Mini Review

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Lifestyle modification as first line of treatment for chronic disease

Volume 1 Issue 2 - 2014

Meg Hartley
Department of Functional Medicine and Diabetes Treatment, AT Still University, USA

Correspondence: Meg Hartley, Department of Functional Medicine and Diabetes Treatment, AT Still University, Greater Denver Area, APA 507, Module 6, Daniel Cervonka, DHSc, PA-C, USA, Tel 970 376 4185, Email meghat805@yahoo.com

Received: April 25, 2014 | **Published:** June 14, 2014

Abbreviations: TLC, therapeutic lifestyle change; LDL, low density lipoprotein; HDL, high density lipoprotein; TG, triglycerides; VAT, visceral adipose tissue; CRP, c-reactive protein; CVD, cardiovascular disease; T2DM, type 2 diabetes mellitus; DPP, diabetes prevention program; MetS, metabolic syndrome; NHANES, national health and nutrition examination; VAT, visceral adipose tissue; GI, Glycemic Index; LGI, low glycemic index; IR, insulin resistance; LGIMD, low glycemic index mediterranean diet; HGID, high glycemic index diet

Introduction

The practice of medicine is centered on prescribing medications as first line of treatment for majority of medical problems. Although prescription medications are powerful and improve biomarkers such as blood pressure, hemoglobin A1C and lipids rapidly, prescription medications do not always treat the underlying cause of the disease which could be exacerbated due to poor lifestyle-smoking, lack of exercise, bad food choices and stress. Most health care practitioners would agree that the majority of chronic diseases and sequelae are the result of poor lifestyle choices. The progress report of the Cleveland Clinic's Lifestyle 180 program verifies this with the following statement:

Interactions between lifestyle and genetic factors cause the development and progression of a spectrum of chronic conditions, including obesity, type 2 diabetes mellitus, hypertension, cardiovascular disease and several types of cancer...more than 80% of attributable risks may be related to environmental factors, primarily lifestyle factors.[1] Lifestyle factors such as poor diet, lack of exercise, smoking and substance abuse are all modifiable behaviors that if changed can greatly improve health and significantly improve quality of life. Modifying poor lifestyle choices results in decreased disease burden, lessens disabilities and lowers medical costs. Our society is confused and poorly educated about what constitutes a healthy lifestyle. People are confused about the role food plays in affecting their health. Regular exercise is uncommon. Stress is managed poorly and sleep is undervalued. This lack of healthy lifestyle choices results in the expression and manifestation of chronic diseases. Upon initial presentation of a chronic disease, such as diabetes, obesity or hypertension, it has become usual and customary for the medical provider to prescribe a pharmacological solution for treatment. Medications, although helpful, may cause side effects and nutrient depletions that actually worsen the disease state. For example, diuretics decrease potassium, sodium and calcium levels which in return potentiate hypertension.[2] Statins and some beta blockers deplete ubiquinone or CoQ 10. Low CoQ 10 levels are found in cardiomyopathies and are implicated in the onset of congestive heart failure.[3] As the disease progresses more medications are added. For example a diabetic patient is often started on metformin at presentation, then perhaps an insulin sensitizer, then a DDP 4 inhibitor and then insulin. This may lead to an increase in the risk of adverse reactions, nutrient depletion and therefore, may require close monitoring of the affected patients. This also results in an increased number of office visits, more lab testing and more medications. The cycle is self-perpetuating. Therefore, the question arises whether our patients will be better served by improving their wellness, instead of medicating their bad health choices?

If chronic disease is triggered and exacerbated by poor lifestyle choices would it not make sense to address and correct those factors? Treating diseases that are due to poor lifestyle choices is time consuming, complicated and requires specific skills. Lifestyle modification or therapeutic lifestyle change (TLC) programs address the poor lifestyle choices that are at the root causes of chronic diseases. TLC programs address diet, exercise, stress management and nutrient depletion using cognitive behavioral approaches in an effort to correct the underlying causes of chronic disease. The goal of a TLC program is to empower the patient with knowledge, skills and a desire to create and maintain new habits needed to manage their chronic disease and potentially eliminate its' root cause.

TLC programs are recommended as the first line of treatment for chronic disease by many medical societies and organizations such as the Center for Disease Control, National Institutes of Health, American Heart Association and the American Diabetes Association.[4] TLC programs are an important and underutilized first line of treatment. They improve lifestyle choices, risk factors and multiple bio-markers associated with chronic disease. Bio-markers such as low density lipoprotein (LDL), high density lipoprotein (HDL), triglycerides (TG), visceral adipose tissue (VAT), c-reactive protein (CRP), A1C, c-peptide, C-reactive protein, glucose, bone density, AST and ALT, that are key indicators of disease state and progression of diabetes and hypertension.

What studies show

Common sense, which is not that common, and a modicum of medical knowledge dictates that proper diet, exercise and achieving a healthy weight will improve glucose, blood pressure, cholesterol, metabolic function and reduce inflammation. The literature supports the use of lifestyle modification programs for the treatment of many chronic diseases. According to Lerman et al.[5] the National Cholesterol Education Program, and the American Heart Association, lifestyle modifications including diet and exercise are recommend as the first line of treatment for treating insulin resistance and metabolic

syndrome. Therapeutic lifestyle change programs effectively reduce the risk of cancer,[1] cardiovascular disease (CVD), prevent progression to type 2 diabetes mellitus (T2DM), reverse insulin resistance,[6] decrease hepatic fat,[7] and resolve metabolic syndrome.[8]

The Diabetes Prevention Program (DPP) has demonstrated that an intensive lifestyle intervention focused on lifestyle changes and weight reduction can successfully prevent or delay the onset of type 2 diabetes and the metabolic syndrome in overweight or obese adults with pre-diabetes.[9]

TLC programs are most effective in the presence of metabolic syndrome (MetS) which leads to the progression of multiple chronic diseases. The prevalence of MetS in the US was estimated to be 34.5% by the National Health and Nutrition Examination (NHANES) in 1999-2000. According to Brown et al.[8] 60% of patients with coronary artery disease entering cardiac rehab programs had MetS, which is twice that of the general population. MetS is a common treatable condition associated with multiple chronic diseases such as hypertension, T2DM, CVD, polycystic ovarian syndrome, obesity and nonalcoholic steatorrhea hepatitis. The common threads are elevated TG, low HDL, insulin resistance and elevated CRP. All these bio-markers are shown to improve with TLC programs. Medication usage for chronic and new onset diseases is reduced or eliminated with TLC programs. In the Cleveland Clinic's Lifestyle 180 program[1] medications where discontinued, reduced and avoided with TLC programs.

The mechanism

The goals of TLC programs are to improve health, increase quality of life and decrease disease burden by improving body composition. Improved body composition results in decreased fat mass-specifically visceral adipose tissue, increased muscle mass and therefore improvement of multiple biomarkers related to chronic disease. Visceral adipose tissue (VAT) leads to systemic inflammation triggering insulin resistance and accelerating atherosclerosis. Ricanati et al.[1] states "A large portion of the global burden of chronic disease, particularly cardiovascular disease, obesity and some cancers, involves non-resolving chronic inflammation" (Discussion section, para. 3). Simply put better body composition creates better body function. See (Figure 1).

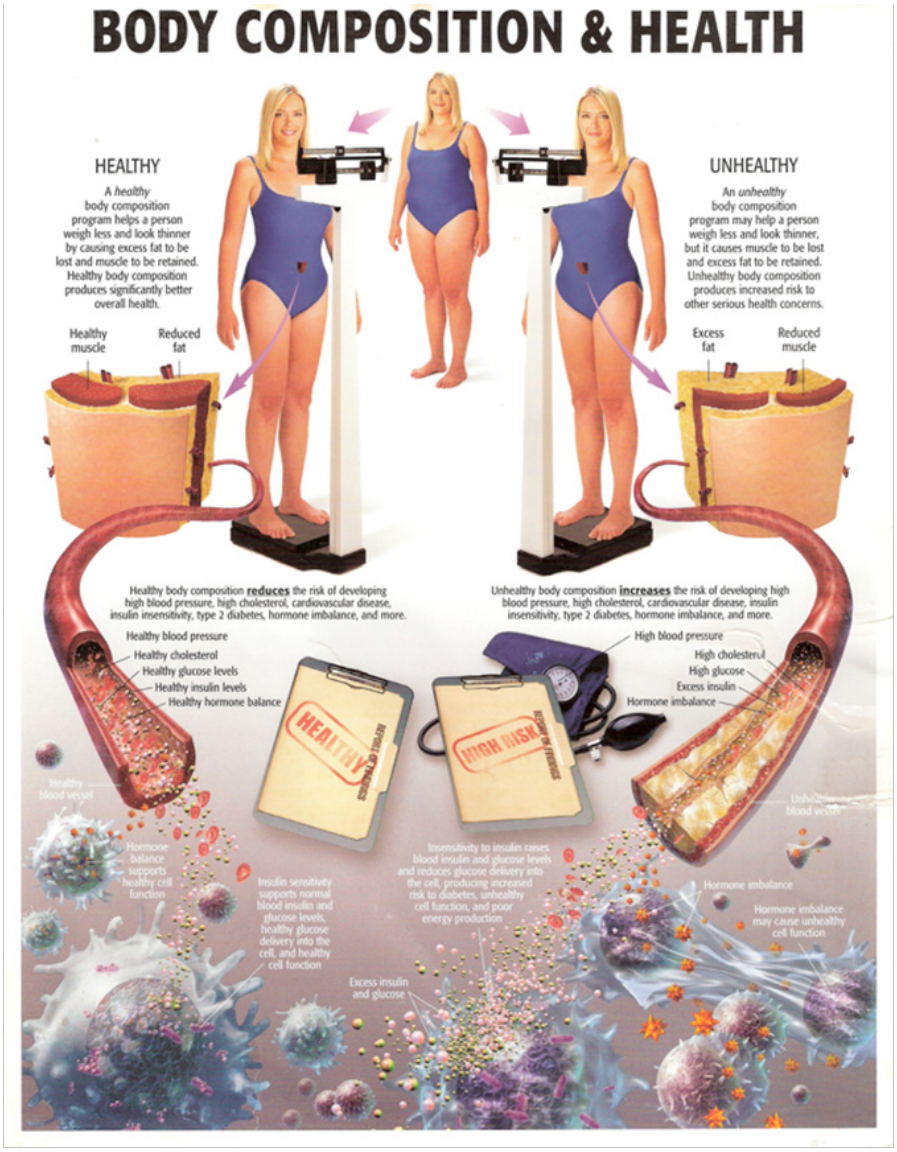

Figure 1 Body composition and health.

Citation: Hartley M. Lifestyle modification as first line of treatment for chronic disease. *J Diabetes Metab Disord Control.* 2014;1(2):35–39.
DOI: 10.15406/jdmdc.2014.01.00009

Diet

Calorie restriction is the main tenet of all weight loss diets. But not all calories are created equal. Calories from proteins, fats and carbohydrates are metabolized differently. All carbohydrates convert into glucose and glucose stimulates insulin release. Insulin regulates fat storage, causes inflammation and elevates triglycerides. Some carbohydrates result in a greater release of insulin than others. This is referred to as the glycemic index (GI). High GI foods produce a rapid and often excessive insulin excretion. Low glycemic index (LGI) foods produce a slower and lower insulin excretion. High levels of insulin signal the body to store more calories into fat stores than it would with normal insulin levels.

Chronically elevated insulin levels coupled with hypertriglyceridemia lead to insulin resistance. Insulin resistance (IR) or pre-diabetes progresses to type 2 diabetes mellitus and cardiovascular disease[5] and is associated with increased risk of cancer.[1] Chronic IR, without overt diabetes, is associated with the same deleterious sequelae of diabetes such as neuropathy, nephropathy and CVD. A LGI diet is the most efficacious way to reduce insulin levels.

A modified low glycemic index Mediterranean diet (LGIMD) promotes increased intake of plant based foods, minimizes grains and dairy, uses small portions of lean animal protein and allows one serving of alcohol per week.[5] Plant based foods provide a spectrum of phytochemicals exerting diverse beneficial biological functions.[1] Reducing grain intake lowers cravings in many subjects.[5] TLC programs using a modified LGIMD decreased postparandial insulin secretion therefore preserving beta-cell function.[6] Preservation of beta-cell function is key to prevent progression to T2DM. Solomon et al.[6] found that a high glycemic index diet (HGID) combined with a reduced calorie diet resulted in weight loss but beta-cell preservation was not realized. A LGI diet decreases hepatic fat[7] thereby decreasing the risk of NASH which can lead to cirrhosis and liver failure, often seen in persons with MetS and family history of diabetes. Creating a nutritional plan using a LGIMD for patients requires a specific set of skills and knowledge.

Exercise

Sarcopenia, or low muscle mass, is rampant among patients with chronic disease. Exercise is essential to build muscle and produce successful weight loss. More muscle mass results in increased basal metabolic rate thus burning more calories at rest. As muscle mass is increased glucose levels decrease, as glucose is the main source of energy for muscle. Resistance activities increase muscle mass while aerobic activities decrease visceral adipose tissue. Visceral adipose tissue (VAT) decreased and muscle mass increased with exercise as noted by Ricanati et al.[1] Lerman et al.[5] Solomon et al.[6] Albu et al.[7] Visceral adipose tissue is preferentially lost while maintaining muscle mass with resistance type exercises.[1] Weight loss was observed in all studies corresponding positively with frequency, duration and intensity of exercise.

There is little consistency among studies regarding intensity, duration, or methods of implementation in regards to exercise. The common denominators found are the use of resistance type activities and frequency of exercise, all agreeing on a minimum of five days a week. This is consistent with the U.S. Department of Health and Human Services,[10] which recommends a minimum of exercise 30minutes a day, five days a week for the general population.

Implementation of an exercise program is not discussed in detail here. Models of exercise implementation ranged from strict supervision with required attendance to advising the patient to exercise. More weight loss was realized in the groups that where held accountable by periodic weight checks. Creating and supporting a tailored exercise program requires knowledge in exercise physiology.

Stress management

Chronic stress raises cortisol levels which elevates CRP, triglyceride and insulin levels and leads to increased VAT deposition. A common manifestation of stress is insomnia. When sleep is poor and is less than 7-8hours a night it results in temporary insulin resistance promoting weight gain.

The importance of stress management and implementation of behavioral interventions is recognized in the Cleveland Clinic's Lifestyle 180 program as reported by Ricanti et al.[1] They hypothesized that reducing psychological stress may improve medical symptoms. Stress management was accomplished by teaching patients relaxation techniques that counter act the "flight or fight" response. Teaching and reinforcing stress reduction techniques to patients is an important component of a TLC program.

Behavior modification

The most common form of behavioral modification is known as the expert-recipient approach where the provider gives the advice while the patient listens. In general telling people what to do doesn't work. Motivational interviewing, a patient-centered approach, occurs when the provider-patient relationship is collaborative and has been proven to be much more effective.[11] Motivational interviewing is different in that it elicits from the patient their motivation to change. From that information a personalized plan that puts the patient's agenda and not the provider's agenda into place is developed. Motivational interviewing resulted in significantly greater weight loss, 1.47 kilograms greater than the control group, in one study done by Armstrong et al.[11]

Conclusion

Successful TLC programs can correct many underlying factors that contribute to the triggering and progression of chronic disease. TLC programs result in reduced levels of total cholesterol, LDL, TG, insulin, glucose, fat mass, elevate levels of HDL and increase muscle mass. (Table 1) demonstrates the effectiveness of lifestyle intervention on weight and fat distribution over a one year period. Improvement in these biomarkers decreases the risk of CVD, T2DM, MetS, cancer and NASH. The main goals of a TLC program are to ingrain new habits in food choices, eating habits, exercise and stress management that last a life time.

The best diet to achieve decreases in these biomarkers and prevent progression of disease is a low-glycemic index diet, with a modified LGIMD showing the largest improvement in biomarkers.[5] Exercise is an essential component of a TLC program. Building muscle, which raises metabolism and improves body function, is critical for success. Without exercise reduction in adipose tissue and particularly VAT is difficult to achieve.

Administering a lifestyle modification program requires time, training and knowledge in nutrition, exercise, stress management, motivational interviewing and behavioral modification. Life style educator certificate programs are offered by several companies and societies such as Metagenics First Line Therapy, American

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Association of Anti-aging Medicine and the American College of Lifestyle Medicine. These are cost effect, evidence based, proven programs that can be easily incorporated into routine primary care for maximum impact on chronic disease. In office TLC programs are reimbursable when coded out under the patient's chronic disease such as T2DM, CVD, hypertension and hyperlipidemia.

Table 1 Weight, adipose tissue mass and distribution, organ fat and abdominal subcutaneous fat cell size before and after 1-year lifestyle intervention

	Men (n=26)*		Women (n=32)†	
	Baseline	**1 Year**	**Baseline**	**1 Year**
Weight (kg)‡	101.2±1.9	88.8±1.8	91.4±1.7	83.9±1.7
BMI (kg/m2)‡	32.4±0.5	28.4±0.5	34.8±0.6	32.0±0.6
FFM (kg)‡	70.9±1.1	66.9±1.0	54.2±1.0	52.1±0.9
Fat mass (Kg)‡	30.3±1.2	22.0±1.2	37.1±1.1	31.8±1.1
Percent fat mass (of weight)‡	29.8±0.8	24.5±0.9	40.4±0.7	37.5±0.8
Upper-body fat (kg)‡	21.4±0.9	15.1±0.9	24.4±0.9	20.7±0.8
Gluteo-femoral fat (kg)§	8.2±0.3	6.2±0.3	12.1±0.6	10.6±0.5
VAT (cm2)‡	311.7±18.3	216.5±18.3	259.5±16.8	213.3±16.7
Deep abdominal SAT (cm2)‡	170.9±11.6	120.4±10.2	148.2±10.6	130.6±9.3
Superficial abdominal SAT (cm2)§	120.9±11.5	92.0±10.6	237.1±10.6	206.8±9.7
Subfascial thigh AT (cm2)(one leg)§	18.1±1.5	12.9±1.1	22.7±1.5	18.1±1.1
Superficial thigh SAT (cm2) (one leg)§	84.7±7.9	66.8±7.5	156.5±7.5	138.4±7.1
Liver attenuation (HU)§	51.2±2.1	59.7±1.8	46.5±1.9	54.6±1.7
Spleen attenuation (HU)§	50.4±0.8	51.3±0.8	47.6±0.8	48.8±0.7
L/S attenuation ratio§	1.01±0.04	1.17±0.04	0.99±0.04	1.13±0.04
Muscle area (cm2) (both legs)‡	311.5±6.8	292.7±6.9	223.4±6.3	215.2±6.4
Muscle attenuation (HU)	46.8±0.9	47.4±0.8	45.0±0.8	45.1±0.7
Fat cell size§	0.73±0.5	0.50±0.04	0.96±0.04	0.76±0.03
Fat cell number§	3,756±271	4,897±370	2,982±239	3,345±325

Using a comprehensive TLC program as first line of treatment results in improved health, lessens medication use, reverses chronic disease and improves quality of life and sense of well being for all involved. Ultimately this results in a decreased burden on our society and health care system. Educating patients about their disease and teaching them skills to regain and maintain their health for a lifetime is a powerful tool. Creating a collaborative environment for health improvement reaps positive benefits for both patients and providers.

Data are unadjusted means±SE. FFM, FM, upper body fat and gluteo-femoral fat measured by DEXA; VAT, SAT, abdominal and thigh SAT subcompartments and organ (liver, spleen, muscle) attenuation measured by CT scan. *Missing data for men (out of 26) for organ attenuations (1 man each) and fat cell size (2 men). †Missing data for women (out of 32) for abdominal adipose tissue measurements (1 woman), thigh adipose tissue and organ attenuations (3 women each) and fat cell size (1 woman). ‡Significant change in both men and women (P range <0.05 to 0.00001), with significant interaction by sex (P range <0.05 to 0.001 for the interaction term). §Significant change in both men and women (P range <0.05 to 0.00001), with no significant interaction by sex.

Acknowledgements

None.

Conflict of interest

Author declares that there is no conflict of interest.

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DOI: 10.15406/jdmdc.2014.01.00009