Effects of wheat germ on a population of hyperlipidemic patients

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Abstract

Purpose – Reducing fat intake or inhibiting fat absorption is a useful solution for blood lipid reduction. It is shown that there are some proteins in wheat germ with pancreatic lipase inhibiting properties that have hypolipidemic effects. This paper aims to evaluate the possible beneficial effects of a daily intake of 30 g of raw wheat germ in a population of Iranian hyperlipidemic subjects with their special dietary habits.

Design/methodology/approach – This experimental trial was conducted on 15 hyperlipidemic patients with the average age of 45.7 ± 7 years. They were not on lipid-lowering drugs for the previous three months. They were asked to consume 30 g of raw wheat germ each day for four weeks, and continue their normal diet (follow-up period) for the following four weeks. Dietary records were taken for three days prior to the study and at the end of a four weeks intervention and follow-up period. Data were analysed using repeated measurement analysis. If the statistical significance was detected, a paired-\textit{t}-test was used.

Findings – The consumption of wheat germ for four weeks lowered the serum total cholesterol (\(p<0.002\)), triglyceride (\(p < 0.001\)) and VLDL-C (\(p < 0.001\)). These levels were significantly increased after the follow-up period, but they did not reach the baseline level. HDL-C level was not significantly changed.

Practical implications – Consumption of wheat germ may lower the risk of CHD by reducing the serum lipids.

Originality/value – The paper evaluates the possible beneficial effects of a daily intake of 30 g of raw wheat germ in a population of Iranian hyperlipidemic subjects with their special dietary habits.

Keywords Wheat, Fats, Diet

Paper type Research paper

Introduction

Cardiovascular diseases (CVD) are the first cause of mortality in Iran (Management and Planning Organization of Iran, 1992) and hyperlipidemia has the most important effect (Grundy \textit{et al.}, 2004; Hokanson and Austin, 1996). Dietary modifications along with other lifestyle changes insert profound effect on controlling hypercholesterolemia
Reducing fat intake or inhibiting fat absorption is a useful solution. It is shown that there are some proteins in wheat germ with pancreatic lipase inhibiting properties that insert hypolipidemic effects (Borei et al., 1989a, b).

Lairon et al. (1987) demonstrated that the addition of 7 per cent raw wheat germ to a diet rich in fat and cholesterol induced a significant decrease in VLDL cholesterol and VLDL triglycerides and a significant increase in HDL cholesterol in adult rats after seven weeks (Lairon et al., 1987). Even lower amounts of raw wheat germ (3.5 per cent) had a hypolipidemic effect in rats (Cara et al., 1991a, b).

The researchers showed that the daily intake of 30 g of raw wheat germ for four week induced significant decreases in plasma cholesterol and VLDL cholesterol in hypercholesterolemic subjects as well as plasma and VLDL triglycerides in hypertriglyceridemic human subjects (Cara et al., 1990, 1991a, b). In rats, it is shown that raw wheat germ interfered with lipid hydrolysis in the stomach and small intestine, thus inducing a decrease in the intestinal absorption of lipids and dietary cholesterol (Borei et al., 1989a, b; Borei et al., 1990). These effects could result from lipase inhibition (Lairon et al., 1985a, b) due to the presence of inhibitory proteins that are present in great quantity in raw wheat germ (Lairon et al., 1985a, b; Borei et al., 1989a, b). Given the effects already observed in rats and in hypercholesterolemic human subjects, the present study was conducted to evaluate the possible beneficial effects of a daily intake of 30 g of raw wheat germ in a population of Iranian hyperlipidemic subjects with their special dietary habits.

Materials and methods
This was a prospective four-week clinical trial with before and after design. A total of 15 subjects (ten males, five females) with total cholesterol 200-300 mg/dl and triglyceride greater than 150 mg/dl were recruited from Lipid Clinic, Sari, Iran. Patients with hepatic, kidney diseases, diabetic hyperthyroidism and hypothyroidism, frequent alcohol consumption, smoking habits and hormone replacement therapy (HRT) were excluded. Patients with regular consumption of wheat germ were also excluded from the study.

They were not allowed to use lipid lowering drug or pharmaceuticals known to affect the blood lipid mechanism. The study was approved by the university ethical committee and all subjects gave informed consent to participate.

A total of 30 g fresh wheat germ was added to patients’ regular diet (15 g with lunch and dinner) for four weeks after that they returned to their usual basal diet (four weeks follow-up). The wheat germ was produced by the Sarchin Company in Tehran. The patients were recommended to follow their regular diet and to maintain their normal level of physical activity.

Fasting blood samples were taken at baseline and at the end of each period. Serum total cholesterol, triglyceride, HDL-C and glucose were measured enzymatically. LDL-C was calculated through the Friedewald formula (Friedewald et al., 1972).

Patients’ weight and height were determined while wearing underwear and without shoes with SECA balance with accuracy of 100 grams and 0.5 cm respectively and body mass index was calculated. A 3-d dietary recall was done at baseline and during
the intervention and follow-up period and mean daily intake of energy and nutrients were calculated using Nutritionist III software modified for Iranian foods. Statistical analysis was performed using the SPSS, Version 10.0.

Repeated measurement analysis was performed to compare the values of baseline, intervention and follow-up periods. A level of $p < 0.05$ was considered significant.

Mean age of patients was 45 ± 7 years. Body weight and blood glucose levels remained stable during the three stages of the study. There was no change in the daily intake of energy and nutrients.

**Results**

Table I shows alterations of lipid profiles before and after consumption of the wheat germ and after four weeks follow-up period.

Serum total cholesterol, TG and VLD-C significantly reduced after 4 weeks intervention ($p < 0.001$). After four weeks follow-up, total cholesterol returned to its baseline values. The level of TG and VLD-C increased in this stage, but did not reach to the initial levels.

**Discussion**

In this study, total cholesterol and triglyceride decreased by 6.5 and 15 per cent respectively. However, in a clinical trial on hypercholesterolic individuals, 30 grams raw wheat germ intake reduced total cholesterol level by 8.3 per cent and serum triglyceride by about 40 per cent (Cara et al., 1991a, b). Wheat germ inserts its hypolipidemic effect via inhibiting pancreatic lipase. This effect by the wheat germ proteins is related to their ability to interact with the emulsified substrate and to hinder the adsorption of the enzyme on the interface. The extent of inhibition depends on the amount of substrate (Borei et al., 1989a, b). So, lower percentage of cholesterol and triglyceride reductions in our study can be due to a lower intake of fat and cholesterol by this Iranian population compared to other studies (29 per cent of the energy from fat and 280 mg/day cholesterol). In a study, wheat germ had more effect on blood lipids of individuals with a diet rich in cholesterol (Cara et al., 1992). We should notice that 40 per cent of patients in our study used to consume garlic in their diet. Since the effect of garlic on the metabolism of blood lipid has been proved in previous studies (Ide and Lau, 1997), it is possible that garlic influence the mechanism of wheat germ effects on blood lipids.

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Four weeks</th>
<th>After follow-up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total cholesterol (mg/dl)</td>
<td>237.7 ± 30.4</td>
<td>222.4 ± 30.4*</td>
<td>231.0 ± 30.3</td>
</tr>
<tr>
<td>Triglyceride (mg/dl)</td>
<td>272.0 ± 87.7</td>
<td>232.0 ± 66.9*</td>
<td>256.0 ± 72.0**</td>
</tr>
<tr>
<td>LDL-C (mg/dl)</td>
<td>144.7 ± 26.8</td>
<td>136.5 ± 25.3</td>
<td>140.8 ± 28.3</td>
</tr>
<tr>
<td>VLDL-C (mg/dl)</td>
<td>54.4 ± 15.7</td>
<td>46.2 ± 13.2*</td>
<td>51.2 ± 14.4**</td>
</tr>
<tr>
<td>HDL-C (mg/dl)</td>
<td>38.5 ± 6.5</td>
<td>41.5 ± 6.7</td>
<td>39.8 ± 6.4</td>
</tr>
</tbody>
</table>

Notes: * $p < 0.01$ compared with baseline values; ** $p < 0.05$ compared with baseline values
It is concluded that the amount of fat in diet or diet composition, are important determinants of lipid lowering effect of wheat germ. It seems that wheat germ is more effective in populations with higher fat intake.

References


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