Investigation of Fasting Plasma Glucose in Masters Athletes

Joe Walsh¹, Ian Timothy Heazlewood², Mark DeBeliso³, Mike Climstein⁴,⁵

¹ Sport Science Institute www.sportscienceinstitute.com
² The School of Psychological and Clinical Sciences, Faculty of Engineering, Health, Science and the Environment, Charles Darwin University, Darwin, Northern Territory, Australia
³ Department of Physical Education and Human Performance, Southern Utah University, Cedar City, USA
⁴ Clinical Exercise Physiology, Southern Cross University, School of Health and Human Sciences, Gold Coast, Queensland, Australia
⁵ Physical Activity, Lifestyle, Ageing and Wellbeing Faculty Research Group, University of Sydney, Sydney, NSW, Australia, 2006

Abstract

Prior research documented differences in fasting plasma glucose (FPG) between older and younger masters athletes at the Golden Oldies Rugby Festival (GORF). It was the purpose of our study to further investigate FPG on a larger sample. FPG data was collected on 486 participants at the Sydney World Masters Games. Of the males, 241 reported optimal FPG and 36 reported sub-optimal FPG. For females 183 reported optimal FPG and 26 reported sub-optimal FPG. Analysis was conducted utilising the age ranges implemented in past research on the GORF. The mean FPG for masters athletes below 50 years old was 5.10±1.52 mmol/L, whilst for those 50 years and above it was 5.01±1.02. The difference between the groups was not significant (t = 0.722, p = 0.471). This aligned with the finding of the GORF study that there was no significant difference in FPG between the different age ranges analysed. The sample size obtained for this investigation of FPG in masters athletes was more than double the number of participants used in previous research on the GORF. Many participants had FPG above optimal levels. Therefore, an age-related decline in pancreatic function may outweigh protective exercise benefits attained from masters sport participation.

Keywords: World Masters Games, Golden Oldies Rugby Festival, Masters Athletes, Fasting Plasma Glucose.

INTRODUCTION

Fasting Plasma Glucose

The Fasting Plasma Glucose (FPG) test is used to screen for diabetes. High FPG levels and diabetes are associated with a higher incidence of cardiovascular disease and all-cause mortality [1]. The World Health Organisation defines an optimal FPG test result as a score below 5.5 mmol/L [2].

The Golden Oldies Rugby Festival

The Golden Oldies Rugby Festival (GORF) is an International rugby competition held biennially and open to all rugby players aged 35 and over. Prior published research collected demographics of physiological and pathology variables for competitors of at the GORF [3]. Analysis in this published study on the GORF examined FPG differences between competitors aged below fifty years old and those fifty years old and above (<50yrs, n = 96 and ≥50yrs, n=120) [3]. The FPG scores (mmol/L) were such that 75.0% of the under 50s had FPG in optimal ranges with mean ± standard deviation of 5.5 ± 3.4, whilst for those with age 50 and above 50.0% had FPG in optimal ranges, with mean ± standard deviation of 5.8 ± 2.6 [3]. An independent samples t-test (p < 0.05) was conducted between these groups to see if there was a significant difference between groups, but no significant difference was identified [3]. It was therefore the purpose of this study to further investigate FPG differences between older and younger athletes by analyzing medical and physiological demographics on an alternative larger sample from a similar athletic cohort. As well as physiological and pathological demographics, published research on the GORF includes motivations [4-6], medical consequences [7] and training type and frequency [5].
This manuscript focuses on differences in FPG between older and younger masters athletes. Masters athletes are defined as those systematically training for and competing in organized sporting events designed specifically for older adults [8]. Masters athletes have led a physically active lifestyle for an extended period of time or initiated exercise/sport in later life [9]. Competing in sport at older ages has been shown to be beneficial for a number of health indices including general cardiovascular health [10], blood pressure [11], improved lipids [12], reduced frailty/sarcopenia [13] and muscular strength and function [14]. GORF participants are categorized as masters athletes. The biggest masters sporting event (by participant number) is the World Masters Games (WMG). It is also the world’s largest lifelong sports competition with over 170,000 sports enthusiasts participating so far [15]. Participation at the WMG is open to sports people of all abilities, limited by age. The minimum age criterion ranges between 25 and 35 years depending upon the sport. The data used in this manuscript was data gathered at the Sydney WMG, which attracted 28,089 competitors who represented 95 countries competing in 28 sports [16-18]. Published research on the masters athletes competing at the Sydney WMG has included investigation of smoking prevalence [19], body mass index [16, 20-27], injury incidence [28-32] and health [12, 33-41] of competitors. Much analysis has also been published in the literature on psychological motivation of Sydney WMG athletes [18, 42-50].

AIM

To analyse differences in FPG between older and younger masters athletes at the WMG to test for significant differences between groups above and below 50 years old.

METHODOLOGY

Data was collected on masters athletes participating in the Sydney WMG, after approval for the project was granted by a university Research Ethics Committee in accordance with the ethical standards of the Helsinki Declaration of 1975 (revised in 2008) and the Sydney World Masters Games Organising Committee. An online survey was created using Limesurvey, an open-source, web-based application to deliver the survey. The survey consisted of several sections, one of which required FPG data survey. A total of 485 masters athletes provided FPG data as part of this investigation. This manuscript analyses contained within the survey. Further details about the survey methodology and an overview of findings from the survey has been previously published [51].

Statistical analysis was conducted in SPSS version 25 (data exploration and independent samples t-tests). Figures were created in Python 3.6.5.

RESULTS

A total of 486 masters athletes provided FPG data as part of this investigation (277 males and 209 females). The histogram in Figure 1 displays the distribution of FPG readings in the 486 athletes. Of the males 241 reported optimal (low) FPG and 36 reported sub-optimal (high) FPG. For females 183 reported optimal (low) FPG and 26 reported sub-optimal (high) FPG.

Results were analysed split by age range, utilising the split examined in past research on the GORF [3]. The distribution of FPG for the two groups is displayed in Figure 2. The mean FPG for masters athletes below 50 years old was 5.10±1.52 mmol/L, whilst for those 50 years and above it was 5.01±1.02. An independent t-test was conducted to determine if there was a statistical difference between the groups, however the difference was not significant (t = 0.722, p = 0.471).

DISCUSSION

The sample size obtained for this investigation of FPG in masters athletes was more than double the number of participants in the sample used in previous research on the GORF [3]. The average age in this WMG data was less for the older masters athletes, whilst in the GORF the age was less for the younger athletes below 50 years old [3]. However, none of these patterns were statistically significant. Figure 2 demonstrates the FPG distribution was fairly consistent for the older and younger age ranges, supporting the relatively high p-value obtained in the independent samples t-test. This research supported the finding of the GORF study [3] that there was no difference in FPG between the under 50 and the 50 years old and above groups.

Similar to the GORF data [3] a large number of participants had FPG above optimal levels. In the case of a couple of participants, a very high FPG was recorded, as evidenced in Figures 1 and 2. Therefore although participation in exercise is noted to have protective benefits the age-related decline in pancreatic function may outweigh the benefits attained from masters sport participation.

CONCLUSION

This research supported the finding of the GORF study that there was no difference in FPG between the under 50 and the 50 years old and above groups. However it was observed that a large number of participants had FPG above optimal levels.
Acknowledgements

The authors appreciate the time taken by the 3,298 WMG masters athletes in completing the 56 questions in the MOMS survey tool. The authors also appreciate the assistance of Evan Wills in data collection using Limesurvey and the Sydney World Masters Games Organising Committee in approving the project.

Conflicts of interest

None.

REFERENCES

1. Wei M, Gibbons LW, Mitchell TL, Kampert JB, Stern MP, Blair SN. Low fasting plasma glucose level as a predictor of cardiovascular disease and all-cause mortality. Circulation. 2000;101(17):2047-52.
2. Excellence NIFC. Type 2 diabetes: prevention in people at high risk. NICE guideline (PH38). 2012.
3. Climstein M, Walsh J, Best J.P., Heazlewood, I.T., Burke, S., Kettunen, J., Adams, K.J., DeBeliso M. Physiological and Pathology Demographics of Veterans Rugby Athletes at Rugby Festival. International Journal of Medical, Health, Biomedical, Bioengineering and Pharmaceutical Engineering. 2011;5(5):227-31.
4. Dong E, Zhang L, Choe J, Pugh S. Rugby Union among middle-aged American men: an exploration. Leisure Studies. 2013;32(2):219-28.
5. Heazlewood I, Walsh J, Climstein M, editors. Can participant motivation predict training frequency and training type in Male Masters Rugby players competing at the 2010 World Golden Oldies Rugby Festival? Singapore Conference on Applied Psychology 2018; 2018.
6. Heazlewood IT, Walsh J, Climstein M, editors. Participant Motivation of Male Master’s Rugby Players Participating in Golden Oldies World Rugby Festival. In Proc World Congress on Science and Sport; 2019.
7. Ardagh MW. The medical consequences of a golden oldies rugby tournament. Emergency Medicine. 1997;9(1):11-4.
8. Reasburn P, Dascombe B. Endurance performance in masters athletes. European Review of Aging and Physical Activity. 2008;5(1):31.
9. Walsh J, Heazlewood IT, Climstein M. Body Mass Index in Master Athletes: Review of the Literature. Journal of Lifestyle Medicine. 2018;8(2):79-98.
10. Beaumont A, Campbell A, Grace F, Sculthorpe N. Cardiac Response to Exercise in Normal Ageing: What Can We Learn from Masters Athletes? Current Cardiology Review. 2018;14(4):245-53.
11. Buyukyazi G. Differences in blood lipids and apolipoproteins between master athletes, recreational athletes and sedentary men. The Journal of Sports Medicine and Physical Fitness. 2005;45(1):112.
12. Climstein M, Walsh J, DeBeliso M, Heazlewood T, Severne T, Adams K. Cardiovascular risk profiles of world masters games participants. The Journal of Sports Medicine and Physical Fitness. 2018;58(4):489-96.
13. Fien S, Climstein M, Quilter C, Buckley G, Henwood T, Grigg J, et al. Anthropometric, physical function and general health markers of Masters athletes: a cross-sectional study. PLoS One. 2017;12(6):17608.
14. Mckendry J, Breen L, Shad BJ, Greig CA. Muscle morphology and performance in master athletes: A systematic review and meta-analyses. Ageing Research Reviews. 2018;45:62-82.
15. The Organizing Committee of the World Masters Games 2021 Kansai. What is the World Masters Games 2020 [cited 2020, 8th February]. Available from: https://wmg2021.jp/en/
16. Walsh J, Heazlewood, I.T., Climstein, M., DeBeliso, M., Adams, K.J., Burke, S., Kettunen, J., editor The Obesity Prevalence in Masters Athletes, a Comparison of all World Masters Games Sports. Proc Pre-Olympic Conference: International Convention on Science, Education and Medicine in Sport; 2012.
17. Walsh J, Heazlewood I, DeBeliso M, Climstein M. Psychological factors in competitive masters athletes in the context of body mass index. Sport Science. 2018;10(2):8.
18. Walsh J, Heazlewood IT, DeBeliso M, Climstein M. Assessment of motivations of masters athletes at the World Masters Games. The Sport Journal. 2018;20.
19. Walsh J, Climstein M, Heazlewood I, DeBeliso M, Kettunen J, Severne T, et al. Reduced prevalence of smoking in masters football codes (rugby union, soccer and touch football). Journal of Science and Medicine in Sport. 2018;21:1343.
20. Heazlewood I, Walsh J, Climstein M, Adams K, Severne T, DeBeliso M, editors. Differences in Participant Motivation Based on Category of Body Mass Index and Gender. Singapore Conference of Applied Psychology; 2016: Springer, Singapore.
21. Walsh J, Climstein M, Heazlewood IT, Burke S, Kettunen J, Adams K, et al. The loess regression relationship between age and BMI for both Sydney World Masters Games athletes and the Australian national population. International Journal of Biological and Medical Sciences. 2011;1(1):33.
22. Walsh J, Heazlewood I, Climstein M, Burke S, Adams K, DeBeliso M, et al. Body mass index for Australian athletes participating in rugby union, soccer and touch football at the World Masters Games. Journal of the World Academy of Science, Engineering and Technology. 2011;7(77):1119-23.
23. Walsh J, Climstein M, Burke S, Kettunen J, Heazlewood I, DeBeliso M, et al. Obesity prevalence for athletes participating in soccer at the World Masters Games. International SportMed Journal. 2012;13(2):76-84.
24. Walsh J, Heazlewood IT, Climstein, M., DeBeliso, M., Adams, K.J., Burke, S., Kettunen, J., editor The effect of body mass index on motivations for competition at the Sydney World Masters Games. Proc Pre-Olympic Conference: International Convention on Science, Education and Medicine in Sport; 2012.
25. Walsh J, Climstein M, Heazlewood IT, DeBeliso M, Adams K, Burke S, et al. Body mass index of masters basketball players. Medicina Sportiva. 2013;7:1700-5.
26. Walsh J, Climstein M, Heazlewood IT, Kettunen J, Burke S, DeBeliso M, et al. Body mass index for athletes participating in swimming at the World Masters Games. The Journal of Sports Medicine and Physical Fitness. 2013;53(2):162-8.
27. Walsh J, Heazlewood IT, DeBeliso M, Climstein M. Comparison of obesity prevalence across 28 world masters games sports. Sport Science. 2012;25(2):30-6.
28. Climstein M, Walsh J, DeBeliso M, Heazlewood IT, Severne T. CV Risk Profiles of WMG athletes. The Journal of Sports Medicine and Physical Fitness. 2018;58(4):489-96.
29. Heazlewood I, Walsh J, Climstein M, Adams K, Severne T, DeBeliso M. Injury location, type and incidence of male and female athletes competing at the world masters games. Journal of Science and Medicine in Sport. 2017;20:e51-e2.
30. Walsh J, Climstein M, Heazlewood I, Adams K, DeBeliso M, Burke S, et al. Rugby union, soccer, touch football: Injury classification (masters athletes). Journal of Science and Medicine in Sport. 2011;14:e76.
31. Walsh J, Climstein M, Heazlewood I, Adams K, DeBeliso M, Burke S, et al. Masters athletes: Are they hurt more often?(rugby union, soccer and touch football). Journal of Science and Medicine in Sport. 2011;14:e76-e7.
32. Walsh J, Climstein M, Heazlewood IT, DeBeliso M, Kettunen J, Adams KJ, et al. Masters athletes: No evidence of increased incidence of injury in football code athletes. Advances in Physical Education. 2013;3(1):36-42.
33. Climstein M, Walsh J, Burke S, Adams K, DeBeliso M, Kuttunen J, et al. Physiological demographics of the Sydney World Masters Games competitors. Journal of Science and Medicine in Sport. 2011;14:e80.
34. Climstein M, Walsh J, Heazlewood I, DeBeliso M, Adams K, Severne T, et al. Robustness: Injuries and Comparison of Injury Rates between Sydney World Masters Games and Sydney Olympic Games. Journal of Sports Medicine and Physical Fitness. 2012;52:151-9.
35. Climstein M, Walsh J, DeBeliso M, Heazlewood I, DeBeliso M, Adams KJ. Cardiovascular risk profiles of world masters games participants. The Journal of Sports Medicine and Physical Fitness. 2018;58(4):489-96.
36. DeBeliso M, Climstein M, Adams K, Walsh J, Burke S, Heazlewood I, et al. North American medical and health history survey of 2009 Sydney World Masters Games participants. Journal of Science and Medicine in Sport. 2011;14:e79-e80.
37. DeBeliso M, Walsh J, Climstein M, Heazlewood I, Kettunen J, Seveone T, et al. World Masters Games: North American participant medical and health history survey. The Sport Journal. 2014;2014:1-17.
38. DeBeliso M, Walsh J, Heazlewood T, Severne T, Adams KJ, Climstein M. Cardiovascular Risk Profiles Of World Masters Games Participants: 1023 Board 202 May 31 200 PM-330 PM. Medicine & Science in Sports & Exercise. 2017;49(5):277.
39. Climstein M, Burke S, Walsh J, Adams K, DeBeliso M, Heazlewood I, et al. Sydney 2009 World Masters Games: Participants medical and health history survey. Journal of Science and Medicine in Sport. 2010;13:e71.
40. Climstein M, Heazlewood IT, Walsh T, Walsh J, DeBeliso M, Severne T, et al., editors. Non-optimal blood panels in World Masters Games participants. Proc ESSA Conference 2012 (6th Exercise & Sports Sciences Australia Conference and Sports Dietitians Australia Update: Research to Practice); 2014.
41. Climstein M, Walsh J, DeBeliso M, Heazlewood IT, Severne T. CV Lipid Profiles. J Sports Med Phys Fitness. 2016.
42. Adams KJ, DeBeliso M, Walsh J, Burke S, Heazlewood I, Kettunen J, et al. Why do people participate in the World Masters Games? Journal of Science and Medicine in Sport. 2011;14:e82.

43. Adams KJ, DeBeliso M, Walsh J, Burke S, Heazlewood IT, Kettunen J, et al. Motivations to Participate in Sport at the Sydney 2009 World Masters Games: 3236Board# 199 June 4 8: 00 AM-9: 30 AM. Medicine & Science in Sports & Exercise. 2011;43(5):940.

44. Climstein M, Adams K, Sevè T, DeBeliso M, editors. Participant motivation: A comparison of male and female athletes competing at the 2009 World Masters Games. Applied Psychology-Proceedings Of The 2015 Asian Congress (Acap 2015); 2015: World Scientific.

45. Heazlewood I, Walsh J, Climstein M, Kettunen J, K A, M D. A Comparison of Classification Accuracy for Gender Using Neural Networks Multilayer Perceptron (MLP), Radial Basis Function (RBF) Procedures Compared to Discriminant Function Analysis and Logistic Regression Based on Nine Sports Psychological Constru. Advances in Intelligent Systems and Computing. 392: Springer; 2016. p. 145-52.

46. Sevè T, Adams K, Climstein M, Walsh J, Heazlewood I, DeBeliso M, et al. Are masters athletes primarily motivated by intrinsic or extrinsic factors? Journal of Science and Medicine in Sport. 2012;15:S357.

47. Walsh J, Heazlewood IT, Climstein M. Regularized linear and gradient boosted ensemble methods to predict athletes' gender based on a survey of masters athletes. Model Assisted Statistics and Applications. 2019;14(1):47-64.

48. Walsh J, Heazlewood IT, DeBeliso M, Climstein M. Investigation of the psychological motivating factors behind competition (masters sport) in the context of body mass index. Sport Science: International Scientific Journal of Kinesiology. 2017;10(2):9-13.

49. Walsh J, Heazlewood IT, Climstein M. Application of gradient boosted trees to gender prediction based on motivations of master athletes. Model Assisted Statistics and Applications. 2018;13(3):235-52.

50. Walsh J, Heazlewood IT, DeBeliso M, Climstein M. Application of t-distributed Stochastic Neighbor Embedding (t-SNE) to clustering of social affiliation and recognition psychological motivations in masters athletes. International Journal of Sport, Exercise and Health Research. 2020; 4(1):1-6.

51. Walsh J, Heazlewood IT, DeBeliso M, Climstein M. A profile of Sydney World Masters Games athletes: Health, injury and psychological indices. Central European Journal of Sport Sciences and Medicine. 2018;23(3):37-52.