Effect of Education on Loss of Body Weight and Adjustment of Lipid Profile

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Abstract

Context: Prevalence of obesity is increasing worldwide, and its impact on health is mainly due to its association with a higher risk of coronary heart disease. Such risk is related to the increase in the lipid level that is often associated with increase in the body weight.

Objective: To determine the effect of health education on reducing body weight and body mass index with the decrease in serum lipid.

Design: A longitudinal study.

Setting: A primary health care center.

Patients: Fifty-five individuals willing to participate in the study. The criteria for sample selection included being overweight, having high serum lipid and willingness to reduce their weight.

Intervention: Patients were followed up for 26 weeks while being maintained on a low caloric diet and exercise to help them reduce their body weight. This period included a lifestyle enhancement awareness program (LEAP) consisting of 4 sessions on weight loss, 4 sessions on weight loss maintenance and frequent and regular visits to the clinic to make sure those patients were compliant with the given instructions.

Main outcome: Patients who completed the designed program showed a reduction in body weight, body mass index, and lipid level and an increase in physical activity and dietary readiness to control over-eating.

Results: In both genders there was a significant drop in all the parameters. Only body mass index (BMI) ($p<0.002$) and cholesterol (0.007) showed a statistically significant difference between men and women. In men, cholesterol level at the initial stage of the study was strongly related to the body weight ($r=0.65$ $p<0.002$) and body mass index ($r=0=83$ $p<0.000$). Although, the cholesterol level reduced more in women than men; women decreased less in weight ($p<0.0005$) and body mass index ($p<0.0005$) than men.

Conclusion: Overweight individuals would benefit from a life enhancement program that helps in reducing body weight and serum lipid level.

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Introduction

The prevalence of obesity and overweight are increasing worldwide (Schrauwen & Westerterp, 2000) and both have reached epidemic proportions in the developed countries (Szczygielska et al., 2003) to the extent that in a few countries, such as the Lublin region of Poland, it was reported that only 30% of people have normal body weight (BMI<25) (Szczygielska et al., 2003). In the USA the age-adjusted prevalence of BMI > 30 kg/m2 increased between 1960 and 1994 from 13% to 23% for people over 20 years of age (Schrauwen & Westerterp, 2000).

It has been reported that excess body weight is usually associated with deleterious changes in the lipoprotein profile (Denke et al., 1993). Higher levels of cholesterol are found in the overweight compared with control subjects and significantly higher triglyceride levels were also reported in the overweight compared with control subjects (Viroonudomphol et al., 2003). As a consequence of increased fat intake and decreased physical activity, the prevalence of obesity has increased (Schrauwen & Westerterp, 2000). In both genders, the systolic and diastolic blood pressure and serum cholesterol increase with weight gain and decrease with weight loss independently of the intentionality to lose weight (Czernichow et al., 2002).

Obesity is considered as an established predictor of cardiovascular disease. In several populations, increase in body weight is associated with an increased risk of morbidity and mortality from coronary heart disease (Jooste et al., 1988, Lamon-Fava et al., 1996). The socio-economic impact of obesity is mainly due to its association with a higher risk of

coronary heart disease. It is likely that atherosclerosis develops against a background of obesity (Castro Cabezas et al., 2001). Reports indicate that the relationships between obesity and atherosclerotic risk factors decrease with age in healthy subjects (Wakabayashi & Masuda , 2004). However, obesity may increase the atherosclerotic risk even at higher ages in diabetic patients (Wakabayashi & Masuda , 2004). Therefore, weight reduction by means of life-style changes, supported by medical interventions or appetite suppressants is essential in order to decrease the risk of atherosclerosis (Castro Cabezas et al., 2001). Weight management significantly improves the lipid and non-lipid abnormalities of the metabolic syndrome, which is associated with reduced blood pressure (Christ et al., 2004). In children early identification of obesity remains the crucial initial step in the management of obesity later on in life (O'Brien, 2004).

Jooste et.al., in their study in 1988 indicated that the mean values of serum cholesterol, uric acid and systolic and diastolic blood pressure increased progressively from the underweight, through the normal and overweight to the obese category in both sexes, while the high-density lipoprotein/total cholesterol ratio showed an inverse trend (Jooste et al., 1988).

In middle-aged women, obesity is associated with a significant decrease in serum high-density lipoprotein cholesterol and apoA-I levels, a significant increase in apoB and apoB/A-I ratio, even if serum total cholesterol and triglycerides concentrations are unaltered. Changes of the lipid profile in obese women are indicative of a higher risk of coronary heart disease (Maksvytis & Stakisaitis, 2004). Apolipoprotein (apo) A-IV is an antiatherogenic apolipoprotein, which may be involved in the regulation of food intake. Plasma apoA-IV is

elevated in human obesity and apoA-IV polymorphisms have been associated with the extent of obesity (Lingenhel et al., 2004). It is also reported that women who were maintained on a lifestyle enhancement awareness program maintained a significant loss in body mass index, and increased their high-density lipoproteins and dietary readiness to monitor hunger and eating cues.

Such women will reduce their risks for developing chronic diseases (Walcott-McQuigg et al., 2002).

Objective

The aim of this study was to assess the effect of structured health education of a 26-week of a lifestyle enhancement awareness program on the body weight (and BMI) and the level of serum cholesterol and triglyceride.

Methods

This is a prospective longitudinal study, which was implemented in a primary health care center during 2004 on a group of 63 Bahraini male and female adults. The criteria for sample selection were: a- that they should be overweight, b- that they should be willing to reduce their body weight and c- that they have high serum lipid [since it has been reported that fasting plasma lipids may be normal in obese subjects, but they may be affected by postprandial hyperlipidemia (Wakabayashi & Masuda , 2004), a few people who had normal cholesterol were also included]. Their consent indicating their interest in participating in the study was taken. They were oriented to the study aims and methods and were informed that they would be followed up for a 26 week period while they were on a structured health education program, special low caloric diet and exercise. Only 55 patients remained to the end of the study period while all efforts to keep the other 8 failed. The 26-week period of lifestyle enhancement awareness program (LEAP) (Castro Cabezas et al., 2001) consisted of programs that contained: many health education sessions consisting of 4 education sessions on weight loss and 4 on weight loss maintenance and frequent and regular visits to the clinic to make sure that they were compliant with the given instructions.

A pre-designed educational handout containing general health information, instructions about types of foods and their nutritional values, style of eating and dieting and exercise was handed out to the sample before the study was started and their understanding for all the information was tested.

For the sake of ease of the study, two stages were defined, an initial stage at the beginning of the study and the last stage, at the end of the study. Assessments at the initial and at the last

stages of the study were made for the entire sample. These included general examination, measurement of height, body weight and BMI and laboratory investigation after eight hours fasting of cholesterol and triglyceride.

Abbreviations :

Initial stage:1. Last stage: 2. Body Weight: BW. Body Mass Index: BMI.

Cholesterol: CHOL. Triglyceride: TRIG.

The difference between variables at the initial and last stage:

- Body weight value at initial stage minus body weight at last stage: BW1-BW2
- Body Mass Index value at initial stage minus Body Mass Index at last stage: BMI1-BMI2
- Cholesterol level at initial stage minus cholesterol level at last stage: CHOL1-CHOL2
- Triglyceride level at initial stage minus triglyceride level at last stage: TRIG1-TRIG2

The statistical analysis was carried out using SPSS (Statistical product and service solutions) version 12. The analysis included the mean and its standard error for the parameters. Both paired and independent sample t-tests were used in comparisons. Also Pearson correlation and stepwise regression were used to identify the relationships between the parameters of the study.

Results

Out of the 63 males and females who were initially willing to participate in the study, only 55 (87.3%) continued till the last stage of the study. All patients were Bahraini nationals, of whom 20 were males and 35 were females. Their ages ranged between 25 and 49.

The males were found to be older than the females (mean age 43.5 vs. 36.5) and were taller (mean height 170 vs.164.5). They were also heavier at the initial stage (mean body weight 90.55 vs. 88.76). However, according to the BMI; the females were more overweight than the males (mean BMI 32.63 vs. 31.31). The mean cholesterol level in males was lower than females at the initial stage (6.16 vs. 6.31) but higher at the last stage (4.99 vs. 4.55). On the other hand, the mean TRIG level in males was higher than in females at the initial stage (1.80 vs. 1.42) and in the last stage (1.26 vs. 0.93).

The paired T test showed a significant difference between the various parameters at the initial and last stages (Table 1).

Insert Table 1 here.

Table 1 shows that in both genders there was a significant drop in all the parameters after the 26 weeks of the LEAP program, and there were no significant differences between males and females in all parameters at the initial stage. However, only BMI and CHOL showed a statistically significant difference between males and females at the last stage. It is also noticed that although in females the mean reduction in BW (the difference between mean BW1 and BW2) was less than males (3.27 vs. 7.79 kg); the mean reduction in CHOL was more than males (1.77 vs. 1.17 mmol/dl). Table 2 highlights the difference between both sexes, and

shows that the degree of decrease in all parameters was highly significant except in triglyceride.

The degrees of losses in BW, BMI, CHOL and TRIG in both sexes between the initial and last stages of the study are shown Table 2. Although the mean body weight loss in males was more than females, the amount of cholesterol loss in females was more than in the males.

Insert Table 2 here.

1-In males:

Pearson correlation showed that there is a strong correlation, at the initial stage, between BW1 and BMI1 ($r=0.79$, $p<0.000$), and CHOL1 level with both BW1 ($r=0.65$, $p<0.002$), and BMI1 ($r= 0.83$, $p<0.000$). The results also showed that the decrease in cholesterol level has a significant and strong positive relation with the decrease in weight ($r= 0.59$, $P=0.006$) and in BMI ($r=0.49$, $P=0.029$), while age has a strong negative significant relation with the decrease in weight ($r= - 0.58$, $P=0.007$) and in BMI ($r= - 0.65$, $P=0.029$) which indicate that the loss in weight in young males was higher than in older males. Also it was found that there is a relationship between the cholesterol and body weight at the initial stage of the study and the amount of body weight and body mass index lost at the end of the study. This means that males who had higher cholesterol level and were heavier at the initial stage of the study lost more cholesterol, weight and BMI after the LEAP program (Table 3).

Insert Table 3 here.

A stepwise regression analysis was carried out to find the factors that affect the change in the cholesterol level in males. Age, height, CHOL1, BW1, BMI1, TRIG1, BW1-BW2, BMI1-BMI2, TRIG1-TRIG2 were used as independent variables and CHOL1 - CHOL2 was used as the dependent variable. The variable in the final step was the height (R-square = 71%). For each 1cm. of increase in height the loss in cholesterol (CHOL1-CHOL2) will increase around 0.09 units. See Table 4.

2-In females:

In females Table 3 shows the following findings:

At the initial stage, a strong correlation was found between BW1 and BMI1 ($r=0.88$, $p<0.000$). Also a strong correlation was found between CHOL1 and loss of cholesterol ($r=0.80$, $p<0.0005$). The decrease in cholesterol level has a significant and strong negative relation with the decrease in body weight ($r= - 0.45$, $P=0.007$) and in BMI ($r= -0.52$, $P=0.001$).

A stepwise regression analysis was carried out to find the factors that affect the change in the cholesterol level in females. Age, height, CHOL1, BW1, BMI1, TRIG1, BW1-BW2, BMI1-BMI2, TRIG1-TRIG2 were used as independent variables and CHOL1 - CHOL2 was used as the dependent variable. The variables in the final step were CHOL1, height, and BW1 (R-square = 87%). For females with the same initial BW and height it was found that for each unit of increase in CHOL1 the loss in cholesterol will increase by 0.85 units. Also for females with the same initial CHOL1 and height it was found that for each unit of increase in BW the loss in cholesterol will decrease by 0.02 unit, and finally for females with the same initial CHOL1 and

BW it was found that for each unit of increase in height the loss in cholesterol will increase by 0.09 unit. See Table 4

Insert Table 4 here.

Discussion

The obesity epidemic is a worldwide problem and its complications have great consequences on the health of the population and the economy of countries. Its prevalence is very high, reaching up to 20% in Australia and 25% in some states in the United States. In the United Kingdom 22% of men and 24% of women are obese. The direct cost of obesity to the national health services in UK is £0.5 billion, while the indirect cost is £2 billion (Ioana, 2003, Lamon-Fava et al., 1996). It is well known that the mean total cholesterol and triglyceride concentrations are higher in obese persons in comparison to normal weight subjects and HDL cholesterol concentration is lower in obese subjects as compared to normal and overweight individuals (Szczygielska et al., 2003).

Obesity in women has been shown to be associated with indices predisposing to coronary heart disease. However this type of obesity has not been associated with significant differences in either serum cholesterol or triglyceride concentrations (Al-Mannai & Khalfan, 2001). Increase in the BMI is reported to be strongly associated with elevation in triglyceride level and diabetes in women. It is also associated with an adverse effect on all major coronary heart disease risk factors (Lamon-Fava et al., 1996).

In our study we found that the women were more obese than men (BMI 32.63 vs. 31.31), a finding that has been reported elsewhere (Hu et al., 2000). Although all women included in our study were obese and their cholesterol was high and hence, they could be labeled as hyperlipidemic, it has been reported that even if serum total cholesterol and triglyceride

concentration in middle aged obese women are unaltered, the chances that they have decreased high density lipoprotein cholesterol and increase in apo B and apo B/A- ratio are very high (Maksvytis & Stakisaitis, 2004). Therefore, medical professionals should be aware of this fact when they are dealing with obese females.

In women, we found a significant negative relationship between the amount of cholesterol lost and the patients' age. That means older women lost less cholesterol than the younger. This finding is consistent with Denke et al., who reported that excess body weight in older women was associated with smaller differences in total cholesterol level (Denke et al., 2002).

Our study found that patients' height is positively associated with the amount of cholesterol lost after the 26 weeks of LEAP, but there was no relationship between height and the level of cholesterol. However, other studies suggested that in pubertal children, total cholesterol level was negatively associated with height (Kouda et al., 2003). This finding may indicate that there are differences in the relationship between the cholesterol level and the height of adult and child populations.

In males, the age of the patient was found to be negatively associated with the decrease in body weight and BMI. This finding has been supported by other reports which indicated that advancing age may blunt the BMI-associated differences in total and LDL cholesterol levels (Denke et al., 1993).

Any intervention program that consists of dieting and exercise could effectively improve the dietary pattern, control body weight, and decrease the level of serum cholesterol (Zhang et al., 2002). The outcome of our study indicated that after a 26 weeks of a life style enhancement

program and health education, the sample population managed to reduce their body weight, body mass index and their lipid profile. These findings are consistent with other studies. Walcott-McQuigg et. al., reported that women completing the weight loss phase of a special program managed to reduce their body weights, body mass index, percentage body fat and waist/hip ratio, increased their high-density lipoproteins and reduced their risks for developing chronic diseases (Walcott-McQuigg et al., 2002).

Conclusion

Excess body weight is to be considered a major public health issue because obesity and overweight are accompanied by unfavorable blood lipid patterns that lead to increased risk factors of getting coronary heart disease. There is a strong association between reducing body weight and hence the BMI with the decrease in a patient's lipid profile. Therefore, there is a need for increased public awareness about obesity in the primary care setting, early identification and prevention, which will help in reducing the proportion of people with high lipid level that consequently increases the risk of acquiring cardiovascular diseases. Therefore patient education is the cornerstone for any disease prevention.

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Table 1: Mean and its standard of parameters at both the initial and last stages for males and females.

		Male	Female	Total	
	Stages	**Mean ± S.E**	**Mean ± S.E**	**Mean ± S.E**	**P-value[b]**
Body weight*	Initial	90.55 ± 1.74	88.64 ± 2.63	89.34 ± 1.78	0.547
	Last	82.76 ± 1.29	85.37 ± 2.74	84.42 ± 1.80	0.393
	P-value	**< 0.0005[a]**	**< 0.0005[a]**	**< 0.0005[a]**	
Body mass index	Initial	31.31 ± 0.48	32.60 ± 0.71	32.13 ± 0.49	0.137
	Last	28.63 ± 0.37	31.35 ± 0.73	30.36 ± 0.51	**0.002**
	P-value	**< 0.0005[a]**	**< 0.0005[a]**	**< 0.0005[a]**	
Cholesterol**	Initial	6.15 ± 0.07	6.31 ± 0.14	6.26 ± 0.10	0.329
	Last	4.99 ± 0.11	4.55 ± 0.10	4.71 ± 0.08	**0.007**
	P-value	**< 0.0005[a]**	**< 0.0005[a]**	**< 0.0005[a]**	
Triglyceride**	Initial	1.80 ± 0.21	1.43 ± 0.09	1.57 ± 0.10	0.121
	Last	1.26 ± 0.19	0.93 ± 0.06	1.05 ± 0.08	0.104
	P-value	**< 0.0005[a]**	**< 0.0005[a]**	**< 0.0005[a]**	

N=55

a: P-values computed using paired samples t-test

b: P-values computed using independent samples t-test

*Body Weights are in Kilograms

**Cholesterol and Triglyceride are in mmol/dl

Table 2: Mean age, height and changes in the parameters for males and females.

	Male	**Female**	**Total**	
	Mean ± S.E	**Mean ± S.E**	**Mean ± S.E**	**P-value[a]**
Age	43.5 ± 1.27	36.5 ± 1.14	39.5 ± 0.97	< **0.0005**
Height	170 ± 1.00	164.5 ± 1.10	166.5 ± 0.86	**0.002**
BW1 – BW2	7.80 ± 0.52	3.52 ± 0.19	5.07 ± 0.36	< **0.0005**
MW1 – MW2	2.68 ± 0.16	1.32 ± 0.08	1.82 ± 0.12	< **0.0005**
Chol1 – Chol2	1.17 ± 0.11	1.77 ± 0.16	1.55 ± 0.12	**0.003**
Trig1 – Trig2	0.54 ± 0.10	0.51 ± 0.07	0.52 ± 0.06	**0.779**

N=55
a: P-values computed using independent samples t-test
Age in years
Height is in centimeters
Body Weights are in Kilograms
Cholesterol and Triglyceride are in mmol/dl

Table 3: Pearson Correlation between age, height and other parameters at the initial stage and the differences between the initial and last stages.

	Sex	Age	Height	BW1	BMI1	CHOL1	TRIG1	BW1-BW2	BMI1-BMI2	CHOL1-CHOL2
Height	Male	-.014								
	Female	-.447**								
BW1	Male	-.251	.636**							
	Female	-.291	.719**							
BMI1	Male	-.301	.026	.788**						
	Female	-.098	.309	.882**						
CHOL1	Male	-.390	.018	.651**	.829**					
	Female	.090	.022	-.053	-.068					
TRIG1	Male	.435	-.200	-.271	-.184	-.112				
	Female	.473**	-.236	-.027	.124	-.092				
BW1-BW2	Male	-.583**	.619**	.898**	.665**	.637**	-.389			
	Female	.031	-.487**	-.188	.047	-.133	.075			
BMI1-BMI2	Male	-.650**	.480*	.871**	.740**	.709**	-.395	.986**		
	Female	.114	-.646**	-.309	-.008	-.152	.120	.980**		
CHOL1-CHOL2	Male	-.206	.844**	.563**	.054	.249	-.278	.592**	.487*	
	Female	-.052	.467**	.165	-.069	.800**	-.165	-.449**	-.517**	
TRIG1-TRIG2	Male	-.010	-.355	-.726**	-.659**	-.431	.463*	-.588**	-.582**	-.248
	Female	.323	-.112	-.028	.035	-.089	.751**	.074	.091	-.087

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 4: A stepwise regression analysis for factors that affect the change in the cholesterol level (CHOL1 – CHOL2)

		Unstandardized Coefficients	Standardized Coefficients	t	P-value	R Square	Adjusted R Square
Males	(Constant)	-14.252		-6.161	.000		
	Height	.091	.844	6.669	.000	.712	.696
Females	(Constant)	-17.192		-8.968	.000		
	CHOL1	.852	.773	11.897	.000	.640[a]	.629
	Height	.090	.625	6.685	.000	.842[b]	.832
	BW1	-.015	-.243	-2.601	.014	.870[c]	.858

a Predictors: (Constant), CHOL1
b Predictors: (Constant), CHOL1, Height
c Predictors: (Constant), CHOL1, Height, BW1
Height is in centimeters
Body Weights are in Kilograms
Cholesterol and Triglyceride are in mmol/dl