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**EFFECT OF NONPHARMACOLOGICAL INTERVENTIONS ON DIETARY PRACTICES, ENERGY EXPENDITURE AND BIOCHEMICAL PARAMETERS OF HYPERCHOLESTEROLEMIC TYPE 2 DIABETIC SUBJECTS**

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**Abstract**

Nonpharmacological interventions play an important role in the management of diabetes and its complications. This study analyzed the effect of nonpharmacological interventions on dietary practices, energy expenditure and management outcome in terms of glycemic and lipidemic status of type 2 diabetic subjects with hypercholesterolemia. These interventions included dietary advice, leaflets, televised lectures, booklets, posters and a bimonthly publication in Bangla. Eighty newly diagnosed type 2 diabetic subjects (male: female ratio 47:33, age  $46 \pm 8$  years) with hypercholesterolemia (fasting serum total cholesterol  $> 200$  mg/dl) were selected from BIRDEM by purposive sampling. The first interview was taken before any intervention while the second interview was taken after a minimum interval of 8 weeks. The daily intake of macro- and micro- nutrients was assessed by 24-hr recall method. Energy expenditure of the subjects was calculated by factorial method using physical activity level (WHO/FAO/UNU 1985). After intervention, the proportion of carbohydrate, protein and fat intake of the study subjects did not differ significantly compared to values before intervention. The daily intake of micronutrients also did not differ compared to those before intervention. No significant difference was found between pre and post intervention values of per day energy intake (kcal,  $1621 \pm 426$  vs  $1645 \pm 623$ ). Total energy expenditure after intervention was significantly higher ( $1649 \pm 340$ ) compared to before intervention ( $1519 \pm 353$ ,  $p < 0.002$ ). After intervention, fasting serum glucose level ( $7 \pm 1.43$  mmol/l), serum glucose 2 hrs after breakfast ( $11 \pm 4.1$  mmol/l) and total cholesterol ( $217 \pm 35$  mg/dl) were significantly reduced compared to before intervention values ( $9 \pm 4$ ,  $16 \pm 7$ ,  $231 \pm 32$  respectively;  $p = 0.001$  for FSG,  $p = 0.001$  for SGABF,  $p < 0.001$  for total cholesterol). Nonpharmacological intervention was found to be effective in improving the management of diabetes and its complications.

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**Introduction**

The prevalence of diabetes and its complications are increasing worldwide at an alarming rate. According to the WHO estimates, approximately 171 million people of the world are suffering from diabetes and this number is supposed to more than double by the year 2030.<sup>1</sup> Dyslipidemia is also a common problem

in type 2 diabetic population. Dyslipidemia is defined as total cholesterol  $> 200$ mg/dl, triglyceride  $> 150$  mg/dl, LDL-C  $> 100$  mg/dl, HDL-C  $> 50$  mg/dl.<sup>2</sup> Dietary restrictions, exercise and life style modifications are the initial nonpharmacological measures to control dyslipidemia. Balanced diet and

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physical activity assists in controlling blood glucose and lipids.

The present study was conducted to determine the effect of nonpharmacological interventions on dietary practice, energy expenditure and management outcome in terms of glycemic and lipidemic status of type 2 diabetic subjects with hypercholesterolemia.

### Materials and Methods

By purposive samplly, eighty newly diagnosed type 2 diabetic subjects (male: female ratio 47:33, age  $46 \pm 8$  years) with hypercholesterolemia (fasting serum total cholesterol  $> 200$  mg/dl) were recruited from the Out-Patient Departments of BIRDEM.

The first interview was conducted before the intervention. Second interview was taken after a minimum interval of 8 weeks. The daily intake of macro and micronutrients was assessed by 24-hour recall method. Energy expenditure of the subjects was calculated by factorial method (WHO/FAO/UNU 1985). Data analysis was done by using SPSS PC version 10.0.

### Results

A total of 80 newly diagnosed type 2 diabetic subjects with hypercholesterolemia were included in this study. The characteristics of the study subjects are shown in Table 1. Age (mean  $\pm$  SD) of the study subjects was  $46 \pm 8.38$  years and among them 47 were males and 33 were females. Most of the subjects (80%) came from the urban area. Only 28% subjects were graduates and 47% subjects did manual work. Weight, Body Mass Index (BMI), waist, hip, SBP and DBP of the study subjects were (mean  $\pm$  SD)  $61.54 \pm 8.33$ ,  $24.47 \pm 2.9$ ,  $47 \pm 22$ ,  $49 \pm 22$ ,  $127.56 \pm 17.9$  and  $81.06 \pm 7.23$  respectively. According to BMI classification 35% were overweight.

Proportion of macro and micro intake of the study subjects did not differ significantly after getting intervention (Table 2). The daily energy intake and energy expenditure of the subjects is shown in Table 3. Energy expenditure significantly increased ( $p < 0.002$ ) after getting intervention. After intervention, mean values of fasting serum glucose ( $7 \pm 1.43$ mmol/l), serum glucose 2hrs after breakfast ( $11 \pm 4.1$ mmol/l) and total cholesterol ( $217 \pm 35$ mg/dl) were significantly

reduced compared to before intervention values FSG  $9 \pm 4$  mmol/l, SGABF  $16 \pm 7$  mmol/l, TC  $231 \pm 32$  mg/dl respectively;  $p < 0.001$ ) (Table 4).

### Discussion

This study was designed to evaluate the effectiveness of nonpharmacological measures of newly diagnosed type 2 diabetic subjects with hypercholesterolemia. Diabetes and its complications can be prevented by lifestyle modifications like changes of dietary pattern, physical activity. Lifestyle modification is beneficial for preventing diabetes and CVD but is very difficult to sustain. In a Polish study, it was found that pharmacological as well as nonpharmacological interventions helped in normalization of glucose in patients with DM.<sup>3</sup> In another study in Finland, after getting nonpharmacological intervention the overall incidence of diabetes was reduced by 58%.<sup>4</sup> In this

**Table-1:** Characteristics of the study subjects (n=80)

Variables	
Age (years)	$46 \pm 8.38$
Sex	
Male	47 (59%)
Female	33 (41%)
Area	
Urban	64 (80%)
Rural	12 (15%)
Semi urban	4 (5%)
Level of Education	
Illiterate-primary	31 (39%)
SSC-HSC	27 (34%)
Graduate & above	22 (28%)
Occupation	
Manual worker	38 (47%)
Labor	4 (5%)
Others	38 (48%)
Weight (Kg)	$61.54 \pm 8.33$
BMI (Kg/m <sup>2</sup> )	$24.47 \pm 2.9$
Under-nutrition (< 18.5)	1 (1%)
Normal weight (18.5-25)	47 (59%)
Over-weight (25-30)	28 (35%)
Obese (> 30)	4 (5%)
Waist (cm)	$47 \pm 22$
Hip (cm)	$49 \pm 22$
SBP (mm Hg)	$127.56 \pm 17.9$
DBP (mm Hg)	$81.06 \pm 7.23$

Results are expressed as Number(%), mean $\pm$ SD. SBP= Systolic blood pressure, DBP=Diastolic blood pressure

**Table-2:** Dietary intake of the study subjects after receiving intervention (n=80)

Nutrients	Total Intake	
	Before	After
Carbohydrate (g/d)	239 ± 65	243 ± 90
Protein (g/d)	64 ± 20	71 ± 46
Fat (g/d)	45 ± 13	47 ± 17
Ca (mg/d)	363 ± 166	280 ± 111
Iron (mg/d)	25 ± 9	24 ± 7
Vitamin B1 (mg/d)	1.2 ± 0.45	1.17 ± 0.42
Vitamin B2 (mg/d)	0.87 ± 0.36	0.76 (0.32-2.46)
Vitamin C (mg/d)	40 ± 18	35 (7.5-179)
Retinol (µg/d)	545 ± 243	597 (212-7880)

Results are expressed as mean ± SD and median (Range).

**Table-3:** Energy intake and energy expenditure of the study subjects after receiving intervention (n=80)

Variables	Before	After	t/p
Energy intake (Kcal/ day)	1621±426	1645±623	0.28/0.77
Energy expenditure	1519±353	1649±340	3.25/0.002*

Results are expressed as mean ± SD. Paired t- test was performed as the test of significance,  $p < 0.05$  was taken as level of significance.

**Table-4:** Glycemic status and lipid profile of the study subjects after receiving intervention (n=80)

Variables	Before	After	t/p
FSG (mmol/ dl)	9±3.89	7±1.43	4.2/0.001*
SGABF (mmol/ dl)	16±6.46	11±4.08	6.4/0.001*
Total Cholesterol (mg/dl)	231±31.89	217±35.10	7.5/0.001*

Results expressed as mean ± SD, FSG=Fasting Serum Glucose, SGABF= Serum Glucose After Break fast, TC= Total Cholesterol. Paired t- test was performed as the test of significance,  $p < 0.05$  was taken as level of significance.

study, dietary intake of macro and micro nutrients of the study subjects did not significantly differ before and after intervention. After receiving nonpharmacological intervention, energy expenditure of the study subjects significantly increased ( $p < 0.002$ ). Majority (60%) of the participants performed exercise according to the instruction of the physician. It was

seen that changes in dietary practice was relatively more difficult to change compared to initiation of physical exercise. Nonpharmacological interventions that emphasize lifestyle changes, including education, regular physical activity and behavior modification are important components in maintenance of the desired weight. After getting intervention, glycemic and total cholesterol level of the study subjects were significantly reduced ( $p < 0.001$ ). In Sweden<sup>5</sup> and China<sup>6</sup> studies also provided that changes in lifestyle were effective in preventing diabetes and its complications. Results of this study suggest that nonpharmacological interventions are effective in the metabolic control of hypercholesterolemic diabetic subjects. It may also suggest that more focused motivation is needed to improve the dietary practices of this population to prevent diabetes related complications.

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