THE UNIVERSITY OF MANITOBA

AN EVALUATION OF THE ABILITY OF FOOD GUIDES TO RECOMMEND A DIETARY INTAKE WHICH WILL MEET THE 1975 CANADIAN DIETARY STANDARD RECOMMENDATION FOR IRON

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by

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A dissertation submitted to the Faculty of Graduate Studies of the University of Manitoba in partial fulfillment of the requirements of the degree of

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Twenty-four hour dietary intakes were collected from a non-random sample of 2,925 volunteers participating in ReNu, a recreation-nutrition project. These individuals were classified into the ten physiological groups outlined in the 1975 Canadian Dietary Standard for iron. The individuals' dietary intake was given a score in each of the four Food Groups of the ReNu Food Guide. Then the milligrams of iron contained in each dietary intake were calculated. A regression equation was developed using the four Food Group scores as the independent x variables, and the milligrams of iron contained in the diet as the dependent y variable. The average milligrams of iron contained in a diet including the recommended number of servings of foods in each of the four Food Groups was predicted, using the regression equation, for each of the ten physiological groups. These calculations were performed to determine if a diet including the food consumption recommendations of the Food Guide would subsequently contain an average iron level which meets the recommendations of the 1975 Canadian Dietary Standard. The predictions indicated that only the diets of adult men and adult women over 50 years of age including the recommended foods would supply an average iron level which meets the 1975 Canadian Dietary Standard. The diets of the other physiological groups were predicted to contain an average iron level below the 1975 Canadian Dietary Standard. The physiological groups that were predicted to be

least able to meet their iron recommendations were adult women under 50 years of age, and adolescents, especially female. If these groups are unable to meet their iron requirements by following Food Guide recommendations, then perhaps other means need to be investigated to increase their dietary status.

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INTRODUCTION

The aim of nutrition education is to teach the principles of a well balanced diet. A well balanced diet could be defined as one which contains the needed amounts of the essential nutrients. It includes the kinds and amounts of foods which supply the needed quantity of the essential nutrients. A food guide consists of foods with similar nutrient content placed into groups, and then recommendations are made concerning the number of servings of foods from each of the groups that should be consumed by an individual in order that the required amount of the essential nutrients is provided. The foods included in food guides are labelled as protective foods, since they make the largest contribution of essential nutrients to the diet. Food guides have been developed to promote a pattern of food consumption which will ensure an adequate intake of nutrients and conform to existing patterns of food use (McClinton et al., 1971). A food guide will also ensure uniformity in the advice given to the public on the selection of foods (McClinton et al., 1971).

How useful have food guides been in meeting these objectives? It is recognized that the amounts of foods recommended by the guide will not meet the caloric needs of an individual (Stare and McWilliams, 1973). The primary concern of this thesis is whether the food guide fulfills its major objective of promoting a pattern of food consumption which will ensure an adequate intake of nutrients. Can an individual following the recommendations of a food guide be guaranteed that he will receive all the essential nutrients? This thesis examines this question by looking

at one nutrient, iron, in particular.

An inadequate iron intake is one of the most common dietary deficiencies found in the world population. This dietary iron deficiency is not limited to the underdeveloped areas of the world, but is very prevalent in North America. Nutrition Canada (1973), this country's first national nutrition survey, reported the presence of a widespread iron deficiency among both men and women. The survey results specific to Manitoba were similar to the national sample (Nutrition Canada, 1975). The dietary data for Manitoba indicated that women and adolescents had only marginal intakes of iron with a median intake in the range of 10 to 15 milligrams, and only men had adequate iron intakes well in excess of the recommended 10 milligrams (Nutrition Canada, 1975).

A deficit of iron in the diet is not a recent problem. The results of four Canadian Dietary Surveys conducted in 1939-40 reported the existence of extensive dietary deficiencies (Young, 1949). The men surveyed had adequate levels of iron intake, but one-half of the women and one-third of the children had iron intakes below 70% of the 1939 Canadian Dietary Standard (Young, 1949).

The primary cause of this widespread dietary deficiency was thought to be a lack of nutrition knowledge (McHenry, 1939_a; McHenry 1939_b; Pett, 1942_a). People did not seem to be able to select the kinds and quantity of foods that would provide them with the needed amounts of the essential nutrients. Therefore, an educational tool, in the form of a food guide, was developed to serve as a guide to the public in their food selection.

The present widespread incidence of iron deficiency would indicate that either the public has not been consuming the foods recommended by the food guide, or else the recommendations of the food guide are inadequate, as far as iron is concerned. The latter has been suggested as the more likely by Stare and McWilliams (1973). They state in their text that the consumption of food according to the Basic Four[1] will provide adequate amounts of nutrients with the exception of iron and energy.

Canada's Food Guide is the food guide of this nation. It consists of five food groups, and the recommended number of servings are presented in Figure 1. If Canada's Food Guide fulfills its objective of recommending a pattern of food consumption that will ensure an adequate intake of nutrients, then individuals consuming the recommended number of servings of foods in each of the Food Groups should also be receiving the milligrams of iron recommended by the Canadian Dietary Standard. The nutrient recommendations in the Canadian Dietary Standard cover the needs of the majority of the population, therefore consuming a level of iron recommended by the Canadian Dietary Standard will make a dietary deficiency very unlikely.

A calculation of the iron content of a menu based on Canada's Food Guide recommendations should answer this question. Table 1 presents a menu for one day that includes the recommended number of servings from each of the Food Groups. The iron content of this menu is calculated to be nine milligrams. This intake is insufficient to meet the

1 The Basic Four is the food guide of United States containing four food groups.

FIGURE 1

CANADA'S FOOD GUIDE RECOMMENDATIONS

C A N A D A ' S F O O D G U I D E

These Foods Are Good To Eat.
Eat Them Everyday For Health.
Have Three Meals Each Day.

MILK	Children (up to about 11 years)	2½ cups (20 fl.oz.)
	Adolescents	4 cups (32 fl.oz.)
	Adults	1½ cups (12 fl.oz.)
	Expectant & Nursing Mothers	4 cups (32 fl.oz.)
FRUIT	Two servings of fruit or juice including a satisfactory source of Vitamin C such as oranges, tomatoes, vitamized apple juice.	
VEGETABLES	One serving of potatoes Two servings of other vegtables, preferably yellow or green and often raw.	
BREAD and CEREALS	Bread (with butter or fortified margarine) One serving of whole grain cereal.	
MEAT and FISH	One serving of meat, fish or poultry. Eat liver occasionally. Eggs, cheese, dried beans or peas, may be used in place of meat. In addition, eggs and cheese each at least three times a week.	
VITAMIN D	400 International Units, for all growing persons and expectant and nursing mothers.	

APPROVED BY THE CANADIAN COUNCIL ON NUTRITION, 1961

NUTRITION DIVISION, DEPT. NATIONAL HEALTH & WELFARE, CANADA

iron recommendations of the 1975 Canadian Dietary Standard for all physiological groups except women over 50 years of age.

If liver was included in the menu presented in Table 1 , the iron content of the diet would be increased from nine milligrams to fifteen milligrams. This level would,according to the 1975 Canadian Dietary Standard, meet the needs of all physiological groups.

Of course, the menu presented in Table 1 can be criticized because it represents a very basic food intake which does not include either additional servings of the recommended foods, or non-recommended foods, such as cakes and cookies. It would most certainly not meet the caloric needs of an individual. Including sufficient foods in the diet to increase the caloric intake would increase the iron intake, as well. Therefore, instead of looking at the iron content of menus written according to Canada's Food Guide, it would be more appropriate to examine the iron content of diets consumed by a sample of people. Examining the types of foods eaten and the iron content would indicate whether the consumption of a diet including the recommendations of Canada's Food Guide would supply enough iron to meet the recommendations of the 1975 Canadian Dietary Standard.

One sample, although non-random, of individuals for which this type of dietary information was available was the sample of individuals participating in Operation ReNu. Operation ReNu is a recreation-nutrition program sponsored by the Manitoba Department of Health and Social Development. ReNu evaluated the physical fitness levels and dietary status of Manitobans during the summers of 1973, 1974, 1975 and 1976. This thesis utilizes the dietary data collected by the ReNu teams in the summer months of June, July and August in the years 1974 and 1975.

TABLE 1

A ONE DAY MENU BASED ON CANADA'S FOOD GUIDE

	FOOD ITEMS	IRON (MG)[2]
BREAKFAST	1/2 cup rolled oats	0.7
	1/2 cup 2% milk	0.05
	1/2 cup orange juice	0.50
LUNCH	1 sandwich - 2 slices bread	1.2
	1 tbsp. margarine	-
	1-1/2oz. canned salmon	0.35
	50 gm. carrot sticks	0.4
	1/2 cup 2% milk	0.05
SUPPER	*3.6oz. roast beef	3.6
	1 boiled potato	0.6
	57 gm. lettuce	0.3
	1/2 cup broccoli	0.6
	1/2 cup yoghurt	0.05
	1/2 cup raspberries	0.68
	DAILY TOTAL	9.08

* If 3 oz. liver was substituted for the 3.6 oz. of roast beef, the DAILY TOTAL would be increased to 15.48 milligrams.

2 Iron values according to Stare and McWilliams, 1973.

Only the information on individuals 13 years of age and older is utilized. Another study by Barrett (1975) also utilized ReNu data to investigate the relationship between obesity, caloric intake, and level of physical fitness.

Twenty-four hour recalls were collected from the ReNu participants and then the foods listed in the 24-hour recall were separated into Food Groups, and the dietary intake was given a score in each of the Food Groups. The nutrient content of the 24-hour dietary intakes was calculated in order to determine the iron content. This calculation made it possible to determine if individuals attaining the desired score in each of the Food Groups would in turn receive the number of milligrams of iron recommended by the 1975 Canadian Dietary Standard.

REVIEW OF LITERATURE

The Canadian Dietary Standard makes recommendations for the amount of energy and essential nutrients required daily by the population to meet the physiological needs of practically all healthy persons (Canadian Dietary Standard, 1975). The nutrient intake recommendations of the Canadian Dietary Standard are aimed at population groups, not individuals. The Canadian Dietary Standard nutrient intake recommendations should not be used to assess the nutritional adequacy of an individual's diet, since nutrient requirements vary for each individual. However, if an individual's diet does meet the recommendations of the Standard, there is only a small likelihood that a dietary deficiency could develop.

The Canadian Dietary Standard has been used to evaluate the nutritional adequacy of diets. Comparison of dietary intakes to the Standard requires that the nutrient content of the diet be calculated. If Canada's Food Guide could be used to assess the nutritional adequacy of a diet, time consuming nutrient calculations could be omitted. It would be easier to evaluate the foods of the diet against the Food Guide, than to calculate the nutrient content and then compare these results to the Canadian Dietary Standard. Before evaluating dietary intakes with the Food Guide, one would have to know if consuming the recommended number of servings of foods from each of the food groups would supply the nutrient levels specified in the Canadian Dietary Standard.

The following review of literature outlines the history of the development of the Canadian Dietary Standard and Canada's Food Guide; and the results of other investigators when these tools have been used

for evaluating dietary iron intakes.

The nutritional adequacy of the Canadian diet became a concern in the late 30's (Editorial Board, 1941). In 1938 the Department of Pensions and National Health of Canada organized a Division of Nutrition, and a Canadian Council on Nutrition was formed (Editorial Board, 1941; McHenry, 1941). One of the primary objectives of the Canadian Council on Nutrition was to secure accurate information on the food habits of Canadians. Accordingly food consumption data was collected from urban, low income Canadian families in the cities of Halifax, Quebec, Toronto, and Edmonton (Editorial Board, 1941; McHenry, 1939_a). Information was collected on food consumption and money spent on food. There were no physical examinations nor laboratory tests.

It followed that the Canadian Council on Nutrition now needed to approve a dietary standard so the food consumption data could be evaluated for nutritional adequacy (McHenry, 1941). The Council considered the standards set forth by the Health Organization of the League of Nations, but decided that these standards were not applicable to Canadians (Canadian Council on Nutrition, 1945; McHenry, 1941). The Council decided to draw up a dietary standard of their own based on the available scientific information. This first Canadian Dietary Standard of 1939 recommended an iron intake of five milligrams daily for infants; ten milligrams for men and children, one to five years of age; and fifteen milligrams for women and children, five to eighteen years of age (McHenry, 1941; McHenry, 1939_b).

The 1939 Canadian Dietary Standard was used to evaluate the nutritional adequacy of the food consumption data of the four Canadian Dietary Surveys conducted in 1939 to 1940. The dietary intakes were judged to be inadequate if the iron level was less than 70 percent of the daily intake recommended by the 1939 Canadian Dietary Standard. Only a small percentage of the men had an inadequate iron intake, but almost half of the adult women and about a third of the adolescents and children had inadequate iron intakes (Patterson et al., 1941; Young, 1941; Hunter et al., 1941; Sylvestre et al., 1941; Young, 1949). What does comparing the dietary intakes to the Dietary Standard indicate? The people who met the nutrient recommendations of the Standard are not necessarily free from a deficiency, but they have the least likelihood of a nutrient deficiency.

The Council now wondered why dietary deficiencies should exist in a country where it was possible to secure an adequate diet from existing food sources (Editorial Board, 1941). The main factor responsible for inadequate food intakes seemed to be a lack of nutritional knowledge (McHenry, 1939_a; McHenry, 1939_b; Editorial Board, 1939; Patterson et al., 1941; Sylvestre et al., 1941; Editorial Board, 1941; Pett, 1942_a; Pett, 1942_b).

The Canadian Dietary Standard does not serve as a very useful guide to the average citizen for his nutrient intake. The dietary intake recommendations are expressed in terms of nutrients. The scientific nutrient recommendations of the Dietary Standard must be translated into a language that can be better understood by the public. Since the public is more familiar with foods than nutrients, recommendations are needed regarding what types and quantities of

foods should be consumed in order to guarantee an adequate nutrient intake. This need for food consumption guidelines led to the development of food guides.

Canada's first food guide, Canada's Food Rules[3], was originally issued in 1944 (Baxter, 1952; Canadian Council on Nutrition, 1949). Canada's Food Rules placed foods with similar nutrient content together into groups, and then recommended the number of servings of food that should be eaten daily from each of the food groups. The recommendations of Canada's Food Rules are presented in Figure 2.

Copies of Canada's Food Rules were published by the Federal Government, and sent in bulk to Provincial Health Departments for distribution to the public. The usefullness of this food guide was never evaluated. The Canadian Government gave the public 26 years, from 1944 to 1970, to learn and practice the recommendations of the food guide. Then in 1970, the Federal Government began conducting the nation's first national nutritional survey, Nutrition Canada. The aim of this study was to provide precise scientific information on the nutritional status of the Canadian population (Nutrition Canada, 1973). These results could be used to indicate if Canada's Food Guide had been useful in improving the nutrition knowledge and dietary habits of the Canadian public.

Nutritionists collected 24-hour food records from more than 19,000 Canadians of different ages, areas, and incomes (Nutrition Canada, 1973). The nutrient content of the 24-hour dietary intakes were calculated.

3 Canada's Food Rules were later revised and retitled as Canada's Food Guide.

FIGURE 2

CANADA'S FOOD RULES RECOMMENDATIONS

CANADA'S FOOD RULES

These Foods are Good to Eat.

East Them every day for Health.

Have at least Three Meals each Day.

1. MILK

   Children (up to about 12 years).....at least 1 pint
   Adolescents.....at least 1-1/2 pints
   Adults.....at least 1/2 pint

2. FRUIT

   One serving of citrus fruit or tomatoes or their juices; and one serving of other fruit

3. VEGTABLES

   At least one serving of potatoes; and
   at least two servings of other vegtables, preferably leafy, green or yellow and frequently raw.

4. CEREALS AND BREAD

   One serving of whole grain cereal; and
   at least four slices of bread (with butter or fortified margarine).

5. MEAT AND FISH

   One serving of meat, fish,poultry, or meat alternates such as dried beans, eggs and cheese.
   Use LIVER frequently. In addition:
   EGGS and CHEESE at least three times a week each.
   VITAMIN D - At least 400 International Units daily for all growing persons and expectant and nursing mothers.

Approved by the Canadian Council on Nutrition, 1950
Nutrition Division, Department of National Health and Welfare, Ottawa.

The results indicated that a deficit of iron in the diet is more common among women than men (Nutrition Canada, 1973). Approximately seventy-five percent of older adult women had less than desirable dietary intakes of iron (Nutrition Canada, 1973). Less than twenty-five percent of young and middle-aged adult men and about thirty-three percent of older adult men had dietary intakes low in iron (Nutrition Canada, 1973). Inadequate iron intakes were more prevalent among adolescent girls than boys. Seventy percent of adolescent girls and fifty percent of adolescent boys had less-than-adequate and inadequate dietary intakes.

In 1939 and 1940, Canadian Dietary Surveys also reported dietary inadequacies in the nation. An educational tool in the form of Canada's Food Rules was developed to promote a pattern of eating that would supply the essential nutrients. Many years later, in 1973, dietary inadequacies were still reported in the nation (Nutrition Canada, 1973). The development of a food guide has not cured the problem. The occurrence of these dietary inadequacies leads one to believe that people either are not following the recommendations of the food guide, or people are following the guide, but the guide does not meet its objective. In other words, eating the recommended number of servings of food in each of the food groups will not guarantee that one will be receiving the level of iron recommended by the Canadian Dietary Standard.

The ability of the Food Guide to recommend a pattern of food consumption that will subsequently provide the level of nutrient consumption recommended by the Dietary Standard has been investigated in the past. In 1949, the Canadian Council on Nutrition used the recommendations of the Food Guide to write two-week menus for a sedentary man weighing 160 pounds. The average daily intake of nutrients was then

calculated. A few years later, Baxter (1952) did a similar nutrient calculation on a one-day menu for a five-year old boy weighing 40 pounds. The calculated iron intake from these menus is presented in Table 2.

The calculated daily iron intakes for the boy and for the man were 6.19 and 11.8 milligrams, respectively. When these iron intakes are compared to the 1949 Canadian Dietary Standard iron recommendation of six milligrams, both the boy and the man meet the recommendation by consuming a diet based on the food guide recommendations. However, when their daily iron intakes are compared to the 1975 Canadian Dietary Standard recommendation of ten milligrams for the man and nine milligrams for the boy, only the man is able to meet the recommendation. This comparison illustrates one problem with dietary standards. The interpretation of the quality of intakes varies with the standard chosen for comparison (Ferguson et al., 1944). For example in 1952 the boy was considered to have an adequate intake of iron but today his iron intake would be considered less-than-adequate.

The investigations of the Canadian Council on Nutrition (1949) and Baxter (1952) are important not only because they allow one to evaluate the ability of the food guide recommendations to meet, or not meet the nutrient recommendations of the Dietary Standard, but also because they point out the relative contribution each group makes toward the iron content of diet. If the food guide cannot promote a pattern of food consumption that will ensure an adequate intake of the essential nutrients, then it is interesting to learn which food group contains the foods which contribute most toward the iron content of the diet. The foods of the Meat and Alternatives Group made the largest contribution to the iron content of the diet, followed by the Vegetable

TABLE 2

FOOD GROUP CONTRIBUTION TO IRON INTAKE

Average Daily Intake for Sedentary Man (Canadian Council on Nutrition, 1949)	Iron Content (mg.)	Percentage of 1975 Canadian Dietary Standard for Iron		Iron Content (mg.)	Average Daily Intake for 5 Year Old Boy (Baxter, 1952)
MILK 1/2 pt.	0.3	3	6.7	0.6	1 pt.
FRUIT					
-citrus	0.5			.16	1/2 orange
-other	0.6			.15	1/4 cup applesauce
TOTAL	1.1	11	3.4	.31	
VEGETABLE					
-potato	1.6			0.4	1 serving
-2 other	1.2			1.28	1/4 cup beets & 1/4 cup green beans
TOTAL	2.8	28	18.7	1.68	
BREAD					
-4 slices	1.1			0.6	3 slices bread
-whole grain cereal	1.2			.08	1/2 cup rolled oats
- butter or margarine	0.1			-	butter
TOTAL	2.4	24	15.6	1.4	
MEAT					
-(liver once in 2 wk.)	4.7			1.65	2oz. ground beef
-eggs (3/wk.)	0.6			0.51	(3/wk.)
-cheese (3 times/wk.)	0.1			0.4	1/7oz. cheese (1oz./wk.)
TOTAL	5.4	54	24.4	2.2	
DAILY TOTAL	11.8	118	68.8	6.19	DAILY TOTAL