Hypercholesterolemia screening

Does knowledge of blood cholesterol level affect dietary fat intake?

Michèle Aubin, MD, MSC, CCFP Gaston Godin, PHD Lucie Vézina, MA
Jean Maziade, MD, MSC, CCFP Raymond Desharnais, PHD

ABSTRACT

OBJECTIVE To assess whether knowing blood cholesterol test results influences people's intention to lower their dietary fat intake and to assess changes in diet after 3 months.

DESIGN Randomized clinical study.

SETTING Two hospital-based family medicine centres.

PARTICIPANTS A total of 526 patients aged 18 to 65, without prior knowledge of their blood cholesterol levels, were recruited. Seventy did not appear for their appointments, and 37 did not meet study criteria, leaving 419 participants. From that group, 391 completed the study.

INTERVENTIONS Patients submitted to cholesterol screening were randomly assigned to one of two groups, completing the study questionnaires either before (control group) or after (experimental group) being informed of their screening test results. All participants were called 3 months after transmission of test results to assess their dietary fat intake at that time.

MAIN OUTCOME MEASURES Differences in intention to adopt a low-fat diet reported between the experimental and control groups and differences in dietary fat intake modification after 3 months between patients with normal and abnormal blood cholesterol test results.

RESULTS Knowledge of test results influenced patients' intentions to adopt low-fat diets ($F_{1,417}$=5.4, P=.02). Patients reported lower mean dietary fat intake after 3 months than at baseline (P<.0001). The reduction was greater in patients with abnormal screening results ($F_{2,388}$=3.6, P=.03).

CONCLUSIONS Being informed of personal blood cholesterol levels effects an immediate change in eating habits that translates into reduced dietary fat intake.

RÉSUMÉ

OBJECTIF Cette étude vise à vérifier l'effet de connaître sa cholestérolémie sur l'intention d'adopter une alimentation faible en gras et en cholestérol et l'influence du niveau de cholestérolémie sur la variation de consommation de gras rapportée après 3 mois.

CONCEPTION Étude clinique hasardisée.

CONTEXTE Deux unités de médecine familiale situées dans des centres hospitaliers de soins de courte durée.

POPULATION À L'ÉTUDE Un total de 526 patients âgés de 18 à 65 ans, ne connaissant pas leur cholestérolémie, ont été recrutés. Soixante-dix ne se sont pas présentés à leur rendez-vous, et 37 ne recontraient pas les critères d'inclusion, ce qui laisse 419 participants. De ce nombre, 391 ont complété l'étude.

MÉTHODOLOGIE Les participants ont eu un bilan lipidique complet. Ils ont été assignés au hasard à un des deux groupes, selon qu'ils complétaient les questionnaires avant (groupe témoin) ou après (groupe expérimental) avoir été informés par leur médecin du résultat de leur cholestérolémie. Tous les patients ont été rejoints par téléphone trois mois après avoir été avisés de leur cholestérolémie, afin d'évaluer leur consommation de gras à ce moment.

PRINCIPALES MESURES L'intention d'adopter une diète faible en gras dans le groupe expérimental et le groupe témoin, et la variation de consommation de gras après 3 mois des patients ayant une cholestérolémie anormale comparativement à celle rapportée par ceux ayant un résultat normal.

RÉSULTATS La connaissance de la cholestérolémie influence de façon significative l'intention d'adopter une diète faible en gras ($F_{1,417}$ = 5,4, P = 0,02). Les patients rapportent une consommation de gras significativement inférieure après 3 mois, comparativement à la consommation indiquée au début de l'étude (P<0,0001). Cette réduction était plus marquée chez les patients ayant une cholestérolémie anormale ($F_{2,388}$ =3,6, P=0,03).

CONCLUSION Le fait de connaître sa cholestérolémie a un effet à court terme sur les habitudes alimentaires se traduisant par une réduction de la consommation de gras.

This article has been peer reviewed.
Cet article a fait l'objet d'une évaluation externe.
Can Fam Physician 1998;44:1289-1297.

← FOR PRESCRIBING INFORMATION SEE PAGE 1350

High blood cholesterol levels are considered an important risk factor for cardiovascular diseases (CVD). They are known to contribute to atherosclerosis and subsequently to coronary heart disease.[1-3]

Several surveys report a high prevalence of hypercholesterolemia in North American populations, for both men and women.[4-8] Such data can explain the general concern over this risk factor, especially since clinical trials have shown that a reduction in blood cholesterol level can reduce CVD risk.[9-18]

Several Canadian, American, and European professional organizations have produced guidelines to assist physicians treating patients with high blood cholesterol levels.[19-21] There is general agreement that dietary fat intake should be reduced as the first step of treatment. Total cholesterol level can be reduced by an estimated 10% to 20% with a rigorous dietary approach. Various strategies have been suggested to assist hypercholesterolemic patients to adopt low-fat diets.[22-26]

These interventions were effective in the short-term, but compliance with dietary treatment was unreliable in the long run.[24,25] To effect behavioural change requires judicious choice of strategy and appropriate educational messages.[27] These choices and messages should be based on factors that can influence patients' decisions to adopt low-fat diets. When giving nutritional advice or referring patients to dietitians, physicians should also assess patients' intentions to modify their diets. Few studies have focused on why patients change to low-fat diets, but some researchers interested in lifestyle change have examined characteristics that might positively influence intention toward healthy behaviour. For example, studies on active living have shown that knowledge of personal physical fitness had a positive effect on intention to exercise.[28,29]

Whether cholesterol screening and knowledge of blood cholesterol levels can motivate people to reduce dietary fat intake is still unclear. Some studies have shown that patients with high blood cholesterol levels are more likely to modify their eating habits than those with borderline cholesterol levels.[30-33] On the other hand, Robertson et al[34] have not found any significant relationship between knowledge of test results and blood cholesterol reduction. The present study was designed to assess, among patients recruited in two family practice settings, the effect of knowing blood cholesterol test results on intention to adopt a low-fat diet. It looked also at the influence of cholesterol levels on dietary fat intake modification after 3 months.

Dr Aubin, *a Fellow of the College, is an Assistant Professor in the Department of Family Medicine,* **Dr Godin** *is a Professor in the School of Nursing Sciences, and* **Dr Desharnais** *is a Professor in the Department of Social and Preventive Medicine, Kinesiology Division, at Laval University in Quebec.* **Ms Vézina** *is a Research Assistant at the Family Medicine Center in Laval Hospital in Ste-Foy, Que.* **Dr Maziade** *is a Clinical Professor at the Family Medicine Center in a community health centre in Haute-Ville in Quebec city.*

METHODS

This experimental study was conducted at two hospital-based family medicine centres (FMCs) in the Quebec city area. Study procedures were approved by the Hospital Ethics Research Committee. A total of 29 family physicians (14 in FMC 1 and 15 in FMC 2) and 37 family medicine residents (20 in FMC 1 and 17 in FMC 2) were asked to invite all their patients aged 18 to 65 who did not know their blood cholesterol levels to participate in the study. Exclusion criteria included health conditions (pregnancy, uncontrolled thyroid disorders, myocardial infarction, major surgeries in the past 3 months, nephrotic syndrome, severe hepatic diseases, porphyria, acute pancreatitis, cancers, uncontrolled diabetes, morbid obesity [BMI >35]) or use of medication (diuretics, β-blockers [except those with intrinsic sympathetic activity], systemic steroids, lipid-lowering agents) that could disturb blood cholesterol levels.

Eligible patients who agreed to participate signed an informed consent form. First they submitted to cholesterol screening, including levels of total plasma cholesterol, triglycerides, high-density lipoprotein (HDL) cholesterol, and low-density lipoprotein (LDL) cholesterol. Screening tests were performed after a fasting period of 12 hours and alcohol withdrawal of at least 48 hours.

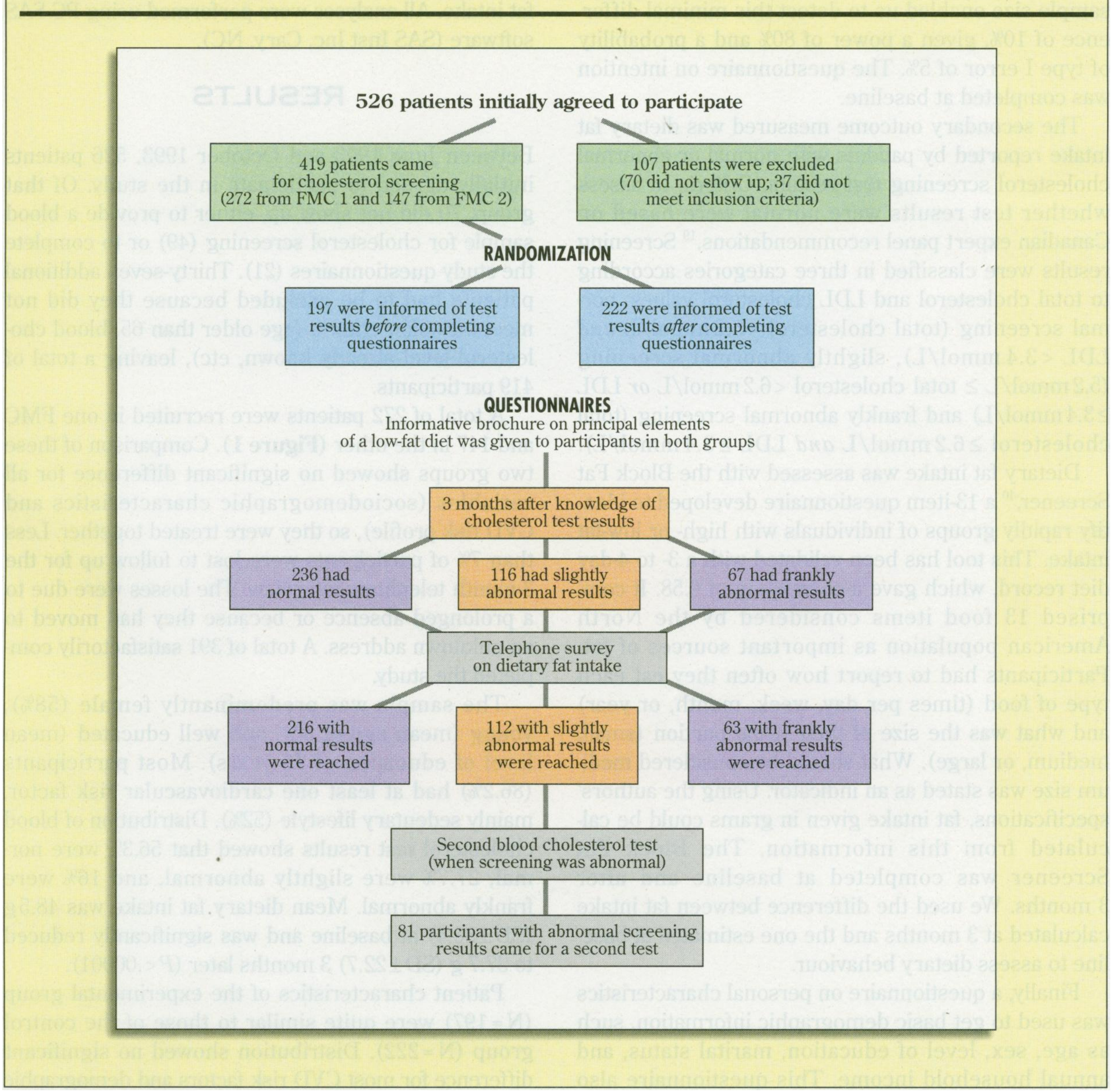
Once participants had provided blood samples, they were randomly assigned to one of the two study groups, completing the questionnaires either before (control group) or after (experimental group) being informed of their screening test results. Questions assessed personal characteristics, cardiovascular risk profile, intention to adopt a low-fat diet, and dietary fat intake.

Participants from both groups were informed by their family physicians of their test results, even when results were normal. A training session on current Canadian recommendations on hypercholesterolemia diagnosis and dietary management[19] was conducted with physicians just before the study to standardize information given to patients.

After participants had completed the baseline questionnaires, they all received a brochure validated by two dietitians summarizing the main components of a low-fat diet, in an attempt to further standardize information given to patients. Participants from both groups were called 3 months after their screening test results were transmitted to assess their dietary fat intake at that time. Comparison of their actual diets with those registered at baseline served to assess changes in eating habits during that 3-month period. Finally, patients with abnormal screening test results were invited to come back for a second blood test.

The primary outcome measured was the intention to adopt a low-fat diet. Intention was measured with two questions developed following Ajzen's method.[35-39] A short description of what is considered a low-fat diet was developed with the assistance of two dietitians and written on top of the questionnaire, in order to standardize the definition of low-fat diet.

Figure 1. Study design and number of participants at each stage



Participants were asked to indicate the likelihood (in percentage) that they would eat low-fat foods regularly in the next 3 months. Answers were measured on a 10-point scale, ranging from 0 to 10% to 91% to 100%. Participants also had to indicate on a 7-point scale, ranging from very unlikely to very likely, their intention of always eating low-fat foods in the next 3 months. Intention was then estimated, using the mean score of those two questions, which are well correlated, with an R^2 of .69. This way of measuring intention is standard procedure in Ajzen's method.[35-39] Considering that intention is the consequence of many factors, a 10% difference between the groups is considered important. Our sample size enabled us to detect this minimal difference of 10%, given a power of 80% and a probability of type I error of 5%. The questionnaire on intention was completed at baseline.

The secondary outcome measured was dietary fat intake reported by patients with normal or abnormal cholesterol screening test results. Criteria to assess whether test results were normal were based on Canadian expert panel recommendations.[19] Screening results were classified in three categories according to total cholesterol and LDL cholesterol values: normal screening (total cholesterol <5.2 mmol/L *and* LDL <3.4 mmol/L), slightly abnormal screening (5.2 mmol/L ≥ total cholesterol <6.2 mmol/L *or* LDL ≥3.4 mmol/L) and frankly abnormal screening (total cholesterol ≥6.2 mmol/L *and* LDL ≥3.4 mmol/L).

Dietary fat intake was assessed with the Block Fat Screener,[40] a 13-item questionnaire developed to identify rapidly groups of individuals with high- or low-fat intake. This tool has been validated with a 3- to 4-day diet record, which gave a correlation of 0.58. It comprised 13 food items considered by the North American population as important sources of fat. Participants had to report how often they eat each type of food (times per day, week, month, or year) and what was the size of their usual portion (small, medium, or large). What should be considered medium size was stated as an indicator. Using the authors' specifications, fat intake given in grams could be calculated from this information. The Block Fat Screener was completed at baseline and after 3 months. We used the difference between fat intake calculated at 3 months and the one estimated at baseline to assess dietary behaviour.

Finally, a questionnaire on personal characteristics was used to get basic demographic information, such as age, sex, level of education, marital status, and annual household income. This questionnaire also compiled information on personal cardiovascular risk (smoking, sedentary lifestyle, high blood pressure, diabetes, obesity [BMI ≥ 27], family history of CVD) and on family history of hypercholesterolemia.

The χ^2 statistic and Student's t test were used to compare samples recruited from the two FMCs as well as the two study groups (aware or not of their test results when they completed the questionnaires). Pearson correlation analysis was used to assess whether the two items used to determine intention were well correlated. Analyses of variance (ANOVA) were used to assess both the effect of knowing their test results on the intention to adopt a low-fat diet and the influence of blood cholesterol results on dietary fat intake. All analyses were performed using PC SAS software (SAS Inst Inc, Cary, NC).

RESULTS

Between June 1993 and October 1993, 526 patients initially agreed to participate in the study. Of that group, 70 did not show up, either to provide a blood sample for cholesterol screening (49) or to complete the study questionnaires (21). Thirty-seven additional patients had to be excluded because they did not meet inclusion criteria (age older than 65, blood cholesterol level already known, etc), leaving a total of 419 participants.

A total of 272 patients were recruited in one FMC and 147 in the other (**Figure 1**). Comparison of these two groups showed no significant difference for all variables (sociodemographic characteristics and CVD risk profile), so they were treated together. Less than 7% of participants were lost to follow up for the 3-month telephone interview. The losses were due to a prolonged absence or because they had moved to an unknown address. A total of 391 satisfactorily completed the study.

The sample was predominantly female (58%), young (mean age of 35), and well educated (mean level of education of 15 years). Most participants (86.2%) had at least one cardiovascular risk factor, mainly sedentary lifestyle (52%). Distribution of blood cholesterol test results showed that 56.3% were normal, 27.7% were slightly abnormal, and 16% were frankly abnormal. Mean dietary fat intake was 48.5 g (SD±38.4) at baseline and was significantly reduced to 37.7 g (SD±22.7) 3 months later ($P<.00001$).

Patient characteristics of the experimental group (N=197) were quite similar to those of the control group (N=222). Distribution showed no significant difference for most CVD risk factors and demographic variables, except for smoking, people living in the household, and level of education (**Tables 1 and 2**). Mean levels of total cholesterol and LDL cholesterol were identical in both groups. Similarly, the two study groups showed comparable distribution of normal, slightly abnormal, or frankly abnormal screening test results. Finally, both groups were also comparable in their baseline mean dietary fat intake.

Analyses of variance (ANOVA) indicated that knowledge of test results influences dietary choices. Patients aware of their results when they completed the questionnaires had a significantly higher mean score for intention than those unaware of their results (4.1 vs 3.7, $F_{1,417}=5.4$, $P=.02$). Blood cholesterol levels could influence intention to adopt a low-fat diet because, in the group aware of their test results, intention generally rose with blood cholesterol level but was stable whether blood cholesterol level was normal or not in the group unaware of their results. However, this trend did not reach significance ($F_{5,413}=2.0$, $P=.08$) (**Table 3**).

After 3 months, patients with abnormal cholesterol levels reported a significantly greater mean reduction in dietary fat intake than those with normal results ($F_{2,388}=3.6$, $P=.03$) (**Table 4**). A subgroup of 81 patients with abnormal cholesterol levels at baseline who came back for a second test 3 months later reported a significant decrease in total blood cholesterol (from 6.31 to 5.98 mmol/L, $P<.001$) and LDL-cholesterol (from 4.04 to 3.62 mmol/L, $P<.01$) levels. Pearson's correlation between their reduced dietary fat intake and their decrease in blood cholesterol level was significant ($R^2=.5$, $P<.001$). Among the 81 patients initially screened as abnormal, 14 had a second test in which results were strictly normal. These patients also reported a significant reduction in their mean dietary fat intake, from 52.9 g at baseline to 36.0 g 3 months later ($P=.02$).

DISCUSSION

This study showed that knowledge of personal blood cholesterol level has an immediate positive impact on intention to adopt a low-fat diet. Thus, even before any counseling on healthy diet, giving patients their blood cholesterol results can motivate them in the short term to adopt low-fat diets.

Table 1. Characteristics of patients at baseline

PATIENT CHARACTERISTICS	GROUP AWARE OF TEST RESULTS (N = 197) %	GROUP UNAWARE OF TEST RESULTS (N = 222) %	*P* VALUE
Sex			NS
• Female	60.9	55.4	
• Male	39.1	44.6	
Marital status			NS
• Single	38.1	34.7	
• Couple (married or not)	51.3	50.0	
• Divorced or separated	8.6	13.5	
• Widowed	2.0	1.8	
Annual household income			NS
• Student income	6.1	7.2	
• Less than $10 000	10.7	14.4	
• $10 000-$29 999	21.8	25.2	
• $30 000 or more	61.4	53.2	
Living in household			<.05
• Alone	11.2	19.8	
• With spouse	38.6	30.2	
• With spouse and children	50.2	50.0	
Family history of dyslipidemia			NS
• Yes	47.7	39.6	
• No	52.3	60.4	
Mean age ± SD	35.9 ± 12.1	34.8 ± 11.0	NS
Mean level of education ± SD	15.7 ± 3.4	14.8 ± 3.3	<.01

Table 2. Cardiovascular risk factors, screening test results, and dietary fat intake at baseline

PATIENT CHARACTERISTICS	GROUP AWARE OF TEST RESULTS (N = 197) %	GROUP UNAWARE OF TEST RESULTS (N = 222) %	P VALUE
Smoking			<.01
• Yes	26.9	40.1	
• No	73.1	59.9	
High blood pressure			NS
• Yes	3.1	4.1	
• No	96.9	95.9	
Family history of CVD			NS
• Yes	42.6	46.8	
• No	57.4	53.2	
Sedentary lifestyle			NS
• Yes	48.7	54.9	
• No	51.3	45.1	
Obesity (BMI ≥ 27)			NS
• Yes	26.4	32.9	
• No	73.6	67.1	
Screening test results*			NS
• Normal	58.9	54.0	
• Slightly abnormal	26.9	28.4	
• Frankly abnormal	14.2	17.6	
Mean total cholesterol ± SD (mmol/L)	5.1 ± 1.2	5.1 ± 1.1	NS
Mean LDL cholesterol ± SD (mmol/L)	3.0 ± 1.1	3.1 ± 1.1	NS
Mean dietary fat intake at baseline ± SD (g)	49.6 ± 49.1	47.5 ± 25.3	NS

**Test results were based on Canadian reference values:*
- *Normal—total cholesterol < 5.2 mmol/L and LDL < 3.4 mmol/L*
- *Slightly abnormal—5.2 mmol/L ≥ total cholesterol < 6.2 mmol/L or LDL ≥ 3.4 mmol/L*
- *Frankly abnormal—total cholesterol ≥ 6.2 mmol/L and LDL ≥ 3.4 mmol/L*

Results showed also that patients who had higher blood cholesterol levels were more likely to plan dietary changes. Although this suggests blood cholesterol levels have some influence on intention to adopt a low-fat diet, this trend did not reach .05 significance. Small proportions of patients with abnormal screening results in each study group could account for these results. The hypothesis that blood cholesterol levels affect intention to adopt a low-fat diet is, however, supported by the observation that blood cholesterol levels significantly influenced eating habits; patients with the highest blood cholesterol levels reported the greatest reduction in dietary fat intake.

Our results are supported by other studies showing that patients with high blood cholesterol levels are more likely to modify their eating habits than those with borderline cholesterol levels.[30-32] Rastam et al[33] reported, in a group of 424 adults with two successive abnormal blood cholesterol test results, that 66% had greatly modified their diets. Other studies have noted a decrease in blood cholesterol levels after specific preventive interventions. Allen et al[41] found a mean reduction in total cholesterol level of 8.5% after only one dietary counseling visit. Similarly, Hahn[42] recorded, in a group of family practice patients with high cholesterol levels at screening, a 9.2% decrease in follow-up cholesterol values 1 year later.

Current results differ from those of Robertson et al,[34] who did not find any significant relationship between knowledge of test results and blood cholesterol reduction. Nevertheless, their conclusions are based only on total cholesterol measures, which give incomplete information. In addition, they did not assess patients' eating habits nor fat intake. Finally, in their study, they gave dietary counseling only to patients aware of their test results and whose cholesterol values were higher than 6.5 mmol/L. In contrast, our study focused primarily on how knowledge of cholesterol test results affected eating behaviour, rather than on blood cholesterol lowering, because changing diet appears a preliminary and necessary step to reduction of blood cholesterol levels.

The possibility that a *social desirability* bias might be the cause for the reduced fat intake reported by participants after 3 months was scrutinized. Participants might have indicated that their dietary fat intake was closer to what is generally recommended rather than their real dietary behaviour. This possibility, however, did not seem to hold because the reduction in fat intake was different at every level of blood cholesterol. Also, blood cholesterol level was significantly associated with a decrease in total and LDL-cholesterol fractions in the subgroup who initially had abnormal screening results and came back for a second test.

Although these last results should be taken cautiously considering the small sample size, it is interesting to note that 14 of these 81 patients had reduced their blood cholesterol levels below normal values, for an effectiveness rate of 17%. Assuming unchanged cholesterol values for patients not followed up, the effectiveness rate was 8%; this figure might appear modest at first but is encouraging from a public health perspective. It is also consistent with other authors' results.[33]

Expected trends over time or regression to the mean could also partially account for the decrease in serum cholesterol levels found after 3 months. However, these trends cannot solely explain the observed proportion of abnormal screenings that turned normal on the second test. In fact, most of the 14 patients who brought their blood cholesterol levels to normal after 3 months had frankly abnormal baseline test results, suggesting that something more than regression to the mean alone had happened.

This study has some other limitations. Even though participants were randomly distributed in two samples, the group who did not know their test results when completing the questionnaires was larger than the group who did. This can be explained by the fact that two visits were required for patients in the group aware of their results (one visit for the blood test and one for completing the questionnaires) and a single visit needed for patients in the group unaware of their results because they completed the questionnaires the same day they came for their blood tests. Fortunately, this distribution did not

Table 3. Mean intention to adopt low-fat diet in the next 3 months according to knowledge and screening test results

BLOOD CHOLESTEROL TEST RESULT*	MEAN INTENTION (95% CONFIDENCE INTERVAL) ON SCALE OF 1 TO 10	
	AWARE OF TEST RESULTS (N = 197)	UNAWARE OF TEST RESULTS (N = 222)
Normal	3.9 (3.6-4.2)	3.7 (3.5-3.9)
Slightly abnormal	4.4 (4.0-4.8)	3.8 (3.6-4.0)
Frankly abnormal	4.6 (4.0-5.2)	3.7 (3.4-4.0)

$F_{5,413}$ = 2.0, P = .08
**Test results were based on Canadian reference values:*
- *Normal—total cholesterol < 5.2 mmol/L and LDL < 3.4 mmol/L*
- *Slightly abnormal—5.2 mmol/L ≥ total cholesterol < 6.2 mmol/L or LDL ≥ 3.4 mmol/L*
- *Frankly abnormal—total cholesterol ≥ 6.2 mmol/L and LDL ≥ 3.4 mmol/L*

Table 4. Mean dietary fat intake at baseline and after 3 months for patients with normal and abnormal screening test results: *Mean reductions in dietary fat intake according to blood cholesterol test results were compared.*

BLOOD CHOLESTEROL TEST RESULT*	MEAN DIETARY FAT INTAKE ± SD (G)		
	AT BASELINE (N = 419)	AFTER 3 MONTHS (N = 391)	DIFFERENCE BETWEEN BASELINE AND 3 MONTHS (N = 391)
Normal	45.1 ± 30.9	38.0 ± 29.4	6.4 ± 26.0
Slightly abnormal	53.7 ± 54.2	38.4 ± 22.9	15.3 ± 54.2
Frankly abnormal	51.5 ± 26.8	35.0 ± 17.5	17.6 ± 23.8

$F_{2,388}$ = 3.6, P = .03.
**Test results were based on Canadian reference values:*
- *Normal—total cholesterol < 5.2 mmol/L and LDL < 3.4 mmol/L*
- *Slightly abnormal—5.2 mmol/L ≥ total cholesterol < 6.2 mmol/L or LDL ≥ 3.4 mmol/L*
- *Frankly abnormal—total cholesterol ≥ 6.2 mmol/L and LDL ≥ 3.4 mmol/L*

> **Key point**
> This randomized controlled trial showed that the simple intervention of informing patients of their personal blood cholesterol levels leads to reduced dietary fat intake.

seem to introduce any bias because patient characteristics were similar in the two groups, including mean dietary fat intake and mean levels of total cholesterol and LDL cholesterol. Also, there was no control group to assess dietary behaviour after 3 months because all patients were aware of their test results when they completed the Block Fat Screener at that time. It was considered unethical to retain screening test results for 3 months.

Furthermore, the Block Fat Screener used to assess dietary fat intake could be an imperfect tool, with a correlation of .58, in comparison to a complete 3- to 4-day diet record. Another dietary questionnaire more detailed than the Block Fat Screener, with its 100 items, reached a similar correlation (R^2=.60) compared with a standard 3- to 4-day diet record. Thus, considering the large sample size and the limited resources available for this study, the Block Fat Screener appeared to be an acceptable compromise to estimate dietary fat intake. Finally, this study assessed only the short-term impact (3 months) of cholesterol screening on the intention to adopt a low-fat diet, and its conclusions cannot be extended to a longer term.

CONCLUSION

Knowledge of blood cholesterol level influenced people to adopt low-fat diets in the short term. These results are encouraging because giving patients' cholesterol test results is considered a low-intensity intervention. Thus, knowledge of personal blood cholesterol level can be seen as one initial step in promoting healthy eating patterns, which are essential to cardiovascular disease prevention. Its effects on long-term maintenance remains to be established.

Acknowledgment

This work was supported by a grant from the Fonds de Recherche en Santé du Québec.

Correspondence to: *Dr M. Aubin, Family Medicine Center, Laval Hospital, 2725, Chemin Sainte-Foy, Sainte-Foy, QC G1V 4G5; telephone (418) 656-4795; fax (418) 656-4503; e-mail* **michele.aubin@mfa.ulaval.ca**

References

1. Grundy SM. Cholesterol and coronary heart disease. A new era. *JAMA* 1986;256:2849-58.
2. Stamler J, Wentworth D, Neaton JD. Is relationship between serum cholesterol and risk of premature death from coronary heart disease continuous and graded? *JAMA* 1986;256:2823-8.
3. Kannel WB, Castelli WP, Gordon T. Serum cholesterol lipoproteins, and the risk of coronary heart disease. The Framingham Study. *Ann Intern Med* 1971;74:1-12.
4. Connelly PW, MacLean DR, Horlick L, O'Connor B, Petrasovits A, Little JA, et al. Plasma lipids and lipoproteins and the prevalence of risk for coronary heart disease in Canadian adults. *Can Med Assoc J* 1992;146(11):1977-87.
5. Burke GL, Sprafka JM, Folsen AR. Trends in serum cholesterol levels from 1980 to 1987: the Minnesota Heart Survey. *N Engl J Med* 1991;324:941-6.
6. Sytkowski PA, Kannel WB, D'Agostino RB. Changes in risk factors and the decline in mortality from cardiovascular disease: the Framingham Heart Study. *N Engl J Med* 1990; 322:1635-41.
7. Linn S, Fulwood R, Rifkind B. High density lipoprotein cholesterol levels among US adults by selected demographic and socioeconomic variables. *Am J Epidemiol* 1989;129:281-94.
8. The Lipid Research Clinics Epidemiology Committee. Plasma lipid distribution in selected North American populations: the Lipid Research Clinics Program Prevalence Study. *Circulation* 1979;60:427-39.
9. Assman G, Frick MH. Redefining risk factors for coronary heart disease: the benefit of regulating lipoproteins. *Drugs* 1990;40(Suppl 1):1-56.
10. Brown G, Albers JJ, Fisher LD. Regression of coronary artery disease as a result of intensive lipid lowering therapy in men with high levels of apolipoprotein B (FATS). *N Engl J Med* 1990;323:1289-98.
11. Pekkanen J, Linn S, Heiss G. Ten-year mortality from cardiovascular disease in relation to cholesterol level among men with and without preexisting cardiovascular disease. *N Engl J Med* 1990;322:1700-7.
12. Holme I. An analysis of randomized trials evaluating the effect of cholesterol reduction on total mortality and coronary heart disease incidence. *Circulation* 1990;82:1916-24.
13. Blakenhorn DH, Johnson RL, Nessim SA. The Cholesterol Lowering Atherosclerosis Study (CLAS): design, methods and baseline results. *Control Clin Trials* 1987;8(4):356-87.
14. Canner PL, Berge KG, Wenger NK. Fifteen year mortality in Coronary Drug Project (CDP) patients: long term benefit with niacin. *J Am Coll Cardiol* 1986;8:1245-55.
15. The Lipid Research Clinics Coronary Primary Prevention Trial Results. The relationship of reduction in incidence of coronary heart disease to cholesterol lowering (LRC-CPPT). *JAMA* 1984;251:351-74.

16. Scandinavian Simvastatin Survival Study Group. Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). *Lancet* 1994;344:1383-9.
17. Shepherd J, Cobbe SM, Ford I, Isles CG, Lorimer AR, Macfarlane PW, et al. Prevention of coronary heart disease with pravastatin in men with hypercholesterolemia. *N Engl J Med* 1995;333:1301-7.
18. Sacks M, Pfeffer MA, Moye LA, Rouleau JL, Rutherford JD, Cole TG, et al. The effect of pravastatin on coronary events after myocardial infarction in patients with average cholesterol levels. *N Engl J Med* 1996;335:1001-9.
19. Congrès du consensus canadien sur le cholestérol: Rapport final. Le Congrès du consensus canadien sur la prévention de la cardiopathie et des maladies vasculaires par la modification des facteurs de risque inhérents au cholestérol et aux lipoprotéines sériques. *Can Med Assoc J* 1988;139(Suppl 11):1-8.
20. Expert Panel (National Cholesterol Education Program). Summary of the Second Report of the National Cholesterol Education Program Expert Panel on Detection and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel II). *JAMA* 1993;269:3015-23.
21. European Atherosclerosis Society. Prevention of coronary heart disease—scientific background and new clinical guidelines. *Nutr Metabol Cardiovasc Dis* 1992;2:113-56.
22. Huebsch JA. Educational and behavioral strategies for successful cholesterol management. *J Cardiovasc Nurs* 1991;5(2):44-54.
23. Crouch M, Sallis JF, Farquhar JW. Personal and mediated health counseling for sustained dietary reduction of hypercholesterolemia. *Prev Med* 1986;15:282-91.
24. Carmody TP, Fey SG, Pierce DK. Behavioral treatment of hyperlipidemia: techniques, results, and future directions. *J Behav Med* 1982;5(1):91-116.
25. Foreyt JP, Scott LW, Mitchell R. Plasma lipid changes in the normal population following behavioral treatment. *J Consult Clin Psychol* 1979;47(3):440-52.
26. Bandura A. *A social learning theory.* Englewood Cliffs, NJ: Prentice-Hall; 1977.
27. Godin G. L'éducation pour la santé: les fondements psychosociaux de la définition des messages éducatifs. *Sci Soc Santé* 1991;9(1):67-94.
28. Godin G, Desharnais R, Jobin J, Cook J. The impact of physical fitness and health-age appraisal upon exercise intentions and behavior. *J Behav Med* 1987;10(3):241-50.
29. Desharnais R, Godin G, Jobin J. Motivational characteristics of Evalu*Life and Canadian Home Fitness Test. *Can J Public Health* 1987;78(3):161-4.
30. Denke MA, Frantz ID. Response to a cholesterol-lowering diet: efficacy is greater in hypercholesterolemic subjects even after adjustment for regression to the mean. *Am J Med* 1993;94:626-31.
31. Strychar I, Potvin L, Pineault R, Pineau R, Prévost D. Changes in knowledge and food behaviour following a screening program held in a supermarket. *Can J Public Health* 1993;84(6):382-8.
32. Gordon RL, Klag MJ, Whelton PK. Community cholesterol screening: impact of labeling on participant behavior. *Arch Intern Med* 1990;150:1957-60.
33. Rastam L, Luepker RV, Pirie PL. Effect of screening and referral on follow-up and treatment of high blood cholesterol levels. *Am J Prev Med* 1988;4(5):244-8.
34. Robertson I, Phillips A, Mant D. Motivational effect of cholesterol measurement in general practice health checks. *Br J Gen Pract* 1992;42:469-72.
35. Ajzen I. The theory of planned behavior: some unresolved issues. *Organ Behav Human Decis Processes* 1991;50:179-211.
36. Ajzen I, Timko C. Correspondence between health attitudes and behavior. *Basic Appl Soc Psychol* 1986;7:259-76.
37. Ajzen I, Madden TJ. Prediction of goal-directed behavior: attitudes, intentions, and perceived behavioral control. *J Exp Soc Psychol* 1986;22:453-74.
38. Ajzen I. From intentions to actions: a therapy of planned behavior. In: Kuhl J, Beckmann J, editors. *Action-control: from cognition to behavior.* Heidelberg: Springer; 1985. p. 11-39.
39. Ajzen I, Fishbein M. *Understanding attitudes and predicting social behavior.* Old Tappan, NJ: Prentice-Hall; 1980.
40. Block G, Clifford C, Naughton MD, Henderson M, McAdams M. A brief dietary screen for high fat intake. *J Nutr Educ* 1989; 21(5):199-207.
41. Allen SS, Bache-Wiig ML, Hunninghake DB. Patient perceptions about the influence of cholesterol on heart disease. *Am J Prev Med* 1992;8(1):30-6.
42. Hahn DL. Systematic cholesterol screening during acute care visits. *J Am Board Fam Pract* 1993;6:529-36.