and function. *Exp Physiol*. 2018;103(6):851–859.
- Horton TJ, Pagliassotti MJ, Hobbs K, Hill JO. Fuel metabolism in men and women during and after long-duration exercise. *J Appl Physiol*. 1998;85(5):1823–1832.
- Venables MC, Achten J, Jeukendrup AE. Determinants of fat oxidation during exercise in healthy men and women: A cross-sectional study. *J Appl Physiol*. 2005;98(1):160–167.
- White LJ, Ferguson MA, McCoy SC, Kim H. Intramyocellular lipid changes in men and women during aerobic exercise: A (1)H-magnetic resonance spectroscopy study. *J Clin Endocrinol Metab*. 2003;88(12):5638–5643.
- Tarnopolsky MA. Sex differences in exercise metabolism and the role of 17-beta estradiol. *Med Sci Sports Exerc*. 2008;40(4):648–654.
- Blatchford FK, Knowlton RG, Schneider DA. Plasma FFA responses to prolonged walking in untrained men and women. *Eur J Appl Physiol Occup Physiol*. 1985;53(4):343–347.
- Tarnopolsky LJ, MacDougall JD, Atkinson SA, Tarnopolsky MA, Sutton JR. Gender differences in substrate for endurance exercise. *J Appl Physiol*. 1990(68):302–308.
- Phillips SM, Atkinson SA, Tarnopolsky MA, MacDougall JD. Gender differences in leucine kinetics and nitrogen balance in endurance athletes. *J Appl Physiol*. 1993;75(5):2134–2141.
- Tarnopolsky MA, Atkinson SA, Phillips SM, MacDougall JD. Carbohydrate loading and metabolism during exercise in men and women. *J Appl Physiol*. 1995;78(4):1360–1368.
- Lundby C, Robach P. Performance enhancement: What are the physiological limits? *Physiology (Bethesda)*. 2015;30(4):282–292.
- Rontoyannis GP, Skoulis T, Pavlou KN. Energy balance in ultramarathon running. *Am J Clin Nutr*. 1989;49(5 Suppl):976–979.
- Arribalzaga S, Viribay A, Calleja-Gonzalez J, Fernandez-Lazaro D, Cañaneda-Babarro A, Mielgo-Ayuso J. Relationship of carbohydrate intake during a single-stage one-day ultra-trail race with fatigue outcomes and gastrointestinal problems: A systematic review. *Int J Environ Res Public Health*. 2021;18(11):5737.

- Speechly DP, Taylor SR, Rogers GG. Differences in ultra-endurance exercise in performance-matched male and female runners. *Med Sci Sports Exerc.* 1996;28(3):359–365.
- Knechtle B, Dalamitros AA, Barbosa TM, Sousa CV, Rosemann T, Nikolaidis PT. Sex differences in swimming disciplines-can women outperform men in swimming? *Int J Environ Res Public Health.* 2020;17(10):3651.
- Lundby C, Montero D, Gehrig S, et al. Physiological, biochemical, anthropometric, and biomechanical influences on exercise economy in humans. *Scand J Med Sci Sports.* 2017;27(12):1627–1637.
- Vargas VZ, de Lira CAB, Vancini RL, Rayes ABR, Andrade MS. Fat mass is negatively associated with the physiological ability of tissue to consume oxygen. *Motriz The Journal of Physical Education.* 2018(4).
- Hamilton T, Coyle D. *The Secret Race: Inside the Hidden World of the Tour de France.* New York: Bantam;2013.
- Liguori D, et al. *ACSM's Guidelines for Exercise Testing and Prescription.* Philadelphia: Lippincott Williams & Wilkins; 2017.
- Diaz-Caneŝtro C, Pentz B, Sehgal A, Montero D. Sex dimorphism in cardiac and aerobic capacities: The influence of body composition. *Obesity (Silver Spring).* 2021;29(11):1749–1759.
- Skinner HB, Barrack RL. Ankle weighting effect on gait in able-bodied adults. *Arch Phys Med Rehabil.* 1990;71(2):112–115.
- Rodrigo-Carranza V, Gonzalez-Mohino F, Santos-Concejero J, Gonzalez-Rave JM. Influence of shoe mass on performance and running economy in trained runners. *Front Physiol.* 2020;11:573660.
- van der Ploeg GE, Brooks AG, Withers RT, Dollman J, Leaney F, Chatterton BE. Body composition changes in female bodybuilders during preparation for competition. *Eur J Clin Nutr.* 2001;55(4):268–277.
- Hulmi JJ, Isola V, Suonpaa M, et al. The effects of intensive weight reduction on body composition and serum hormones in female fitness competitors. *Front Physiol.* 2016;7:689.
- Goodpaŝter BH, Wolfe RR, Kelley DE. Effects of obesity on substrate utilization during exercise. *Obes Res.* 2002;10(7):575–584.

◀ منابع

- Lundby C, Robach P. Performance enhancement: What are the physiological limits? *Physiology (Bethesda).* 2015;30(4):282–292.
- Montero D, Diaz-Caneŝtro C. Endurance training and maximal oxygen consumption with ageing: Role of maximal cardiac output and oxygen extraction. *Eur J Prev Cardiol.* 2016;23(7):733–743.
- Montero D, Diaz-Caneŝtro C, Lundby C. Endurance training and **VO₂max**: Role of maximal cardiac output and oxygen extraction. *Med Sci Sports Exerc.* 2015;47(10):2024–2033.
- Lortie G, Simoneau JA, Hamel P, Boulay MR, Landry F, Bouchard C. Responses of maximal aerobic power and capacity to aerobic training. *Int J Sports Med.* 1984;5(5):232–236.
- Bacon AP, Carter RE, Ogle EA, Joyner MJ. **VO₂max** trainability and high intensity interval training in humans: A meta-analysis. *PLOS ONE.* 2013;8(9):e73182.
- Bouchard C, Sarzynski MA, Rice TK, et al. Genomic predictors of the maximal O₂ uptake response to standardized exercise training programs. *J Appl Physiol.* 2011;110(5):1160–1170.
- Cohen L, Holliday M. *Statistics for Education and Physical Education. Inferential Statistics.* London: Harper; 1979.
- Timmons JA, Knudsen S, Rankinen T, et al. Using molecular classification to predict gains in maximal aerobic capacity following endurance exercise training in humans. *J Appl Physiol.* 2010;108(6):1487–1496.
- Shephard RJ, Rankinen T, Bouchard C. Test-retest errors and the apparent heterogeneity of training response. *Eur J Appl Physiol.* 2004;91(2–3):199–203.
- Heckŝteden A, Kraushaar J, Scharhag-Rosenberger F, Theisen D, Senn S, Meyer T. Individual response to exercise training - a statistical perspective. *J Appl Physiol.* 2015;118(12):1450–1459.
- Senn S, Rolfŝ K, Julius SA. Investigating variability in patient response to treatment—a case study from a replicate cross-over study. *Stat Methods Med Res.* 2011;20(6):657–666.
- Montero D, Lundby C. Refuting the myth of non-response to exercise training: ‘non-responders’ do respond to higher dose of training. *J Physiol.* 2017;595(11):3377–3387.
- Montero D, Breenfeldt-Andersen A, Oberholzer L, et al. Erythropoiesis with endurance training: Dynamics

- and mechanisms. *Am J Physiol Regul Integr Comp Physiol.* 2017;312(6):R894–R902.
- Montero D, Cathomen A, Jacobs RA, et al. Haematological rather than skeletal muscle adaptations contribute to the increase in peak oxygen uptake induced by moderate endurance training. *J Physiol.* 2015;593(20):4677–4688.
- Montero D, Lundby C. Regulation of red blood cell volume with exercise training. *Compr Physiol.* 2018;9(1):149–164.
- Lundby C, Montero D, Joyner M. Biology of $\dot{V}O_2$ max: Looking under the physiology lamp. *Acta Physiol (Oxf).* 2017;220(2):218–228.
- Rusko HK. Development of aerobic power in relation to age and training in cross-country skiers. *Med Sci Sports Exerc.* 1992;24(9):1040–1047.
- Bouchard C, Daw EW, Rice T, et al. Familial resemblance for $\dot{V}O_2$ max in the sedentary state: The HERITAGE family study. *Med Sci Sports Exerc.* 1998;30(2):252–258.
- Diaz-Caneiro C, Montero D. Sex dimorphism of $\dot{V}O_2$ max trainability: A systematic review and meta-analysis. *Sports Med.* 2019;49(12):1949–1956.
- Diaz-Caneiro C, Montero D. The impact of sex on left ventricular cardiac adaptations to endurance training: A systematic review and meta-analysis. *Sports Med.* 2020;50(8):1501–1513.
- Levine BD. $\dot{V}O_2$ max: What do we know, and what do we still need to know? *J Physiol.* 2008;586(1):25–34.
- Dominelli PB, Molgat-Seon Y, Bingham D, et al. Dysanapsis and the resistive work of breathing during exercise in healthy men and women. *J Appl Physiol.* 2015;119(10):1105–1113.
- Molgat-Seon Y, Dominelli PB, Ramscook AH, et al. The effects of age and sex on mechanical ventilatory constraint and dyspnea during exercise in healthy humans. *J Appl Physiol.* 2018;124(4):1092–1106.
- Diaz-Caneiro C, Montero D. Female sex-specific curtailment of left ventricular volume and mass in HFpEF patients with high end-diastolic filling pressure. *J Hum Hypertens.* 2020.
- Regitz-Zagrosek V, Kararigas G. Mechanistic pathways of sex differences in cardiovascular disease. *Physiol Rev.* 2017;97(1):1–37.
- de Bold AJ, Borenstein HB, Veress AT, Sonnenberg H. A rapid and potent natriuretic response to intravenous injection of atrial myocardial extract in rats. *Life Sci.* 1981;28(1):89–94.
- Suthahar N, Meijers WC, Ho JE, et al. Sex-specific associations of obesity and N-terminal pro-B-type natriuretic peptide levels in the general population. *Eur J Heart Fail.* 2018;20(8):1205–1214.
- Asif Y, Wlodek ME, Black MJ, Russell AP, Soeding PF, Wadley GD. Sustained cardiac programming by short-term juvenile exercise training in male rats. *J Physiol.* 2018;596(2):163–180.
- Geenen DL, Gilliam TB, Crowley D, Moorehead-Steffens C, Rosenthal A. Echocardiographic measures in 6 to 7 year old children after an 8 month exercise program. *Am J Cardiol.* 1982;49(8):1990–1995.
- Obert P, Mandigout S, Vinet A, N'Guyen LD, Stecken F, Courteix D. Effect of aerobic training and detraining on left ventricular dimensions and diastolic function in prepubertal boys and girls. *Int J Sports Med.* 2001;22(2):90–96.
- Wu WC, Chang LY, Luh DL, et al. Sex differences in the trajectories of and factors related to extracurricular sport participation and exercise: A cohort study spanning 13 years. *BMC Public Health.* 2020;20(1):1639.
- Diaz-Caneiro C, Siebenmann C, Montero D. Blood oxygen carrying capacity determines cardiorespiratory fitness in middle-age and older women and men. *Med Sci Sports Exerc.* 2021;53(11):2274–2282.
- Murphy WG. The sex difference in haemoglobin levels in adults—mechanisms, causes, and consequences. *Blood Rev.* 2014;28(2):41–47.
- Morkeberg J, Lundby C, Nissen-Lie G, Nielsen TK, Hemmersbach P, Damsgaard R. Detection of darbepoetin alfa misuse in urine and blood: A preliminary investigation. *Med Sci Sports Exerc.* 2007;39(10):1742–1747.
- Lundby C, Montero D. Did you know—why does maximal oxygen uptake increase in humans following endurance exercise training? *Acta Physiol (Oxf).* 2019;227(4):e13371.
- Jacobs RA, Lundby C, Robach P, Gassmann M. Red blood cell volume and the capacity for exercise at moderate to high altitude. *Sports Med.* 2012;42(8):643–663.
- Lundby C, Thomsen JJ, Boushel R, et al. Erythropoietin treatment elevates haemoglobin concentration by increasing red cell volume and depressing plasma volume. *J Physiol.* 2007;578(Pt 1):309–314.
- Rasmussen P, Siebenmann C, Diaz V, Lundby C. Red cell volume expansion at altitude: A meta-analysis and Monte Carlo simulation. *Med Sci Sports Exerc.* 2013;45(9):1767–1772.

- Bonne TC, Lundby C, Jorgensen S, et al. 'Live High-Train High' increases hemoglobin mass in Olympic swimmers. *Eur J Appl Physiol*. 2014;114(7):1439–1449.
- Gore CJ, Sharpe K, Garvican-Lewis LA, et al. Altitude training and haemoglobin mass from the optimised carbon monoxide rebreathing method determined by a meta-analysis. *Br J Sports Med*. 2013;47 Suppl 1:i31–i39.
- Schmidt W, Prommer N. Effects of various training modalities on blood volume. *Scand J Med Sci Sports*. 2008;18 Suppl 1:57–69.
- Lundby C, Robach P. Does 'altitude training' increase exercise performance in elite athletes? *Exp Physiol*. 2016;101(7):783–788.
- Klein M, Kaestner L, Bogdanova AY, et al. Absence of neocytolysis in humans returning from a 3-week high-altitude sojourn. *Acta Physiol (Oxf)*. 2021;232(3):e13647.
- Siebenmann C, Dempsey JA. Hypoxic training is not beneficial in elite athletes. *Med Sci Sports Exerc*. 2020;52(2):519–522.
- Ploszczyca K, Langfort J, Czuba M. The effects of altitude training on erythropoietic response and hematological variables in adult athletes: A narrative review. *Front Physiol*. 2018;9:375.
- Azad P, Villafuerte FC, Bermudez D, Patel G, Haddad GG. Protective role of estrogen against excessive erythrocytosis in Monge's disease. *Exp Mol Med*. 2021;53(1):125–135.
- Calbet JA, Gonzalez-Alonso J, Helge JW, et al. Central and peripheral hemodynamics in exercising humans: Leg vs arm exercise. *Scand J Med Sci Sports*. 2015;25 Suppl 4:144–157.
- Secher NH, Ruberg-Larsen N, Binkhorst RA, Bonde-Petersen F. Maximal oxygen uptake during arm cranking and combined arm plus leg exercise. *J Appl Physiol*. 1974;36(5):515–518.
- Diaz-Caneiro C, Pentz B, Sehgal A, Montero D. Sex dimorphism in cardiac and aerobic capacities: The influence of body composition. *Obesity (Silver Spring)*. 2021;29(11):1749–1759.
- Calbet JA, Lundby C, Sander M, Robach P, Saltin B, Boushel R. Effects of ATP-induced leg vasodilation on $\dot{V}O_2$ peak and leg \dot{O}_2 extraction during maximal exercise in humans. *Am J Physiol Regul Integr Comp Physiol*. 2006;291(2):R447–R453.
- Bada AA, Svendsen JH, Secher NH, Saltin B, Mortensen SP. Peripheral vasodilatation determines cardiac output in exercising humans: Insight from atrial pacing. *J Physiol*. 2012;590(8):2051–2060.
- Gonzalez-Alonso J, Mortensen SP, Jeppesen TD, et al. Haemodynamic responses to exercise, ATP infusion and thigh compression in humans: Insight into the role of muscle mechanisms on cardiovascular function. *J Physiol*. 2008;586(9):2405–2417.
- Robbins JL, Duscha BD, Bensimhon DR, et al. A sex-specific relationship between capillary density and anaerobic threshold. *J Appl Physiol*. 2009;106(4):1181–1186.
- Diaz-Caneiro C, Pentz B, Sehgal A, Montero D. Sex differences in cardiorespiratory fitness are explained by blood volume and oxygen carrying capacity. *Cardiovasc Res*. 2021;118(1):334–343.
- Diaz-Caneiro C, Pentz B, Sehgal A, Montero D. Differences in cardiac output and aerobic capacity between sexes are explained by blood volume and oxygen carrying capacity. *Front Physiol*. 2022;13:747903.
- Janssen I, Heymsfield SB, Wang ZM, Ross R. Skeletal muscle mass and distribution in 468 men and women aged 18–88 yr. *J Appl Physiol*. 2000;89(1):81–88.
- Calbet JA, Joyner MJ. Disparity in regional and systemic circulatory capacities: Do they affect the regulation of the circulation? *Acta Physiol (Oxf)*. 2010;199(4):393–406.
- Guo M, Diaz Caneiro C, Pugliese NR, Paneni F, Montero D. Lean body mass and the cardiovascular system: An intrinsic relationship in Hans Chinese women and men. *Hong Kong College of Cardiology Annual Scientific Congress (HKCC ASC 2023)*; 2023; Hong Kong.
- Wilmore JH, Parr RB, Girandola RN, et al. Physiological alterations consequent to circuit weight training. *Med Sci Sports*. 1978;10(2):79–84.
- Francis G. <https://science4performance.com/2019/09/12/cycling-physique/>. 2019. Accessed 25.12.2020.
- Haakonssen EC, Barras M, Burke LM, Jenkins DG, Martin DT. Body composition of female road and track endurance cyclists: Normative values and typical changes. *Eur J Sport Sci*. 2016;16(6):645–653.

« منابع :

- Almog T, Almog O. *Academia: All the Lies: What Went Wrong in the University Model and What Will Come in Its Place*. Independently published;2020.
- Broad W, Wade N. *Betrayers of the Truth: Fraud and Deceit in the Halls of Science*. New York: Simon & Schuster;1983.