Effects of Nonpharmacological Interventions on the Components of Metabolic Syndrome in Tirunelveli City Police

Premalatha Ramaswamy[1], Suresh Ellappan[2]

[1]Assistant Professor of Physiology, [2]Professor of Diabetology, Government Kilpauk Medical College, Chennai

Abstract

Background: Life style modifications like walking, slow deep breathing and dietary modifications play a major role in modifying the components of metabolic syndrome. This study was conducted to determine the effects of non-pharmacological interventions on components of metabolic syndrome among the police personnel in Tirunelveli city.

Method: This is a before and after intervention study in which 44 police personnel working in Tirunelveli city in the age group of 30-58 years with metabolic syndrome were included. After getting due permission from the Deputy Commissioner of Police, Tirunelveli and Head of Department of Bio chemistry Department, Institutional Ethical Committee clearance and oral informed consent from the volunteers the study was started. The study was conducted during the period from August to November, 2013. Height, weight, waist circumference, blood pressure estimation and bio-chemical investigations were measured at baseline and 12 weeks after intervention in the study group.

Results: It is found that the physiological parameters measured before and after non pharmacological intervention in the study group indicate a distinct and statistically significant reduction in all the values and a significant increase in HDL.

Recommendation: Physical fitness schedule, along with stress alleviation techniques and dietary modifications may be made mandatory to keep the police personnel physically and mentally healthy.

Keywords: *Metabolic syndrome, Non pharmacological intervention, Police, Tirunelveli.*

Introduction

Many people think that their health can be restored from non communicable diseases only by taking pharmacological treatments. But it is not so, as there are many non pharmacological interventions or life style modifications, which can bring back the disturbed body functions to normal physiological status or at least reduce the disturbances, which have been proved by many research studies. In the context of metabolic syndrome, life style modification plays a major role in modifying its components. Major non pharmacological interventions are walking (moderate physical activity), slow deep breathing exercise (relaxation technique) and dietary modifications.

According to the Ministry of Health and family welfare, Government of India and the public health foundation of India, food containing whole grains, whole pulses, vegetables, fresh fruits, nuts and fish with low carbohydrate and low saturated fat and decreased salt is considered as optimal diet to be consumed for an healthy living[1]. This diet contains more antioxidants and acts as a protective factor in combating oxidative stress which is one of the cause for insulin resistance. This optimal diet is considered to be rich in dietary fiber. According to WHO, Dietary fibers are defined as the portion of plant

Corresponding Author:
Premalatha Ramaswamy
Assistant Professor of Physiology, Government Kilpauk Medical College, Chennai

foods that are resistant to digestion by digestive enzymes and form the bulk of the food.[2]

Physical inactivity is an important modifiable risk factor in the etiology of metabolic syndrome [3, 4]. Walking for about 30-45 minutes per day for at least 5 times a week is considered as an optimal physical activity for maintaining good health.[5] Certain interventions have shown that the physical activity was an effective means of reducing weight, visceral fat, lowering blood pressure, increasing HDL cholesterol and decreasing the level of triglycerides[6-9].

Studies have shown that slow deep breathing has reduced blood pressure and also increase in vagal and parasympathetic shift in autonomic nervous functions, there by relaxing the individual.[10,11,22]

Metabolic syndrome has been reported to be on the rise in general population[12], more so in personnel involved in occupational stress[13]. Police personnel are exposed to unhealthy life style circumstantially which predisposes them to metabolic syndrome at an early age.

There have been attempts by way of non-pharmacological intervention to reduce blood pressure, decrease hyperglycemia, correction of dyslipidemia[14] and improve the psychological well being to better handle the stressful situations with lesser health complications. Studies have been undertaken to evaluate the usefulness of the various non-pharmacological adjuncts reversing the symptoms of metabolic syndrome, so as to prevent or delay its complications.[15,16]

Hence the present study is under taken.

Aims and Objectives: To determine the effects of non-pharmacological intervention such as dietary changes, walking and slow deep breathing exercise on components of metabolic syndrome among the police personnel in Tirunelveli city.

Materials and Method

This is a before and after intervention study in which 44 police personnel working in Tirunelveli city in the age group of 30-58 years with metabolic syndrome were included. After getting due permission from the Deputy Commissioner of Police, Tirunelveli and Head of Department of Bio chemistry Department, Institutional Ethical Committee clearance and oral informed consent from the volunteers the study was started. The study was conducted during the period from August to November, 2013.

Materials Used:

1. Proforma - A written proforma cum consent form containing subject details and clinical examination findings
2. Stadiometer - To measure the height
3. Portable weighing machine - To record the weight
4. Sphygmomanometer - To record the blood pressure
5. nVac Tube (serum tube) - Non-Vacuum Blood Collecting tube with clot activator to collect blood (5ml tube)
6. Sterile syringes - 3ml sterile disposable syringes for drawing venous blood
7. Auto analyzer - Estimation of serum glucose and lipid profile
8. Intervention program in a written format

The individuals included in the study were contacted personally and the details of study were explained to them. Instructions were given to come prepared with overnight fasting for the investigation to be conducted next day. On the day of examination, the proforma containing the written informed consent was filled up in order to get the data regarding personal details, such as dietary habits, sleep duration, physical activity, history of smoking, alcohol etc, The height was measured using stadiometer and the weight was recorded using standard portable weighing machine. The waist circumference was measured using a non- elastic measuring tape that was kept in the horizontal plane, mid- way between the inferior margin of the ribs and the superior border of the iliac crest, at the level of umbilicus. After an interval of 10 minutes rest, the blood pressure was recorded using Sphygmomanometer by the Standard technique of Auscultatory method.

Under aseptic precautions 3ml of blood was drawn from the mid-cubital vein using sterile disposable syringe by a trained paramedical staff. The blood was collected in a sterile serum tube (nVac) which contains clot activator in it. The labeled blood samples were carefully taken to the central laboratory of Tirunelveli Medical College immediately and given for estimation of fasting plasma glucose levels and lipid profile

The blood investigations were carried out in the Auto analysers in the laboratory.

Plasma glucose was determined using glucose oxidase peroxidase method (Trinder's Method). Total cholesterol and triglycerides were determined by using standard enzymatic method. HDL-C was measured by direct assay method. VLDL was calculated by dividing triglycerides by 5 and LDL was calculated by taking the difference of total cholesterol and VLDL.

Based on the criteria for metabolic syndrome as mentioned in the modified National Cholesterol Education Program – Adult Treatment Panel III (NCEP-ATP III), the individuals suffering from metabolic syndrome were identified.

The criteria for diagnosing metabolic syndrome is the presence of at least three of the following five factors.

1. **Blood pressure** - SBP > 130 mmHg/or DBP > 85mmHg or previously diagnosed hypertension on treatment
2. **Waist Circumference** - >90cm in males >80cm in females
3. **Fasting blood glucose** - >110mg/dl or previously diagnosed diabetes on treatment.
4. **Triglycerides** ->150mg/dl or on drug for treatment for elevated triglycerides
5. **High density lipoprotein-cholesterol** - <40mg/dl in males

<50mg/dl in females or on drug treatment for low HDL.

The study group were given clear instructions of the non-pharmacological adjuncts in a written format and also oral explanation. They were asked to follow the following Life Style Modification activities in their daily routine under the monitoring of an Inspector of police.

1. **Walking:** Minimum 45 minutes, morning/evening.
2. **Relaxation:** Slow deep breathing for 15 minutes, minimum twice a day in the leisure time.
3. **Dietary modification:** Included 6 meal plan and break time snacks.

7-8am breakfast, 10-11amsnacks, 1-2pm lunch, 4-5pm snacks, 7-8pm dinner, 10-11pm salads (vegetable/ fruit).

- One cup of sprouted/boiled pulses/cucumber/fruits as snacks
- Reduce the quantity of rice and add other grains like wheat or millets
- Increase the quantity of vegetables
- Green leafy vegetables at least thrice a week
- Avoid excess salt/oil
- Refrain from alcohol, smoking and carbonated drinks.

At the end of 12 weeks, weight, waist circumference, blood pressure estimation and bio- chemical investigations were repeated in the study group. The data obtained prior to and after the non pharmacological intervention were tabulated, compared and statistically analyzed.

Results Analysis

Table 1: Age distribution among the study group willing for Non- pharmacological intervention. (N= 44)

Age (Years)	Number	Percentage
30-35	07	15.9 %
36-40	05	11.4 %
41-45	14	31.8 %
46-50	08	18.2 %
51-55	09	20.5 %
Above 55	01	2.3 %

This table shows the age distribution of study group. Here the majority of individuals fell in the age group of 41 to 45 years (14) (31.8 %)

Table 2: Physiological parameters before and after non pharmacological intervention for 12 weeks in the study group. (N=44)

Physiological Parameters		Initial Values Mean (SD)	Values at end of 12 weeks Mean (SD)	Statistical Inference (P-values)
Weight (kg)		84.34(9.87)	81.57 (9.44)	.000
BMI (kg/m^2)		27.92(3.08)	26.94(2.87)	.000
WC (cm)		98.86(7.80)	76.89(7.58)	.000
Blood pressure (mm of Hg)	SBP	127.55(14.51)	117.34(10.21)	.000
	DBP	90.41(11.87)	80.86(6.01)	.000
	MAP	102.79(12.14)	93.01(6.34)	.000
Fasting blood sugar (mg/dl)		140.41(52.75)	92.95(16.79)	.000
Lipid profile (mg/dl)	T.cho	170.43 (26.57)	160.39(33.79)	.041
	TGL	227.8(101.13)	159.09(67.57)	.000
	LDL	92.11(24.33)	78.77(17.34)	.000
	HDL	33.93(5.12)	49.30(14.12)	.000
	VLDL	44.02(18.96)	32.07(13.56	.000

T.Cho-Total cholesterol, TGL- Triglycerides, LDL- Low density Lipoprotein. HDL-High Density Lipoprotein, VLDL-Very low density lipoprotein,

It is found that the physiological parameters measured before and after non pharmacological intervention in the study group indicate a distinct and statistically significant reduction in all the values and increase in HDL. It is understood that the higher level of HDL > 40mg/dl is desired for healthy status of the individual. This table shows the mean HDL level has actually increased from 33.93 to 49.30 mg/dl – which is a welcome improvement.

Discussion

The present study included 44 police personnel in Tirunelveli city, identified as suffering from metabolic syndrome, willing to adopt the non-pharmacological adjuncts for a period of 12 weeks as an attempt to evaluate their effects in improving the health condition.

At the end of 12 weeks after following non-pharmacological intervention, 44 participants underwent the estimation of physiological parameters and bio-chemical investigation.

The results, when tabulated and compared, showed significant reduction in almost all the parameters except the HDL level which showed a distinct increase. When the values obtained before and after non-pharmacological intervention were statistically analyzed, all the changes were found to be statistically significant

The optimal diet prevented the accumulation of extra calories, increased the bulk of food (high dietary fiber), decreased gastric empting time and helped in attaining feeling of satiety and thereby reduced the weight.

The levels of fasting blood glucose was reduceddue to optimal diet and also due to increase in physical activity in the form of walking.Glucose was used as energy for active muscles during exercise and this was facilitated by insulin dependent GLUT-4 receptors in muscles. Regular exercise activities sustained and maintained the sugar level for hours after exercise.

The lipid levels were lowered due to decrease in insulin resistance which in turn was due to increased physical activity. The HDL was increased significantly because of the restoration of “reverse cholesterol transport”

The blood pressure was reduced significantly due to the effect of deep breathing exercise, increased physical activity and reduction of salt in their diet.

Studies by Parikka et al., 2010[17], Orchard TJ, et al., 2005[18] and Azadbakht L et al[19]., show that dietary modifications and life style changes reduced the components of metabolic syndrome.

Studies by Watkins LL et al[20]. and Kaukab Azeem[21] showed that there was reduction in systolic blood pressure, diastolic blood pressure, body massindex, waist-hip ratio after 12 weeks of brisk walking which very well coincides with the results of this study.

The study of Pal GK, Velkumary et al[22]. says that regular practice of slow breathing exercise for 12 weeks improves autonomic functions.

Chacko N. Joseph, et al[23], concluded that slow breathing reduced the blood pressure and enhanced the baroreflex sensitivity in hypertensive patients and Jane AMcElroy,et al[24]. in their study results found that the decrease in the blood pressure due to slow breathing was due to improvement in both the parasympathetic and sympathetic activity.

A study by Brazelian public health system showed a decrease in body mass index and waist circumference through life style intervention program. It also concluded that the levels of HDL cholesterol increased with traditional diets which coincides with the result of this study[25].

In police personnel the increased incidence of metabolic syndrome can be reduced by following the Physical fitness schedule, along with stress alleviation techniques and dietary modifications which may be made mandatory to keep the police personnel physically and mentally healthy.

Conflict of Interest: Nil

Ethical Committee Clearance: Obtained

Source of Funding: Self

References

1. Designed and developed for The Ministry of Health and Family Welfare, Govt. of India and the Public Health Foundation of India, 2008. http://www.healthy-india.org;
2. The Institute of Food Science & Technology, through its Public Affairs and Technical & Legislative Committees, has authorised the following Information Statement, dated April 2007, updating that of February 2007.
3. Torjesen P, Birkeland K, Anderssen S, et al. Lifestyle changes may reverse development of the insulin resistance syndrome. The Oslo Diet and Exercise Study: a randomized trial. Diabetes Care 1997; 20(1): 26-31.
4. Eriksson J, Taimela S, Koivisto V. Exercise and the metabolic syndrome. Diabetologia 1997; 40(2):125-35.
5. William L. Haskell, PhD, FAHA; 1-Min Lee, MD, Sc D; Russell R. Pate, PhD, FAHA; Kenneth E. Powell, MD, MPH; Steven N. Blair, PED, FACSM, FAHA; etal. Physical Activity and public Health Updated Recommendation for Adults From the American College of Sports Medicine and the American Heart Association.
6. Ross R, Dagnone D, Jones P, et al. Reduction in obesity and related comorbid conditions after diet-induced weight loss or exercise-induced weight loss in men A randomized, controlled trial. Ann Intern Med 2000;133(2):92-103.
7. Arroll B, Beaglehole R. Does physical activity lower blood pressure: a critical review of the clinical trials. J Clin Epidemiol 1992;45(5):439-47.
8. Tran Z, Weltman A, Glass G, et al. The effects of exercise on blood lipids and lipoproteins: a meta-analysis of studies. Med Sci Sports Exerc 1983; 15(5):393-402.
9. Haskell W. The influence of exercise on the concentrations of triglyceride and cholesterol in human plasma. Exerc Sport Sci Rev 1984; 12: 205-44.
10. Joseph CN, Porta C, Casucci G, et al. Slow breathing improves arterial baroreflex sensitivity and decreases blood pressure in essential hypertension. Hypertension 2005;46;714-718.
11. Chang Q, LiuR, Shen Z. Effects of slow breathing rate on blood pressure and heart rate variabilities. Int J Cardiol 2013; 169; e6-e8.
12. Atanusaha, Subhashissahu and Goutam paul, Evaluation of cardio vascular risk factor in police officers. International Journal of pharma and bio sciences, Vol. 1/issue -4/Oct- Dec. 2010.
13. Kaushik Pandit, Soumik Goswami, Sujoy Ghosh, Pradip Mukhopadhyay and Subhankar Chowdhury, Metabolic syndrome in South Asians. Indian J Endocrinol Metab. 2012 Jan-Feb; 16(1): 44-55.
14. Pan X, Li G, Hu Y et al. Effects of diet and exercise in preventing NIDDM in people with impaired glucose tolerance: the Da Qing IGT and diabetes study. Diabetes Care 1997;20:537-44.
15. Dunkley AJ, Davies MJ, Stone MA, Taub

NA, Troughton J, Yates T, et al. The Reversal Intervention for Metabolic Syndrome (TRIMS) study: Rationale, design and baseline data. Trials. 2011;12:107.

16. Rush EC, Chandu V, Plank LD. Reduction of abdominal fat and chronic disease factors by lifestyle change in migrant Asian Indians older than 50 years. Asia Pac J Clin Nutr. 2007;16:671-6.
17. Parikka PI, Laakso M, Eriksson JG, Lakka JG, Lindstrom J, Pletonen M, Aunola S, : Leisure-timeYamaoka and Tango BMC Medicine 2012, 10:138 http://www.biomedcentral.com/1741-7015/10/138 Page 9 of 10 physical activity and the metabolic syndrome in the Finnish Diabetes Prevention Study. Diabetes Care 2010, 33:1610-1617.
18. Orchard TJ, Temprosa M, Goldberg R, Haffner S, Ratner R, MarcovinaS, Fowter S, Diabetes Prevention Program Research Group: The effect of met for min and intensive lifestyle intervention on the metabolic syndrome: the Diabetes Prevention Program randomized trial. Ann Intern Med 2005, 19:611-619.
19. Azadbakht L, Mirmiran P, Esmaillzadeh A, Azizi T, Azizi F: Beneficial effects of a dietary approach to stop hypertension, eating plan on features of the metabolic syndrome. Diabetes, Care 2005 28:2823-283.
20. Watkins LL, Sherwood A, Feinglos M, Binderliter A, Babyak M, GulletteE, Waugh R Blumenthal JA: Effects of exercise and weight loss on cardiac risk factors associated with syndrome X. Arch Intern Med 2003,163:1889-1895.
21. Kaukab Azeem, Effect of Twelve Weeks Brisk Walking on Blood Pressure, Body Mass Index and Anthropometric Circumference of Obese Males. World Academy of Science, Engineering and Technology 59 2011
22. G.K. Pal, S. Velkumary & Madanmohan. Effect of short-term practice of breathing exercises on autonomic functions in normal human volunteers. Indian J Med Res 120, August 2004, pp 115-121.
23. Chacko N. Joseph, Cesare Porta, Gaia Casucci, Nadia Casiraghi, Mara Maffeis, Marco Rossi, Luciano Bernardi Slow Breathing Improves. Arterial Baroreflex Sensitivity and Decreases Blood Pressure in Essential Hypertension. Hypertension. 2005;46:714-718; originally published online August 29, 2005.
24. Jane AMcElroy, Ph.D., Shamita Misra, M.D., Megan Vasile, Michael C.Hosokawa, Ed.D., A Pilot Study Demonstrating a Significant Reduction in Blood Pressure with 15 Minute Daily Pranayama Breathing. Annals of Behavioral Science and Medical Education, 2012, Vol. 18, No. 2, 15 — 18.
25. Antonela Siqueira-Catania*, Adriana Cezaretto, Camila Risso de Barros, Emanuel Péricles Salvador, Tainá Carvalhodos Santos and Sandra RG Ferreira Cardiometabolic risk reduction through lifestyle intervention programs in the Brazilian public health system. Diabetology & Metabolic Syndrome 2013, 5:21 doi:10.1186/1758-5996-5-21.