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Metabolic syndrome in rural Australia

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Metabolic syndrome in rural Australia: an opportunity for primary health care

Abstract

OBJECTIVE

To measure the impact of a 6-month home-based behaviour change intervention on reducing the risk of chronic disease as determined by metabolic syndrome (MetS) status and cardiovascular risk score, and discuss implications for primary care in rural areas.

DESIGN

A two-arm randomised controlled trial (RCT) of rural adults.

SETTING

The rural town of Albany in the Great Southern region of Western Australia.

PARTICIPANTS

Participants (n=401) aged 50-69 years who were classified *with* or *at risk* of MetS and randomly assigned to intervention (n=201) or waitlisted control (n=200) group.

MAIN OUTCOME MEASURES

Change in MetS status and cardiovascular risk.

RESULTS

Significant improvements in MetS status (p=0.03) and cardiovascular disease (CVD) risk score (-0.82, p <0.001) were observed for the intervention group relative to control group from baseline to post-test.

CONCLUSION

This home-based physical activity and nutrition intervention reduced participants' risk of experiencing a cardiovascular event in the next five years by 1 percent. Incorporating such prevention orientated approaches in primary care might assist in reducing the burden of long-term chronic diseases. However, for realistic application in this setting, hurdles such as current national health billing system and availability of resources will need to be considered.

KEY WORDS

Preventive Health, Cardiovascular Diseases, Rural Health, Obesity, Health Promotion.

What is already known on this subject
• MetS, obesity, and related chronic diseases can be improved via physical activity and dietary behaviour change. • In rural Australia, there is a high prevalence of MetS and overweight/obesity related chronic disease. • General practitioners have access to high-risk chronic disease individuals and regularly treat MetS with drug therapy. • The reorientation of health services should be incorporated into health promotion action as part of a comprehensive approach to the prevention of chronic disease.

What this paper adds
• Participants in a 6-month physical activity and nutrition home-based program lowered their MetS risk and CVD risk score. • Early identification and intervention for high-risk groups can significantly lower the risk of chronic diseases • Opportunities lie within primary care services to contribute to the prevention of chronic diseases in rural areas of Australia.

Introduction

Metabolic syndrome (MetS) is a constellation of factors that are common to, and increase the risk of, type 2 diabetes mellitus (T2DM) and cardiovascular disease (CVD) (1, 2). These factors include hypertension, dyslipidaemia, inflammation, and glucose intolerance (1). Excess body weight, physical inactivity, sedentary behaviour, poor diet, and advancing age (3, 4) all increase an individual's predisposition to developing the identified factors associated with MetS. The risk of T2DM is 3.5 to 5 times more likely among adults with MetS (4), which also increases the risk of CVD (5), with the risk of myocardial infarction increasing 3- to 4-fold (1).

Adults living in rural areas are more likely to be overweight/obese, insufficiently active, and have higher blood cholesterol compared to their metropolitan counterparts (6), which increases their risk of MetS and CVD and in turn their prevalence (7). Often in rural Australia, older adults have limited access to specialist medical and lifestyle services compared to their metropolitan counterparts (6). However, rural primary care is a service that regularly sees patients who may be at high-risk of developing a chronic disease (8, 9), this places general practitioners (GPs) in a unique position to put preventative care high on the agenda (10). This proactive approach by GPs is one that at-risk patients encourage and are receptive to (11).

MetS status and CVD risk score are relatively easy to determine in general practice. The International Diabetes Federation (IDF) criteria is based on five criteria that support identification of risk of developing T2DM (12), while the National Vascular Disease Prevention Alliance's (NVDPA) Australian Absolute CVD Risk Calculator (13) determines the likelihood of an individual having a CVD event within the next five years. Through these methods, early detection and treatment can be initiated by way of lifestyle interventions such as physical activity and nutrition interventions or if required, pharmaceutical treatment (14). However, management of T2DM and CVD are difficult once these diseases develop, emphasising the need for prevention, as well as early warning/screening systems that support early intervention strategies (15) for those at risk of T2DM and CVD (16), especially in rural areas of Australia.

A major challenge for the Australian health system relates to the ageing population and the long-term impact of chronic diseases (6). Improvement in health outcomes through effective prevention, early detection and appropriate management strategies are priorities for the prevention of chronic diseases (6). The Albany Physical Activity and Nutrition (APAN) study specifically targeted rural adults with or at risk of MetS, who were therefore at increased risk of chronic diseases (17). Albany was selected as a study site because of its aging population (32% aged 50 and over) (18) and low Socio-Economic Indexes for Areas (SEIFA) score (989) (19). A SEIFA score of less than 1000 is considered low and known to correlate with a lower health status (20). This paper describes the effect of a home-based randomised controlled trial, to determine the impact of changes in physical activity and diet on MetS status and CVD risk score, and discusses the implications for primary care in rural areas of Australia.

Methods

Study design

The APAN study was a two-arm RCT of a behaviour change intervention conducted during 2014-15. The study was approved by the Curtin University Human Research Ethics Committee (approval number HR149_2013) and the trial was registered with the Australian and New Zealand Clinical Trials Registry (ACTRN12614000512628).

Sample

Rural adults (n=401) were recruited from Albany, Western Australia and participants were required to be aged 50-69 years and classified as *with* or *at risk* of MetS, based on IDF criteria (3). Participants *with* MetS had central obesity (waist circumference ≥94 cm for men or ≥80 cm for women [Europids, Sub-Saharan Africans, Eastern Mediterranean, Middle Eastern]; ≥90 cm for men or ≥80 cm for women [South Asians, Chinese, Japanese]), plus any two of the following parameters: raised triglyceride level (≥1.7 mM, or treatment for this); reduced high-density lipoprotein (HDL) cholesterol (<1.03 mM for men and <1.29 mM for women, or treatment for this); raised blood pressure (systolic ≥130 mmHg or diastolic ≥85 mmHg, or treatment of previously diagnosed hypertension); raised fasting plasma glucose (≥5.6 mM). Participants were classified as being *at risk* of MetS if they had one of the above parameters, in addition to central obesity.

Intervention

Participants provided informed consent and were randomly assigned to intervention (n=201) or waitlisted control (n=200). The intervention group received a 6-month program based on the Australian Dietary (21) and Physical Activity and Sedentary Behaviour Guidelines (22), which incorporated goal setting, self-monitoring and feedback guided by Self-Determination Theory constructs (23). Motivational interviewing (24) was conducted by trained researchers via telephone. The attrition rate for the intervention was 18% and the main reasons for withdrawal were due to health issues, personal reasons and loss of interest (25). The protocol for recruitment, process and intervention outcomes has been described elsewhere (8, 17, 26).

Measures and statistical analysis

Outcome measures for the present study are changes in MetS status and CVD risk score from baseline to post-test. CVD risk score was calculated using the NVDPA's Australian Absolute CVD Risk Calculator (13). Descriptive statistics summarised demographic characteristics, MetS status, and CVD risk score at baseline. CVD risk score was analysed using independent and paired t-tests for continuous outcome variables, and Mann-Whitney U tests and Wilcoxon Signed Rank tests for non-normally distributed variables. Chi-square tests were used to analyse the change in MetS status both between and within groups over time.

Results

A total of 401 participants undertook baseline measures and 310 (77.3%) completed the post-test. The majority of participants were female (66.5%) with a mean age of 61 years (SD=5.41) and mean BMI of 30.8 kg/m^2. Participants were excluded from analysis due to missing blood samples or changes to medication (n=38), leaving 130 intervention (64.7%) and 144 controls (72.0%) available for analysis of MetS status. Six intervention and nine control group participants were excluded from the CVD risk score analysis since their systolic blood pressure was >180 mmHg or total cholesterol >7.5 mM and their score was unable to be calculated as per NVDPA guidelines (13). There were no significant between-group differences in demographic characteristics (17), MetS status (p=0.66), and CVD risk score (p=0.96) (see Table 1).

[Insert Table 1 here]

Between- and within-group changes in MetS status and CVD risk scores are presented in Table 2. Significant improvements in MetS status were observed for the intervention group (p=0.03), with 15 (23%) fewer participants classified with MetS and 8 (12%) less classified at risk of MetS at post-test. No significant changes in MetS status were seen in the control group. Overall, the intervention group demonstrated a significant decrease in CVD risk score (-0.82, p <0.001) from baseline to post-test. There was also a significant difference between groups at post-test for MetS status (p=0.02) and CVD risk score (p=0.02).

[Insert Table 2 here]

Discussion

This study demonstrated the positive impact of a 6-month physical activity and nutrition home-based intervention on MetS status and risk of future CVD events in a rural older population. At the end of the intervention, the prevalence of MetS and CVD risk score were lower for the intervention group, as a result of significant improvements to dietary and physical activity behaviours (fat and fibre intake; moderate intensity physical activity) (8). Improvements in MetS and CVD parameters (triglyceride, total cholesterol, and non-HDL cholesterol concentrations; waist circumference, waist-to-hip ratio, weight, and body mass index) were reported elsewhere (17).

Strategies to increase physical activity levels, maintaining a healthy diet and healthy weight maintenance are central to the prevention of CVD, T2DM and other chronic diseases (27). Intervention program participants' improvements strongly support the effectiveness of a home-based lifestyle approach towards management of chronic disease in a high-risk rural population (28, 29). However, how best to implement such a program on a broader scale is the challenge.

Interestingly, 90 percent of females and 80 percent of males visit a GP in a 12-month period (6) and it is estimated that 60 to 70 percent of primary health care visits are for non-communicable diseases (NCDs) (30). Considering this, primary care may be well placed to identify those individuals at risk via early screening, and management of such factors as high blood pressure, elevated blood glucose, and abnormal lipid profiles. However, the incorporation of prevention into primary care is challenging for a number of reasons. These include the health systems billing process, processes that evolved in an era of infectious disease and acute consultations (31). Review of this billing system would be needed before prevention services could be properly implemented. In addition, those working in primary care are often time poor (32), there can be issues with retention, and language and culture barriers for patients being serviced by overseas trained health professionals (33, 34). Also, the distances travelled by some rural residents for medical consultations can result in sporadic acute visits (35) and health outcomes may be impacted by varying levels of health literacy (31).

It seems currently primary care does not have the capacity or support mechanisms to comprehensively address prevention of NCDs (36). This leads at times to a focus on drug therapy and less emphasis on the provision of healthy lifestyle and management (37, 38). This approach may also be due to drug therapy being seen as more efficacious (39) rather than the longer term and more challenging strategies of increasing physical activity levels, improving dietary intake and losing excess weight as a means to improve glycaemic control and lipid profiles (40). Those working in primary care and patients may have a high affinity and trust in therapeutic methods, as opposed to lifestyle prevention methods (39, 41). This disease-treatment response would benefit from consideration of lifestyle-counselling that supports a proactive dialect, empowerment and behaviour change (30, 42, 43).

Limitations

This was a small study based in a rural community that provides some insight into the impact of a home-based program on metabolic status and CVD risk. Although the lowering of the CVD risk score was marginal, any reduction in the CVD risk is advantageous as it reduces the probability of developing a cardiovascular event in the next five years (13). The study collected objective data, however the intervention period was limited (6-months). Determining the impact of the intervention over a longer period would be advantageous.

In summary, this home-based physical activity and nutrition intervention reduced participants' risk of experiencing a cardiovascular event in the next five years by 1 percent and although this reduction was marginal, surely any reduction is advantageous in an ageing population. Primary care is a setting that provides regular access to high risk individuals, incorporating prevention orientated approaches in primary care might assist in reducing the burden of long-term chronic diseases. For realistic application in this setting, hurdles such as current national health billing system and availability of resources will need to be reviewed. However, we believe the findings emphasise the value of primary prevention and contribute to the evidence to support future policy that calls for increased focus on prevention in primary care.

References

1. Kaur J. A comprehensive review on metabolic syndrome. Cardiology Research and Practice. 2014;2014. doi: 10.1155/2014/943162.

2. Blaha M, Bansal S, Rouf R, Golden S, Blumenthal R, DeFilippis A. A practical "ABCDE" approach to the metabolic syndrome. Mayo Clinic Proceedings. 2008;83(8):932-43. doi: 10.4065/83.8.932.

3. Han T, Lean M. Metabolic syndrome. Medicine. 2006;34(12):536-42. doi: 10.1016/j.mpmed.2010.10.010.

4. Dunkley A, Charles K, Gray L, Camosso-Stefanovic J, Davies M, Khunti K. Effectiveness of interventions for reducing diabetes and cardiovascular disease risk in people with metabolic syndrome: systematic review and mixed treatment comparison meta-analysis Diabetes, Obesity and Metabolism. 2012;14:616-25. doi: 10.1111/j.1463-1326.2012.01571.x.

5. Barazzoni R, Silva V, Singer P. Clinical biomarkers in metabolic syndrome. Nutrition in Clinical Practice. 2013;29(2):215-21. doi: 10.1177/0884533613516168.

6. Australian Institute of Health and Welfare. Australia's Health 2016. Canberra, ACT: Australian Institute of Health and Welfare, 2016 ISSN 1032-6138 Contract No.: Cat. no. AUS 199.

7. Janus E, Laatikainen T, Dunbar J, Kilkkinen A, Bunker S, Philpot B, et al. Overweight, obesity and metabolic syndrome in rural southeastern Australia. The Medical Journal of Australia. 2007;187(3):147-52.

8. Blackford K, Jancey J, Lee A, James A, Howat P, Waddell T. Effects of a home-based intervention on diet and physical activity behaviours for rural adults with or at risk of metabolic syndrome: a randomised controlled trial. International Journal of Behavioral Nutrition and Physical Activity. 2016;13(13). doi: 10.1186/s12966-016-0337-2.

9. Johansson H, Stenlund H, Lundström L, Weinehall L. Reorientation to more health promotion in health services – a study of barriers and possibilities from the perspective of health professionals. Journal of Multidisciplinary Healthcare. 2010;3:213-24. doi: 10.2147/JMDH.S14900. PubMed PMID: PMC3024891.

10. Christopher H, Helena B, Graeme M, Joan H. Prevalence of chronic conditions in Australia. PLoS ONE. 2013;8(7):e67494. doi: 10.1371/journal.pone.0067494.

11. Henderson E. Obesity in primary care: a qualitative synthesis of patient and practitioner perspectives on roles and responsibilities. The British Journal of General Practice : the journal of the Royal College of General Practitioners. 2015;65(633):e240. doi: 10.3399/bjgp15X684397.

12. International Diabetes Federation. The IDF consensus worldwide definition of the metabolic syndrome Brussels: International Diabetes Federation; 2006 [March 2013]. Available from: https://www.idf.org/webdata/docs/MetS_def_update2006.pdf.

13. National Vascular Disease Prevention Alliance. Guidelines for the management of absolute cardiovascular disease risk Canberra: National Stroke Foundation, 2012.

14. Artinian N, Fletcher G, Mozaffarian D, Kris-Etherton P, Van Horn L, Lichtenstein A, et al. Interventions to promote physical activity and dietary lifestyle changes for cardiovascular risk factor reduction in adults. A Scientific Statement From the American Heart Association. 2010;122(4):406-41. doi: http://dx.doi.org/10.1161/CIR.0b013e3181e8edf1.

15. Sherwin R, Jastreboff A. Year in Diabetes 2012: The Diabetes Tsunami. Journal of Clinical Endocrinology & Metabolism. 2012;97(12):4293-301. doi: 10.1210/jc.2012-3487.

16. Wilson P, D'Agostino R, Parise H, Sullivan L, Meigs J. Metabolic syndrome as a precursor of cardiovascular disease and type 2 diabetes mellitus. Circulation. 2005;112(20):3066-72. doi: 10.1161/CIRCULATIONAHA.105.539528.

17. Blackford K, Jancey J, Lee A, James A, Waddell T, Howat P. Home-based lifestyle intervention for rural adults improves metabolic syndrome parameters and cardiovascular risk factors: A randomised controlled trial. Preventive Medicine. 2016;89:15-22. doi: 10.1016/j.ypmed.2016.05.012.

18. Australian Bureau of Statistics. Census QuickStats. Canberra, ACT: Australian Bureau of Statistics; 2016.

19. Australian Bureau of Statistics. Albany (C) (LGA) (50080) 2017 [cited 2017 27 Nov,]. Available from: http://stat.abs.gov.au/itt/r.jsp?RegionSummary&region=50080&dataset=ABS_REGIONAL_LGA

&geoconcept=REGION&datasetASGS=ABS_REGIONAL_ASGS&datasetLGA=ABS_REGIONAL_LGA&regionLGA=REGION&regionASGS=REGION.

20. Pink B. Socio-Economic Indexes for Areas (SEIFA): Technical Paper. Canberra: Australian Bureau of Statistics, 2011 Contract No.: ABS Catalogue no. 2033.0.55.001.

21. National Health and Medical Research Council. Australian Dietary Guidelines. Canberra: National Health and Medical Research Council, 2013 Contract No.: 1864965789.

22. Department of Health. Australia's Physical Activity and Sedentary Behaviour Guidelines Canberra: Australian Government; 2014 [cited 2014 September]. Available from: http://www.health.gov.au/internet/main/publishing.nsf/content/health-pubhlth-strateg-phys-act-guidelines.

23. Patrick H, Williams G. Self-determination theory: its application to health behavior and complementarity with motivational interviewing. International Journal of Behavioral Nutrition and Physical Activity. 2012;9(18):1-12. doi: 10.1186/1479-5868-9-18.

24. Resnicow K, McMaster F. Motivational Interviewing: moving from why to how with autonomy support. International Journal of Behavioral Nutrition and Physical Activity. 2012;9(19):1-9. doi: 10.1186/1479-5868-9-19.

25. Blackford K, Lee A, James AP, Waddell T, Hills AP, Anderson AS, et al. Process evaluation of the Albany Physical Activity and Nutrition (APAN) program, a home-based intervention for metabolic syndrome and associated chronic disease risk in rural Australian adults. Health promotion journal of Australia : official journal of Australian Association of Health Promotion Professionals. 2016. Epub 2016/07/19. doi: 10.1071/he16027. PubMed PMID: 27426475.

26. Blackford K, Jancey J, Lee A, James A, Howat P, Hills A, et al. A randomised controlled trial of a physical activity and nutrition program targeting middle-aged adults at risk of metabolic syndrome in a disadvantaged rural community. BMC Public Health. 2015;15. doi: 10.1186/s12889-015-1613-9.

27. Harkins C, Shaw R, Gillies M, Sloan H, MacIntyre K, Scoular A, et al. Overcoming barriers to engaging socio-economically disadvantaged populations in CHD primary prevention: a qualitative study. BMC Public Health. 2010;10(1):1-7. doi: 10.1186/1471-2458-10-391.

28. Boehm J, Franklin RC, Newitt R, McFarlane K, Grant T, Kurkowski B. Barriers and motivators to exercise for older adults: A focus on those living in rural and remote areas of Australia. Australian Journal of Rural Health. 2013;21(3):141-9. doi: 10.1111/ajr.12032. PubMed PMID: 104182461. Language: English. Entry Date: 20130626. Revision Date: 20150820. Publication Type: Journal Article.

29. Laatikainen T, Dunbar J, Chapman A, Kilkkinen A, Vartiainen E, Heistaro S, et al. Prevention of type 2 diabetes by lifestyle intervention in an Australian primary health care setting: Greater Green Triangle (GGT) Diabetes Prevention Project. BMC Public Health. 2007;7:249. doi: 10.1186/1471-2458-7-249.

30. Egger GJ, Binns AF, Rossner SR. The emergence of "lifestyle medicine" as a structured approach for management of chronic disease. The Medical Journal of Australia. 2009;190(3):143.

31. Egger G, Katz D, Sagner M, Dixon J, Stevens J. The art and science of chronic disease management come together in a lifestyle-focused approach to primary care. International Journal of Clinical Practice. 2014;68(12):1406-9. doi: 10.1111/ijcp.12500.

32. Ball LE, Hughes RM, Leveritt MD. Nutrition in general practice: role and workforce preparation expectations of medical educators. Australian Journal of Primary Health. 2010;16(4):304-10. doi: 10.1071/PY10014.

33. Bailey BES, Wharton RG, Holman CDAJ. Glass half full: Survival analysis of new rural doctor retention in Western Australia. The Australian journal of rural health. 2016;24(4):258-64. doi: 10.1111/ajr.12260.

34. Durey A. Settling In: Overseas Trained GPs and their Spouses in Rural Western Australia. Rural Society. 2005;15(1):38-54. doi: 10.5172/rsj.351.15.1.38.

35. Thomas SL, Wakerman J, Humphreys JS. Ensuring equity of access to primary health care in rural and remote Australia - what core services should be locally available? International journal for equity in health. 2015;14(1):111. doi: 10.1186/s12939-015-0228-1.

36. Swerissen H, Duckett S, Wright J. Chronic failure in primary care. Grattan Institute, 2016 ISBN: 978-1-925015-80-5.

37. Binns C, Howat P, Smith J, Jancey J. The medicalisation of prevention: health promotion is more than a pill a day. Health Promotion Journal of Australia. 2016;27:91-3. doi: 10.1071/HEv27n2_ED.

38. Ettehad D, Emdin CA, Kiran A, Anderson SG, Callender T, Emberson J, et al. Blood pressure lowering for prevention of cardiovascular disease and death: a systematic review and meta-analysis. The Lancet. 2016;387(10022):957-67. doi: 10.1016/S0140-6736(15)01225-8.

39. van Dillen SME, van Binsbergen JJ, Koelen MA, Hiddink GJ. Nutrition and physical activity guidance practices in general practice: A critical review. Patient Education and Counseling. 2012. doi: 10.1016/j.pec.2012.10.022.

40. Passey M, Fanaian M, Lyle D, Harris M. Assessment and management of lifestyle risk factors in rural and urban general practices in Australia. Australian Journal of Primary Health - Interchange. 2010;16(1):81-6. doi: 10.1071/PY09061.

41. Crowley J, Ball L, Wall C, Leveritt M. Nutrition beyond drugs and devices: a review of the approaches to enhance the capacity of nutrition care provision by general practitioners. Australian Journal of Primary Health. 2012;18(2):90-5. doi: 10.1071/PY11116.

42. Luquis RR, Paz HL. Attitudes About and Practices of Health Promotion and Prevention Among Primary Care Providers. Health Promotion Practice. 2015;16(5):745-55. doi: 10.1177/1524839914561516.

43. Dietz WH, Baur LA, Hall K, Puhl RM, Taveras EM, Uauy R, et al. Management of obesity: improvement of health-care training and systems for prevention and care. The Lancet. 2015;385(9986):2521-33. doi: 10.1016/S0140-6736(14)61748-7.

Tables

Table 1 Baseline characteristics of participants, Albany, Western Australia, 2014-2015

Variable	Intervention group (n=151)	Control group (n=159)	p value[1]
Age (years): **Mean (SD)**	 60.5 (5.64)	 61.3 (5.18)	0.18
Gender: female	100 (66.2%)	106 (66.7%)	0.93
Employment status: **Full time** **Part time** **Unemployed** **Retired**	 78 (51.7%) 24 (15.9%) 5 (3.3%) 44 (29.1%)	 65 (40.9%) 29 (18.2%) 7 (4.4%) 58 (36.5%)	0.30
Education: **Primary school** **Secondary school** **TAFE/Diploma** **University**	 3 (2.0%) 55 (36.4%) 52 (34.4%) 41 (27.2%)	 2 (1.3%) 72 (45.0%) 46 (28.8%) 39 (24.5%)	0.42
Relationship status: **With partner**	 124 (82.1%)	 129 (81.1%)	0.81
Smoking status: **Never** **Ex-smoker** **Occasional smoker** **Daily smoker**	 84 (55.6%) 52 (34.4%) 3 (2.0%) 12 (7.9%)	 84 (52.8%) 54 (33.8%) 4 (2.5%) 17 (10.6%)	0.85
Co-morbidity[2]: **Yes**	 92 (60.9%)	 104 (65.4%)	0.41
Alcohol drinking: **Yes**	 99 (65.6%)	 113 (71.1%)	0.96
	(n=130)	**(n=144)**	
Metabolic syndrome status: **With** **At risk**	 66 (50.8%) 64 (49.2%)	 77 (46.5%) 67 (46.5%)	0.66
	(n=124)	**(n=135)**	
CVD risk score: **Mean (SD)**	 7.03 (4.1)	 6.90 (4.0)	0.96

[1] t-test or chi square test between intervention and control groups
[2] Presence of at least one of 8 common health problems

Table 2 Between- and within-group changes in MetS status and CVD risk score

Outcome	Intervention group (n=130)		p[1]	Control group (n=144)		p[1]	p[2]	p[3]
	Baseline	Post-test		Baseline	Post-test			
With MetS	66 (50.8%)	51 (39.2%)	0.03	77 (53.5%)	78 (54.2%)	0.69	0.72	0.02
At risk of MetS	64 (49.2%)	56 (43.1%)		67 (46.5%)	46 (31.9%)			
	(n=124)			(n=135)				
CVD risk score*: all participants	7.03 (4.1)	6.21 (3.9)	<0.001	6.90 (4.0)	6.66 (3.8)	0.30	0.96	0.02
CVD risk score*: with MetS	8.54 (4.2)	7.44 (4.1)	<0.001	7.90 (4.05)	7.30 (3.9)	0.04	0.33	0.72
CVD risk score*: at risk of MetS	5.48 (3.5)	4.93 (3.2)	0.01	5.78 (3.6)	5.95 (3.7)	0.51	0.46	0.08

[1] Chi-square or paired t-test between baseline and post-test
[2] Chi-square or independent t-test between intervention and control groups at baseline
[3] Chi-square or independent t-test between intervention and control groups at post-test
*Mean (SD)