JARDUERA FISIKOAREN PRESKRIPZIOA DIABETESA ETA OBESITATEA PAIRATZEN DUTEN GAIXOENTZAT

Urdampilleta A[1,2,3], Gómez-Zorita S[3, 4,] eta Odriozola A[3]
[1]Kirolerako Irakaskuntzen Eskola Publikoa. KIROLENE. Eusko Jaurlaritza.
[2]Fisiologiako Saila. Farmaziako Facultatea. Euskal Herriko Unibertsitatea (UPV-EHU). Vitoria-Gasteiz.
[3]Nutrizio eta Kirol Aholkularitza. Kirol Fisiología eta Aldizkako Hipoxiako Entrenamenduetarako Unitatea. K2 Kirol Zentrua. Vitoria-Gasteiz. NUTRIAKTIVE. Kirolerako Aholkularitza Zientifiko-Teknikoa. Genetika, Elikadura eta Kirola Saila.
[4]Farmazia eta Elikagaien Zientziak Saila. Euskal Herriko Unibertsitatea (UPV-EHU). Vitoria-Gasteiz.

Emaila: aritz.urdampilleta@ehu.es

SARRERA

Bi motako Diabetes mellitusa (DM2) duten gaixoen % 80-86, aldi berean obesitatea pairatzen dute. Arazo fisiopatologiko hauek hiltzeko arriskua bikoizten dute eta garuneko hodietako zein zirkulazio-apartuko istripuak edukitzeko arriskua laukozten dute. Gaitza bat bestearen sorburua izan daiteke ere, kontutan hartuta DM2 pairatzeko % 75 aren aukera elikapen ohitura kaltegarrietan eta horietatik ondorioztatzen den obesitatean datzala. Hau dela eta, espezialista askok bi gaitzak barne hartu nahiean “diabesitate” adiera erabiltzea gomendatzen dute.

Beraz, diabesitatearen tratamenduan dietaren bidez pisua galtzea oinarrizko faktorea suposatzen duela uste da.

HELBURUA

Errebisio lan honetan eguneroko jarduera fisikoko egitaraua proposatzen dugu bi helburu nagusirekin: alde batetik elikaduraren bidez lortutako pisu galtze hori mantentzen laguntzea eta era berean, gaixo hauen zirkulazio-aparatuan efektu onuragarriak lortzea.

METODOLOGIA

Helburu honekin gaur egungo azterketa bibliografikoa aurkezten dugu, bai jarduera fisiokoaren antolaketarako jarrabideak ezarri ahal izateko eta bai proposamen praktikoak egin ahal izateko. Honetarako PUBMED, Scielo, SCIRUS eta SPORTDISCUS bilatzaileak erabili dira ingeleseko ondorengo hitz gagoekin: "tipo 2 diabetes", "exercise", "training". Era brean artikulo gehiago batu ahal izateko elur maluten estrategia ere ibili da.

EMAITZAK

Burututako azterketa bibliografikoari esker zenbait ondorio atera daitezke. Alde batetik, jardurea fisikoa burutu izanagatik, insulinarako sentikortasuna handiagotu daiteke. Batez ere jarduera hau intentsitate eta bolumen altuan egiten denean eta bereziki indarrezko ariketak lan aerobikoarekin bateratzen direnean. Hau gertatzen da ariketa aerobikoak zirkulazio-aparatuko eta gantz profila hobetzeko oinarrizkoak direlako. Era beran eta gantzaren galera areagotzeko, ariketa aerobikoak indar ariketekin bateratzea funtsezkoa da.

ONDORIOAK

Deskribatutako onurak, jarduera fisikoaren ondorioz GLUT-4 garraiatzaileen espresioaren igoeragatik gerta daitezke, garraiatzaile hauen bidez azukreen metabolismoan eragindako hobekuntza dela medio.

ERREFERENTZIAK

1. Haskell WL. Physical activity and disease prevention: Past, present and future, A personal perspective. Exercise and Sport Sciences Review 2003;31:109-110

2. Myers J, Prakash M, Froelicher V, Do D, Partington S, Atwood JE. Exercise capacity and mortality among men referred for exercise testing. N Engl J Med 2002;346(11):793-801.

3. Idoate F, Ibañeez J, Gorostiaga EM, García-Unciti M, Martínez-Labari C, Izquierdo M. Weight-loss diet alone or combined with resistance training induces different regional visceral fat changes in obese women. International Journal of Obesity 2010;1-14.

4. Thomas DE, Elliott EJ, Naughton GA. Exercise for type 2 diabetes mellitus. Cochrane Database of Systematic Reviews 2006;3:002968

5. Di Loreto C, Fanelli C, Lucidi P, Murdolo G, De Cicco A, Parlanti N, et al. Make your diabetic patients walk: Long-term impact of different amounts of physical activity on type 2 diabetes. Diabetes Care 2005;28:1295–1302.

6. Sigal RJ, Kenny GP, Wasserman DH, Castaneda-Sceppa C. Physical activity/exercise and type 2 diabetes. Diabetes Care 2004;27:2518–2539.

7. Colagiuri S. Diabesity: therapeutic options. Diabetes, Obesity and Metabolism 2010;12:463-473.

8. Wisse BE, Kim F, Schwartz MW. An Integrative View of Obesity. Science 2007;318:928-929.

9. Tuomilehto J, Lindstrom J, Eriksson JG, Valle TT, Hamalainen H, Ilanne-Parikka P, et al. Prevention of Type 2 Diabetes Mellitus by Changes in Lifestyle among Subjects with Impaired Glucose Tolerance. N Engl J Med 2001;344(18):1343-1350

10. Gill JMR, Cooper AR. Physical Activity and Prevention of Type 2 Diabetes Mellitus. Sports Med 2008;38(10):807-824

11. Eijsvogels TMH, Veltmeijer MTW, Schreuder THA, Poelkens F, Thijssen DHJ, Hopman MTE. The impact of obesity on physiological responses during prolonged exercise. International Journal of Obesity 2011;1-9

12. Church T. Exercise in Obesity, Metabolic Syndrome, and Diabetes. Progress in

Cardiovascular Diseases 2011;53:412-418.
13. Nowler WC, Barrett-Connor E, Fowler SE, Hamman RF, Lachin JM, Walker EA, et al. Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. N Engl J Med 2002;346:393-403
14. Joslin EP, Root EF, White P. The treatment of diabetes mellitus. Lea & Febiger, Philadelphia. 1959.
15. De Micheli A. Italian standards for diabetes mellitus 2007: executive summary. Acta Diabetol 2008;45:107-127.
16. Sigal RJ, Wasserman DH, Kenny GP, Castaneda C (2004) Physical activity/exercise and type 2 diabetes. Diabetes Care 10:2518–2539
17. Umpierre D, Ribeiro PAB, Kramer C, Leitao CB, Zucatti ATN, Azevedo MJ, et al. Physical Activity Advice Only or Structured Exercise Training and Association With HbA1c Levels in Type 2 Diabetes. A Systematic Review and Meta-analysis. JAMA 2011;305(17):1790-1799
18. ADA/ACSM (1997) Joint statement: diabetes mellitus and exercise. Med Sci Sport Exercise 29(12):i–vi
19. American College of Sports Medicine (2000) Position stand: exercise and type 2 diabetes. Med Sci Sports Exerc 22:1345–1360
20. Sigal RJ, Castaneda C, Kenny GP, White RD, Wasserman D. Physical activity/exercise and type 2 diabetes. Diabetes Care 2006;6:1433-1438
21. Phielix E, Meex R, Moonen-Kornips E, Hesselink MKC, Schrauwen P. Exercise training increases mitochondrial content and ex vivo mitochondrial function similarly in patients with type 2 diabetes and in control individuals Diabetologia 2010;53:1714-1721
22. Boulé NG, Haddad E, Kenny GP, Wells GA, Sigal RJ (2001) Effects of exercise on glycemic control and body mass in type 2 diabetes mellitus: a meta-analysis of controlled clinical trials. JAMA 2001;286:1218-1227
23. Boulé NG, Kenny GP, Hadda E, Wells GA, Sigal RJ (2003) Meta-analysis of the effect of structured exercise training on cardiorespiratory fitness in Type 2 diabetes mellitus. Diabetologia 2003;46:1071-1081
24. Kelley GA, Kelley KS. Effects of aerobic exercise on lipids and lipoproteins in adults with type 2 diabetes a meta-analysis of randomized-controlled trials. Public Health 2007;121(9):643-655.
25. Hansen D, Dendale P, Jonkers RAM, Beelen M, Manders RJF, et al.. Continuous low- to moderate-intensity exercise training is as effective as moderate- to high-intensity exercise training at lowering blood HbA1c in obese type 2 diabetes patients. Diabetologia 2009;52:1789-1797.
26. Mourier A, Gautier JF, De Kerviler E. Mobilization of visceral adipose tissue related to the improvement in insulin sensitivity in response to physical training in NIDDM. Effects of branched-chain amino acid supplements. Diabetes Care 1997;20:385-391.
27. O'Donovan G, Kearney EM, Nevill AM, Woolf-May K, Bird SR. The effects of 24 weeks of moderate- or high-intensity exercise on insulin resistance. Eur J Appl

Physiol 2005;95(5-6):522-528.
28. Coker R, Hays NP, Williams RH, Brown AD, Freeling SA, Kortebein PM, et al. Exercise-induced changes in insulin action and glycogen metabolism in elderly adults. Med Sci Sport Exerc 2006;38:433-438.
29. Dipietro L, Dziura L, Yeckel CW, Darrel Neufer P. Exercise and improved insulin sensitivity in older women: evidence of the enduring benefits of higher intensity training. J Appl Physiol 2006;100:142-149.
30. Gill JMR. Physical activity, cardiorespiratory fitness and insulin resistance: a short update. Curr Opin Lipidol 2007;18:47-52.
31. Kang J, Robertson RJ, Hagberg JM, Kelley DE, Goss FL, DaSilva SG, et al. Effect of exercise intensity on glucose and insulin metabolism in obese individuals and obese NIDDM patients. Diabetes Care 1996;19(4):341-9.
32. Pan DA, Lillioja S, Kriketos AD, Milner MR, Baur LA, Bogardus C, et al. Skeletal muscle triglyceride levels are inversely related to insulin action. Diabetes 1997;46(6):983-8.
33. Simoneau JA, Colberg SR, Thaete FL, Kelley DE. Skeletal muscle glycolytic and oxidative enzyme capacities are determinants of insulin sensitivity and muscle composition in obese women. FASEB J 1995;9(2):273-8.
34. Goodpaster BH, Thaete FL, Simoneau JA, Kelley DE. Subcutaneous abdominal fat and thigh muscle composition predict insulin sensitivity independently of visceral fat. Diabetes. 1997;46(10):1579-85.
35. Slentz CA, Tanner CJ, Bateman LA, Durheim MT, Huffman KM, Houmard JA, et al. Effects of exercise training intensity on pancreatic beta-cell function. Diabetes Care 2009;32(10):1807-11.
36. Zavorsky GS. Effects of exercise training intensity on pancreatic beta-cell function: response to Slentz et al. Diabetes Care 2010;33(3):e45.
37. Jeon CY, Lokken RP, Hu FB, van Dam RM. Physical Activity of Moderate Intensity and Risk of Type 2 Diabetes. Diabetes Care 2007;30:744-752.
38. Laaksonen DE, Lindström J, Lakka TA. Physical Activity in the Prevention of Type 2 Diabetes. The Finnish Diabetes Prevention Study. Diabetes 2005;54:158-165.
39. Goodwin ML. Blood Glucose Regulation during Prolonged, Submaximal Continuous Exercise: A Guide for Clinicians. J Diabetes Sci Technol 2010;4(3):694-705.
40. McDermott AY, Mernitz H. Exercise and older patients: Prescribing guidelines. American Family Physician 2006;74:437–444.
41. Albright A, Franz M, Hornsby G, Kriska A, Marrero D, Ullrich I, et al. American College of Sports Medicine position stand. Exercise and type 2 diabetes. Medicine & Science in Sports & Exercise 2000;32:1345-1360.
42. Sigal RJ, Kenny GP, Wasserman DH, Castaneda-Sceppa C. Physical activity/exercise and type 2 diabetes. Diabetes Care 2004;27:2518-2539.
43. Ballester I. Evaluación médico-deportiva antes del inicio del ejercicio. Av Diabetol. 2007;23(1):28-32.
44. Centers for Disease Control and Prevention. Perceived exertion (Borg rating of

perceived exertion scale). (2007). Retrieved from www.cdc.gov/nccdphp/dnpa/physical/measuring/perceived exertion.htm
45. Seguin R, Nelson ME. The benefits of strength training for older adults. Am J Prev Med 2003;25:141-149.
46. Bassuk SS, Manson JE. Epidemiological evidence for the role of physical activity in reducing risk of type 2 diabetes and cardiovascular disease. J Appl Physiol 2005;99:1193-1204.
47. Eves ND, Plotnikoff RC. Resistance training and type 2 diabetes. Diabetes Care 2006;29:1933-1941.
48. Minges KE, Cormick G, Unglik E, Dunstan DW. Evaluation of a resistance training program for adults with or at risk of developing diabetes: an effectiveness study in a community setting. International Journal of Behavioral Nutrition and Physical Activity 2011;8:50.
49. Wicherley TP, Noakes M, Clifton PM, Cleanthous X, Keogh JB, Brinkworth GD. A High-Protein Diet With Resistance Exercise Training Improves Weight Loss and Body Composition in Overweight and Obese Patients With Type 2 Diabetes. Diabetes Care 2010;33:969-976.
50. Walker KZ, O'Dea K, Gomez M, Girgis S, Colagiuri R. Diet and exercise in the prevention of diabetes. J Hum Nutr Diet 2010;23:344-352.
51. Praet SF, van Loon LJ. Optimizing the therapeutic benefits of exercise in type 2 diabetes. Journal of Applied Physiology 2007;103:1113-1120.
52. Snowling NJ, Hopkins WG. Effects of different modes of exercise training on glucose control and risk factors for complications in type 2 diabetic patients: A meta-analysis. Diabetes Care 2006;29:2518-2527.
53. Dunstan DW, Puddey IB, Beilin LJ, Burke V, Morton AR, Stanton KG. Effects of a short-term circuit weight training program on glycaemic control in NIDDM. Diabetes Res Clin Pract 1998;40:53-61.
54. Honkola A, Forsen T, Eriksson J . Resistance training improves the metabolic profile in individuals with type 2 diabetes. Acta Diabetol 1997;34:245-248.
55. Eriksson J, Taimela S, Eriksson K, Parviainen S, Peltonen J, Kujala U. Resistance training in treatment of non-insulindependent diabetes mellitus. Int J Sports Med 1997;18:242-246.
56. Yaspelkis BB. Resistance training improves insulin signaling and action in skeletal muscle. Exerc Sport Sci Rev 2006;34(1):42-46.
57. Ibanez J, Izquierdo M, Arguelles I, Forga L, Larrion JL, Garcia-Unciti M, Idoate F, Gorostiaga EM (2005) Twice weekly progressive resistance training decreases abdominal fat and improves insulin sensitivity in older man with type 2 diabetes. Diabetes Care 28:662–667
58. Dunstan DW, Daly RM, Owen N, Jolley D, De Courten M, Shaw J, et al. High-intensity resistance training improves glycemic control in older patients with type 2 diabetes. Diabetes Care 2002;25:729-1736.
59. Castaneda C, Layne JE, Munoz-Orians L, Gordon PL, Walsmith J, Foldvari M, et al. A randomized controlled trial of resistance exercise training to improve glycemic

control in older adults with type 2 diabetes. Diabetes Care 2002;25:2335-2341.
60. Brooks N, Layne JE, Gordon PL, Roubenoff R, Nelson ME, Castaneda-Sceppa C. Strength training improves muscle quality and insulin sensitivity in Hispanic older adults with type 2 diabetes. Int J Med Sci 2007;4:19-27.
61. Gordon PL, Vannier E, Hamada K, Layne J, Hurley BF, Roubenoff R, et al. Resistance training alters cytokine gene expression in skeletal muscle of adults with type 2 diabetes. Int J Immunopathol Pharmacol 2006;19:739-49.
62. Kwon HR, Han KA, Ku YH, Ahn H, Koo BK, Kim HC, Min KW. The Effects of Resistance Training on Muscle and Body Fat Mass and Muscle Strength in Type 2 Diabetic Women. Korean Diabetes J 2010;34:101-110.
63. Albright, A., Franz, M., Hornsby, G., Kriska, A., Marrero, D., Ullrich, I., et al. (2000). American College of Sports Medicine position stand. Exercise and type 2 diabetes. Medicine & Science in Sports & Exercise 2000;32:1345-1360.
64. Cuff DJ, Meneilly GS, Martin A, Ignaszewsky A, Tildesley HD, Frolich JJ. Effective exercise modality to reduce insulin resistance in women with type 2 diabetes. Diabetes Care 2003;26:2977-2982.
65. Sigal RJ, Kenny GP, Boule NG, Wells GA, Prud'homme D, Fortier M, et al. Effects of aerobic training, resistance training, or both on glycemic control in Type 2 diabetes. Ann Intern Med 2007;147:357-369.
66. Balducci S, Zanuso S, Massarini M, Corigliano G, Nicolucci A, Missori S, et al. The Italian Diabetes and Exercise Study (IDES): Design and methods for a prospective Italian multicentre trial of intensive lifestyle intervention in people with type 2 diabetes and the metabolic syndrome. Nutrition, Metabolism & Cardiovascular Diseases 2008;18:585e595.
67. Zanuso S, Jimenez A, Pugliese G, Corigliano G, Balducci S. Exercise for the management of type 2 diabetes: a review of the evidence. Acta Diabetol 2010;47:15-22.
68. Hordern MD, Dunstan DW, Prins JB, Baker MK, Singh MAF, Coombes JS. Exercise prescription for patients with type 2 diabetes and pre-diabetes: A position statement from exercise and sport science Australia. Journal of Science and Medicine in Sport 2011; in press.
69. GR Waryasz y AY McDermot AY. Exercise prescription and the patient with type 2 diabetes: A clinical approach to optimizing patient outcomes. Journal of the American Academy of Nurse Practitioners 2010;22:217-227.
70. Kraemer WJ, Ratamess NA. Hormonal Responses and Adaptations to Resistance Exercise and Training. Sports Med 2005;35(4):339-361.
71. Uchida MC, Crewther BT, Ugrinowitsch C, Bacurau RFP, Moriscot AS, Aoki MS. Hormonal responses to different resistance exercise schemes of similar total volume. J Strength Cond Res 2009;23(7):2003-2008.
72. Saltiel AR, Kahn CR. Insulin signalling and the regulation of glucose and lipid metabolism. Nature 2001;414:799-806.
73. Aoi W, Naito Y, Yoshikawa T. Dietary Exercise as a Novel Strategy for the Prevention and Treatment ofMetabolic Syndrome: Effects on Skeletal Muscle

Function. J Hum Nut 2011(676208): 1-11
74. Holten MK, Zacho M, Gaster M, Jueal C, Wojtaszewsky JF, Dela F. Strength training increases insulin-mediated glucose uptake, GLUT4 content, and insulin signalling in skeletal musclein patients with type 2 diabetes. Diabetes 2004;53:294-305.
75. Earnest CP. Exercise interval training: An improved stimulus for improving the physiology of pre-diabetes. Medical Hypotheses 2008;71:752-761.
76. Green HJ, Duhamel TA, Holloway GP, Moule JW, Ranney DW, Tupling AR, et al. Rapid upregulation of GLUT-4 and MCT-4 expression during 16 h of heavy intermittent cycle exercise. Am J Physiol Regul Integr Comp Physiol 2008;294:R594-R600.
77. Fatone C, Guescini M, Balducci S, Battistoni S, Settequattrini A, Pippi R, et al. Two weekly sessions of combined aerobic and resistance exercise are sufficient to provide beneficial effects in subjects with Type 2 diabetes mellitus and metabolic syndrome. J Endocrinol Invest. 2010;33(7):489-95.
78. Nakai N, Shimomura Y, Sato J, Oshida Y, Ohsawa I, Sato Y. Exercise training prevents maturation-induced decrease in insulin sensitivity, J. Appl. Physiol 1996;80:1963-1967.
79. Sato Y. Diabetes and life-styles: role of physical exercise for primary prevention, Br. J. Nutr. 2000;84:S187-S190.
80. Sato Y, Nagasaki M, Kubota M, Uno T, Nakai N. Clinical aspects of physical exercise for diabetes/metabolic syndrome. Diabetes Research and Clinical Practice 2007;77S:S87-S91.
81. Gómez-Zorita S y Urdampilleta A. El GLUT4: Efectos de la actividad física y aspectos nutricionales en los mecanismos de captación de glucosa y sus aplicaciones en la diabetes tipo II. Av Diabetol; 2012;28:19-26.