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FOOD PREPARATION ACTIVITY OF WOMEN IN FAMILIES USING FOOD BANKS

Master of Science, 2000
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ABSTRACT

A secondary analysis was undertaken to develop and apply a methodology to assess individuals’ food preparation activity from dietary recalls, and to examine the relationships between food preparation and other variables of interest among a sample of 153 women in families using food banks. Food preparation was estimated from two indicative variables using a multiple regression equation developed from intensive examination of a sub-sample of reported eating occasions (time periods when foods were consumed together). The frequency of preparation from scratch and the complexity of preparation were calculated for each woman. Food preparation was positively correlated with energy intake. The complexity of food preparation, but not the frequency, was significantly associated with food security once energy intake was taken into account. Although some significant associations were observed, food preparation was not strongly linked to food group selection or nutrient intakes, once the confounding effect of energy intake was controlled for.
ACKNOWLEDGEMENTS

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<th>Abbreviation</th>
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<tr>
<td>CANDI</td>
<td>Canada Dietary Intake and nutrient analysis software system</td>
</tr>
<tr>
<td>CDP</td>
<td>CANDI Data Processing software system</td>
</tr>
<tr>
<td>FAMEX</td>
<td>Family Food Expenditure</td>
</tr>
<tr>
<td>FCPMC</td>
<td>Food and Consumer Products Manufacturers of Canada</td>
</tr>
<tr>
<td>EFNEP</td>
<td>Extended Food and Nutrition Education Program</td>
</tr>
<tr>
<td>SAS</td>
<td>Statistical Analysis Software system</td>
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CHAPTER 1: INTRODUCTION

The at-home preparation of foods from scratch is generally thought to be declining as the population becomes more reliant on pre-prepared “convenience foods” to compensate for time-demand pressures. The implications of this trend are not known, but it is thought perhaps that dietary quality may decline as a result. Lower intakes of fresh fruits and vegetables, as well as higher intakes of “hidden” fats and sodium may be consequences of a diet high in these pre-prepared foods. However, these consumption patterns have not been definitively linked to preparation behaviours since a method of quantifying food preparation activity has not yet been established.

In addition to the implications of low food preparation activity in relation to dietary quality of the general population, a link has been suggested between food preparation behaviours and household food security status. Food insecurity\(^1\) is of increasing concern for low-income families in Canada, as indicated by the increased use of charitable food assistance programs over the past decade (2-6). A response to these effects of poverty and unemployment has been to focus on improving food-related skills through nutrition education programs (7, 8). In particular, improving food preparation skills has been targeted as a means by which low-income families may improve their situations by making better use of limited household resources (9, 10, 11).

However, the appropriateness of these responses to food insecurity cannot be ascertained since no attempts have been made to relate preparation practices to household food
security, nutritional adequacy, dietary quality or food selection practices. As mentioned above, no methodology currently exists to quantitatively assess food preparation activity.

A secondary analysis of dietary intake from a study of women in families using food banks was undertaken to i) develop a method of quantifying food preparation behaviours, ii) describe the preparation activity occurring at an individual level for a sample of families suffering from food insecurity, and iii) examine the relationships between household food preparation activity and household food security status, markers of dietary quality, and certain personal and household characteristics.

1 Food insecurity is defined here as "limited or uncertain availability of nutritionally adequate and safe foods or uncertain ability to acquire acceptable foods in socially acceptable ways."(1)
CHAPTER 2: LITERATURE REVIEW

2.1 Current Trends in At-Home Food Preparation Activity

Food preparation skills of the general population are thought to have declined over the past few decades due to increased reliance on "convenience foods" (12, 13). Traub and Odland (1979) make reference to the term "convenience foods" as 'fully or partially prepared foods in which a significant amount of preparation time, culinary skills, or energy inputs have been transferred from the home kitchen to the food processor or distributor' (14). Convenience foods, such as canned vegetables, were first made available beginning in the early 1900s (13). Ready-made foods introduced in the 1960's required even less preparation on behalf of the cook: frozen meals and "instant" foods became more common in households (15). At the time of their introduction, convenience foods were thought to symbolize positive changes. Indeed, increased reliance on pre-processed foods represented the emancipation of women from domestic labour.

An increase in the use of convenience foods may have nutritional implications. Increased reliance on pre-prepared foods means that people have less control over the ingredients that are put into their food (12). If people are not cooking food themselves from basic ingredients, it has been argued that nutritional advice cannot be followed; dietary intake of nutrients cannot be well controlled (12). With increasing use of convenience foods, consumers' control over their own diets has shifted from reliance on their own food preparation skills to awareness and understanding of nutritional labeling. Even an educated consumer is somewhat dependent on government and food corporations' standards: nutrition labeling is voluntary unless a specific health claim is made. Diets
high in pre-processed convenience foods may be associated with higher fat and sodium
and lower fiber intakes. Diets high in such foods may also be associated with lower
consumption of fresh fruits and vegetables. All of these factors are thought to put
individuals at increased risk for major chronic diseases that are prevalent in our society
(16, 17, 18). These factors are also thought to contribute to the epidemic of obesity in
Canada, which in and of itself contributes to the morbidity and mortality of
cardiovascular disease, diabetes, stroke and hypertension, among other diseases (16, 17,
18).

In addition to the nutritional implications of increased reliance on ready-made foods,
there are economic implications. While some convenience foods are less expensive than
their homemade counterparts (some baked goods, for instance), most can be prepared
more cheaply at home. Traub & Odland (1985) found that frozen entrees and dinners
were three to four times the price of similar home-prepared meals; even when taking into
account labour costs (the cook’s time), the home-cooked meals were 2/3 to 3/4 the price
of convenience meals (15).

2.2 Nutrition and Low-Income Households

Economic and nutritional concerns for low-income families are particularly relevant. The
association of serious health problems of the poor with nutritional inadequacies has been
documented in medical literature for nearly a century (19). Low-income Canadians have
significantly higher cardiovascular risk factors and mortality than do people living in
middle and high-income households (20). The Nova Scotia Nutrition Survey showed that
people from low-income households were more often in either underweight or overweight categories than other socioeconomic classes (20). The survey also showed that consumption of dietary fat was higher and dietary fiber was lower in low-income households compared to middle and high-income households. In addition, dietary quality and quantity have been shown to decrease with decreasing income; the proportion of diets with less than the recommended intakes of protein, iron, folate and calcium has been shown to increase with decreasing income (20). Food insecurity (see foot note on page 1) is also a problem for many low-income Canadians. In the absence of direct measures, evidence of increasing numbers of Canadian families suffering food insecurity comes from the numbers of families using food banks (2-6).

In attempts to explain the obvious socio-economic health gradient related to nutritional inadequacies, two schools of thought have emerged. On the one hand, economic hardships have been blamed for families being unable to afford an adequate diet. Alternatively, a perception of inadequate nutrition education of the poor has been blamed, such as food acquisition skills and food preparation behaviors. This was expressed in the British Medical Journal in 1913:

"Who is responsible for the conditions which lead to the state of poverty and bad nutrition disclosed by this report? Lies the fault of the poor themselves—because they are thriftless, because they lack training in cooking and economical spending of such income as they possess? Or is it that the actual wages which they can command are so low that it is impossible for them to purchase the actual necessities of life".
However, there is a paucity of literature determining relationships between poor food preparation skills, nutrition inequities and food insecurity. There are no data to suggest that low-income households in Canada have poor food preparation skills or that they are not making use of these skills. It is yet unclear whether food preparation skills are influenced by socio-economic status.

2.3 Food Preparation Activity of Low-Income Households Compared to That of the General Population

Quantitative measurement of food preparation activity in Canadian households is undocumented, irrespective of socio-economic status. Some information regarding food preparation behaviours can be inferred from the Family Food Expenditure (FAMEX) data. In Canada, in 1992, the average weekly expenditure per household on foods purchased at restaurants was $11.36 in the lowest income decile group and $66.28 in the highest (21). In the lowest income quintile group, families spent 79.1% of their weekly food expenditures on food from stores, and in the highest quintile group, 68.1% of food expenditure was spent at stores. We can assume from these data that people from lower-income households are either eating out less often than are people from higher-income households, or occasioning less costly restaurants, or both. Support for these inferences comes from a recent study of low-income families using food banks. Tarasuk and Beaton (35) showed in a group of low-income women in families using food banks that 50% of the sample never ate at restaurants, and another 35% only ate out once or twice per month (35). From these data, we cannot make any assumptions regarding the level of food
preparation that is occurring in low-income households; food purchased at stores does not denote any level of food preparation.

A study by the Food and Consumer Products Manufacturers of Canada (FCPMC) documented information concerning today's consumers' meal purchase, preparation and consumption patterns. The report revealed that lower income consumers almost never eat a store-prepared meal, whereas higher income consumers do so once or twice a week (22). This finding is consistent with the results of an English survey by Lang et al (1996) that showed that the least affluent were eating fewer ready-made meals each week, compared to the most affluent. Interestingly, however, the authors observed that the poorer classes were less confident in their cooking abilities (12).

2.4 Nutrition Education

Despite the lack of evidence, good food preparation skills have increasingly been the suggested means by which low-income families can improve their situations (25-33). In Canada, although some nutrition education projects have been initiated, they have typically not been evaluated, and the need for such programs has not been assessed (7-11). In the US, studies have demonstrated that when nutrition education pilot programs are initiated, participants are able to retain the knowledge and put it into practice (25-30). What follows is a review of several EFNEPs (Expanded Food and Nutrition Education Program) that have been evaluated, and that included some food preparation components.
The goal of the EFNEP in Hawaii is to “help culturally diverse, low-income households eat better for less” (30). To assist low-income families in acquiring food preparation skills and behaviors needed to “improve their diets and contribute to their personal development”, ENFEP nutritionists and staff designed nutrition education cards that would be mailed monthly with food stamp vouchers. Pre- and post-tests were used to assess the effectiveness of the program, which assessed knowledge gains, reported changes in behavior and recipe use. Although only 10% of families who received the cards completed both the pre- and post-program tests, the study showed that most respondents had changed their food behaviors in some way as a result of the cards. Given that 93% of respondents felt that distribution of the cards should continue, the pilot project was judged to be an effective means of providing nutrition education to a large target audience. With such a low response rate, however, conclusions cannot be drawn about low-income families potential to benefit from such education.

A study regarding the food preparation practices of 97 EFNEP participants (low-income parents aged 15-30) in California argued that good food preparation skills are necessary to prepare nutritious meals that are low-cost (33). The study used a Dietary Profile to assess food consumption patterns over a typical week. Fifteen nutrients were examined from the intake data of participants. Nutritional adequacy of participants was estimated using the Recommended Daily Allowances (RDA) as a guide. Participants whose intake for 3 or more nutrients was below two-thirds of the RDA values were classified as ‘Less Adequately Nourished’. Participants whose intake for at least 13 nutrients was above two-thirds of the RDA were classified as ‘More Adequately Nourished’.
Food preparation skills were assessed in this study using a Food Practices Questionnaire. The variety of preparation techniques used was scored (the number of different ways that foods were prepared by participants). The method of assessing preparation activity was problematic since there was no measure of how often people prepared foods. For example, someone who prepared foods from scratch a great deal but only baked or boiled them would receive a score of 2 out of 10.

The study concluded that those who were likely to be deficient in three or more nutrients were less likely to be preparing meals from scratch than those who were likely to be deficient in only two or fewer nutrients.

This study is problematic for two reasons. First, the method of assessing deficiency was problematic since the RDAs for specific nutrients were applied to individuals’ nutrient intakes and usual intakes were assessed using a single Dietary Profile that was assumed to reflect intake over the past month. Second, energy intake was not measured in this study. As the relationship between nutrient deficiency and food preparation did not take into account energy (or total food) intake, it cannot be assumed that food preparation is the cause for nutritional inadequacies rather than an insufficient supply of food.

Auld et al. studied a group of 29 interested clients (all women) from an education and training program for low-income families (28). Cooking classes (which included only six women each) were initiated to promote cooking more foods from scratch in order to decrease the amount of money low-income families spent on groceries. The women who
were involved in cooking classes showed improved attitudes towards cooking and the use of certain foods (i.e. grain products, dairy products, meat and meat alternates and fruits and vegetables) at a three-month follow-up. Food intake patterns were also measured: grain consumption increased in the treatment group relative to the control group. However, the results of the program are based on a very small sample of women in low-income families. In addition, no attempts were made to relate these behaviors to food security status or to quantitatively demonstrate improved nutritional status after the program’s completion. Despite the limitations, the authors noted that the program had the potential to improve the dietary quality of the low-income families who participated.

A project in New York City examined the retention of nutrition knowledge and behaviors among 50 EFNEP participants (25). Food preparation behavior comparisons at entry of the program, graduation and follow-up showed that preparation of meals from scratch increased after graduation from the course compared to at entry, and this was maintained at 9 to 16 months. However, the use of packaged foods did not decrease significantly at either graduation or follow-up compared to usage at entry of the program. Nutrient analysis was done at the three stages of the study through a 24-hour dietary recall at each phase. The only significant change in intake between entry and graduation was a reduction in the amount of energy consumed from fat. When mean nutrient intakes were compared between graduation and follow-up, mean protein, calcium, vitamin A, and energy intakes were significantly lower at follow-up, raising questions about the impact of the intervention. No conclusions were drawn from the nutrient analysis and the authors
noted that both the 24-hour dietary recalls and the small sample size were limiting factors in this study.

A study in California recruited 683 participants who were eligible to receive EFNEP (low-income families) and randomly assigned them to either a control group or to the EFNEP treatment group (27). The individuals in both groups completed a questionnaire of 48 general nutrition questions as well as a 24-hour dietary recall. The EFNEP group then received one-on-one instruction for six months that included counseling on food preparation behaviours. After the six-month instruction period, the questionnaires were repeated for both groups. In the EFNEP group, consumption of milk and milk products increased significantly (by 0.5 servings on average), as did fruit and vegetables (by 1.1 servings on average), and protein (by 0.2 servings on average). Bread and cereal consumption did not change significantly however. No improvements were noted in the control group. The findings of this study showed that although there was a significant change in diets as a result of the program, the effect was so small (e.g. an increase of 0.2 servings of protein) that its practical value is questionable.

In summary, many of the studies regarding the impact that nutrition education has on dietary quality are contradictory due to the various approaches of the programs and their evaluations. Although some have attempted to relate participants' knowledge gains from the program to their nutritional status, results are often not clear. While several studies suggest dietary improvements after completion of the program (27, 28, 30, 33), another suggests no improvements, or even detrimental effects (25). When these programs are
established, it does appear that participants retain the knowledge, and that they practice what was taught. What has not been established in studies is the need for such programs. The level of household food preparation occurring before onset of the programs has not been shown to be either sufficient or insufficient in promoting healthful diets and food security. The study samples have tended to be small and self-selected, raising questions regarding applicability of findings to low-income families in general. Also, program evaluations have not controlled for confounding factors such as level of household resources, energy intake or total food intake.

In the studies reviewed here, preparation activity at the household level has typically not been measured, perhaps because of lack of methods to quantitatively assess household food preparation activity. Food security status, dietary quality and food selection patterns, including the use of convenience foods have therefore yet to be definitively linked to food preparation activity. These gaps in the literature point to the need for more systematic, comprehensive studies of food preparation activity among Canadian households, in general, and among low-income families in particular.

Therefore the objectives of this study are to:

i. Develop a methodology to quantitatively assess the amount of domestic food preparation activity through analysis of 24-hour dietary recalls of food intakes of individuals.

ii. Using this methodology, assess the amount of food preparation activity occurring among a sample of adult women in families using food banks.
iii. Examine the relationship between women's food preparation and household food security status, dietary quality (through food selection behaviours) as well as personal, behavioral and household characteristics in this sample.
CHAPTER 3: DATA

The objectives of this study were achieved through a secondary analysis. The forthcoming sections in this chapter will present a description of the data set used and an overview of pertinent aspects of the original study, a brief description of the software systems used and the method of data entry. A description of some of the errors found in the data set and a summary of their corrections will also be presented. In addition, descriptive statistics of the numbers and types of foods and recipes reported consumed by the participants in this data set will be presented.

3.1 Description of Data

This study is the secondary analysis of data from a study of nutritional vulnerability and food insecurity among women in families using food banks (35, 36, 37). The women were recruited from a stratified, random sample of 21 of the 77 emergency food hampers in Toronto. Participant recruitment for the study spanned from May 1996 to April 1997. Women eligible for the study were between the ages of 19-49; had received emergency food relief within the past year; had at least one child under the age of 15 living with them; were not pregnant and were proficient in English to the extent that they could participate in oral interviews. A final sample of 153 women was achieved. Each participant was interviewed on three separate occasions. The interviews were generally conducted on non-consecutive days and within three weeks following recruitment. During each interview, the participant completed an interviewer-administered 24-hour dietary recall and questionnaire. The questionnaires included questions regarding food sufficiency status, shopping practices, self-rated health, education, and income.
Lone parents represented 65% of the sample. Most of the women (63%) were born outside of Canada; 20% of the sample were recent immigrants (those who had come to Canada within the last five years). The demographic profile of the sample was very broad; the women came from 41 different countries including those in the Caribbean/West Indies, Africa, Europe, South/Latin America and Asia. A full description of the study sample has been published elsewhere (36, 37).

3.2 24-Hour Dietary Intake Recalls

Recording of the 24-hour dietary recalls included detailed descriptions of each food, recipes of "main dishes", and any dietary supplements taken. The interviewers were encouraged to obtain information regarding the dietary recalls using questions, probing comments in an unbiased, non-judgmental manner.

On the 24-hour dietary recall, individual foods were recorded, as well as the time at which the food was consumed, the quantity of the food consumed and the portion of the food consumed. A food preparation code related to the place of food preparation was assigned to each food and recorded at the time of the interview. As well, recipes were recorded on recipe forms and attached to the dietary recalls. A summary of the information recorded on the dietary recalls is presented in Figure 3.1, and the component parts are described in more detail below.
3.2.1 Quantities and Portions
Portions were estimated according to standardized models (models of foods of varying shapes, sizes and thickness) shown to the women to approximate the serving size. This not only helped to estimate portions more accurately, but also eased data entry into the CANDI nutrient analysis software system. The quantity of food recorded was the number of portions that the woman consumed. For example, if the woman consumed two tablespoons of milk in her coffee, the portion recorded would have been ‘tablespoon’ and the quantity recorded would have been ‘2’.

3.2.2 Food Preparation Codes
One of four food codes was assigned to each food according to where the food was prepared. These four codes were letters recorded next to each food:

**Code H:** Any food that was prepared in the home, no matter where the food was consumed.
Code C: Any food that was commercially prepared. This code includes food from restaurants, take-outs and cafeterias, no matter where the food was consumed.

Code P: Any food that was prepared and consumed at a meal program (e.g. community kitchen, daycare, training program)

Code O: Any food that was prepared by others outside the household (e.g. friend, relative). This food could be eaten inside or outside of the home.

3.2.3 Recipes
Detailed recipes of home-prepared foods were recorded on separate recipe forms and attached to the 24-hour recalls during the interviews. Three essential features of a recorded recipe are the ingredients, the quantity of food used and the method of cooking and cooking temperature. The interviewers recording the dietary recalls (and the recipes associated with them) were trained to record recipes for homemade main dishes if they contained a high number of ingredients (greater than 4-5), and/or if they were prepared in large quantities and only a fraction of the dish was consumed. If the homemade dish was prepared for only one person, a recipe form was often omitted and the individual foods included in the dish were recorded directly on the dietary recall.

Recipes were recorded in sufficient detail such that the preparation involved with each ingredient was included (e.g. grating, chopping), but individual steps in the assembly were not necessarily recorded (e.g. mixing, heating). Preliminary preparation steps of ingredients were also recorded (e.g. legumes soaked before cooked).
3.3 Data Entry into CANDI Nutrient Analysis Software system

3.3.1 Coding in CANDI

All 24-hour dietary recalls were entered into the CANDI Nutrient Analysis software system. This system was developed by the Nutrition Research Division, Health Protection Branch, Health Canada, for use in the recent provincial nutrition surveys (20, 41). When recipes are entered into the system, CANDI automatically codes them as such, allowing for the distinction between home-prepared foods included in recipes (recipe foods) and home prepared foods not included in recipes (basic foods). CANDI also automatically differentiated between recipes with a recipe code according to their elaborateness. Basic foods were assigned a recipe code of 0. Recipe foods were assigned a recipe code from 1-6, depending on the level of intricacy of the recipe. Recipe code 1 is the code of the main recipe, and codes 2-6 represent recipes within the main recipe at the indicated level. An example of a level 2 recipe in the data set, is a lentil soup recipe where the lentils were cooked (with several other ingredients) and then added to a vegetable mixture that was cooked separately. An example of a level 3 recipe is a dish where two sauces were prepared separately and then combined to make a more complex sauce, which was used in a chicken dish.

In addition to the recipe code, a food group code is automatically assigned to each food by the CANDI system when it is entered. The CANDI Food Group code (54 CANDI Food Groups in total) is organized into broad categories such as milks, fruits, grains etc. All foods, including those in mixed dishes were assigned a CANDI food group code. A
summary of the information from the dietary recalls, as well as the automatic coding in
CANDI is presented in Figure 3.2.

Dietary Recall Files in CANDI

- quantity of food
- portion of food
- time of consumption
- description of food
- recipe status of food
- food group code
- basic foods
- recipes
- recipe level

FIGURE 3.2 SUMMARY OF INFORMATION FROM THE DIETARY RECALLS AND THE AUTOMATIC CODING IN CANDI

3.4 Data Processing Through the CANDI Data Processing System

CDP (the CANDI Data Processing system) processes data from CANDI such that they can be deciphered and analyzed by the SAS (Statistical Analysis Software) program. No coding can be done within the CDP system; codes remain unaltered when processed through CDP with the exception of the food group code. The food group codes are automatically changed from the more broad CANDI food group codes to more specific categories such as 2% milk, apple, rice etc. (148 CDP Food Groups in total). Based on the classification table provided in the Quebec survey, these 148 Food Groups were
further classified into the four food groups of Canada's Food Guide (41). Once processed through CDP the data were imported into SAS/PC Version 6.12 for Windows.

3.5 Data Cleaning

In order to become familiarized with the CANDI system and the data entry process in CANDI for this study, a pilot sample of dietary recalls were initially examined in detail. The pilot sample consisted of 36 dietary recalls that are from the original study, but are not among the 459 recalls (153 women, each interviewed 3 times) that are analyzed in this study. The dietary recalls from the pilot sample were entered into the CANDI system following the same procedures used in the original study. This allowed for examination of the amount of information related to food preparation that could be extracted from CANDI. This also led to the discovery of several unexpected errors related to food preparation codes and recipe codes in the entire data set (n = 459 dietary recalls). The preparation codes of each food and each recipe of the entire data set were examined for errors at the level of CANDI. Upon examination and cleaning of code errors, some entry errors were discovered in the data set and these were also corrected. What follows is a description of the errors and a summary of corrections made to the entire data set (n = 459).

3.5.1 Code Errors

Some basic foods were classified incorrectly as recipes when in fact no preparatory work on behalf of the individual was required before their consumption. Many foods, particularly store-bought baked goods, were not recognized as commercial foods in the
CANDI system, but were automatically treated as recipes. These recipes included all the basic ingredients of the foods. For example, a store-bought bagel, when entered into CANDI would present as a recipe with 7 ingredients (including flour, yeast, sugar etc.) rather than a single food, as a slice of store-bought bread would. For the most part, commercial baked goods, such as pies, muffins, doughnuts, danish, pita bread, etc. were treated as recipes in CANDI.

In addition to the presence of "pseudo-recipes", there was also a problem with the coding in CANDI in terms of the food preparation codes H, O, C & P. Although each food was given a code at the time of the interview, not all codes were entered into CANDI. Because only the foods coded with an H (home-prepared foods) were assumed to be associated with any preparatory work, the presence of these codes was essential.

3.5.2 Entry Errors

Upon close examination of the recalls entered into CANDI, some entry errors were observed in terms of foods being coded with incorrect food codes, and a handful of recipes were not entered correctly in terms of their recipe status code. Also, in some instances foods were not entered into CANDI. This problem applied most often to spices, and it presumably occurred because spices often contribute little to the nutritional analysis of a dietary recall. Spices were generally not recorded on the recall unless they were part of a recipe; missing spices in CANDI was almost exclusively a recipe phenomenon.
3.5.3 Summary of Corrections

In this study, because the presence of a recipe and the number of ingredients within a recipe are used as indicators of food preparation activity, it was extremely important that the number of ingredients in a recipe be accurate. It was also important to be certain that recipes were true recipes insofar as they were home-prepared by the individual, and that the preparation was not on the part of the manufacturer. For these reasons, it was necessary to refer back to the dietary recalls to correct the code errors and entry errors in CANDI. The following errors were corrected:

3.5.3.1 Food Preparation Codes:

Out of the 12909 foods that were originally entered into CANDI, 583 were entered without food preparation codes. Codes were not entered for 165 foods from Day 1 dietary recalls, 190 foods from Day 2 dietary recalls and 228 foods from Day 3 dietary recalls. Correct codes were entered for these foods.

3.5.3.2 Recipe Codes:

Three level 2 recipes were re-coded as level 1 recipes and two level 3 recipes were re-coded as level 2 recipes according to the number of sub-recipes that the main recipes contained (as indicated on the recipe forms of the dietary recalls). Pseudo-recipes, or commercial foods that CANDI automatically treated as recipes, were distinguished from true recipes by the fact that there was no recipe form associated with the recall for those foods. These were re-coded as commercially prepared foods (food code 'C'). In all, 176 recipes were re-classified as commercial foods. After correcting the food codes and recipe codes, in total 601 true recipes remained in the data set.
3.5.3.3 Missing Foods:
Recipes were also examined in terms of the number of foods in recipes entered in CANDI. The number of foods entered in CANDI was corrected to agree with the number of foods within recipes recorded on the dietary recall at the time of the interview. In all, 227 foods and spices were added to 116 recipes. Of the 227 items that were added, most were spices with only a very small number (n=31; 0.24% of foods in data set) that were entry errors where a food was mistakenly omitted from the recipe.

3.6 Summary of Food Intake Data
After data cleaning, the number of home-prepared foods and recipes reported on participants' recalls were examined. Home-prepared foods comprised the majority of the foods consumed by the women in the data set (Table 3.1).

Table 3.1 Mean, Median, (Minimum, Maximum) Numbers and Proportions of Foods by Preparation Codes in the Data Set (n = 30 x 153 women)

<table>
<thead>
<tr>
<th></th>
<th>Home-prepared Foods</th>
<th>'Other' Foods</th>
<th>Commercial Foods</th>
<th>Program Foods</th>
<th>All foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of foods per</td>
<td>20, 19</td>
<td>2, 0</td>
<td>5, 0</td>
<td>0.1, 0</td>
<td>28, 26</td>
</tr>
<tr>
<td>dietary recall</td>
<td>(0, 67)</td>
<td>(0, 79)</td>
<td>(0, 53)</td>
<td>(0, 13)</td>
<td>(1, 103)</td>
</tr>
<tr>
<td>Percentage of total</td>
<td>75, 85</td>
<td>7, 0</td>
<td>17, 0</td>
<td>0.2, 0</td>
<td>100</td>
</tr>
<tr>
<td>number of foods</td>
<td>(0, 100)</td>
<td>(0, 100)</td>
<td>(0, 100)</td>
<td>(0, 35.13)</td>
<td></td>
</tr>
</tbody>
</table>

Of the foods coded as home-prepared foods, basic foods comprised the majority of the foods consumed by the women in the data set (Table 3.2).
Table 3.2 Mean, Median, (Minimum, Maximum) Numbers and Proportions of Home-Prepared Foods in the Data Set (n = 3d x 153 Women)

<table>
<thead>
<tr>
<th>Basic foods</th>
<th>Recipe foods</th>
<th>All foods coded with ‘H’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of foods per dietary recall</td>
<td>10, 10 (0, 35)</td>
<td>10, 8 (0, 56)</td>
</tr>
<tr>
<td>Percentage of foods coded with ‘H’</td>
<td>59, 45 (0, 100)</td>
<td>41, 55 (0, 100)</td>
</tr>
</tbody>
</table>

Level 1 recipes were the most common types of recipes in the data set. As previously mentioned, level 2 and level 3 recipes were relatively rare in the data set (Table 3.3).

Table 3.3 Numbers and Proportions of All Recipes in the Data Set

(n = 3d x 153 Women)

<table>
<thead>
<tr>
<th>Level 1 recipes</th>
<th>Level 2 recipes</th>
<th>Level 3 recipes</th>
<th>All recipes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of recipes in the data set</td>
<td>565</td>
<td>35</td>
<td>1</td>
</tr>
<tr>
<td>Percentage of total recipes in the data set</td>
<td>94</td>
<td>6</td>
<td>0.2</td>
</tr>
</tbody>
</table>
CHAPTER 4: METHODS

This chapter presents an in-depth description of the methods used to quantify food preparation and the rationale for the methodology. First, the six variables that were available from the original study to capture food preparation activity are introduced. The development and application of a scoring system to quantify food preparation activity in this sample is then presented. The use of the scored eating occasions to develop a regression equation to predict food preparation complexity from readily accessible variables is then detailed. An examination of the prediction capacity of this regression equation is also presented. Finally, the two food preparation variables used in subsequent analyses are described, and the analyses of food preparation activity in relation to various dietary, food security, socioeconomic and behavioural variables of interest is outlined.

4.1 Factors Considered for Use in Developing a Method of Assessment of Food Preparation

The first objective in this study was to develop a method of estimating food preparation activity that can be applied to dietary recall files in the CANDI system. The following is a discussion of the six factors used to develop a method of estimating food preparation activity from the information available in the computerized recalls in CANDI/CDP:
1.1 Food preparation code
1.2 Eating occasions
1.3 Recipe code
1.4 Number of foods
1.5 Time of consumption
1.6 Food group code

These factors, with the exception of food group codes, were integrated into the categorization scheme. As discussed in section 4.1.6, the idea of incorporating food group codes into the categorization scheme was given careful consideration before being discarded.

It should be noted that none of the software systems (CANDI, CDP and SAS) was designed to store or retrieve information regarding food preparation. The factors listed above and the information obtained from them is therefore limited to what has been entered into CANDI and what can be imported into and analyzed through SAS.

4.1.1 Food Preparation Codes
The food preparation codes are useful to distinguish foods that have not undergone preparation. Only home-prepared foods (foods coded with food preparation code ‘H’) had potentially undergone at-home preparation activity. ‘Commercial’, ‘program’ and ‘other’ foods involved no preparation on the participants’ behalf. Therefore only ‘H’ foods were included in the process of estimating food preparation activity.
4.1.2 Eating Occasions

As previously mentioned in section 3.2.1, the time at which each food was consumed was recorded on the dietary recalls during the interviews, and entered into the CANDI system. The time at which a food was consumed is an essential variable because it signifies an “eating occasion”. Eating occasions are time periods when one or more foods were consumed (we refrained from using the conventional term “meal” due to the variability of types and numbers of foods and beverages consumed within eating occasions). The consumption of multiple foods during one eating occasion may indicate the presence of food preparation activity. Figure 4.1 summarizes the categorization of eating occasions by food preparation codes.
2095 eating occasions total

1824 where home-prepared foods were consumed
271 where only foods coded with O, C or P were consumed

1223 where no recipes were present
601 where recipes were present

Figure 4.1 Summary of Eating Occasions in the Data Set

4.1.3 Recipe Code

The presence of a recipe is likely to be a good indication of food preparation. The activity involved in preparing a recipe is likely to be more complex than that involved when consuming basic foods (foods coded with an H that were not included in a recipe). Reported consumption of a certain number of recipe foods is likely to indicate more preparation activity than reported consumption of the same number of basic foods. At a minimum, a recipe entails combining foods together, often requires cooking them, and often requires several steps.

Although the recipe code was extremely useful in determining where food preparation had occurred, the codes above level 1 were not good discriminating factors for
complexity of food preparation activity because so few higher-level recipes were found in this data set. Only 1 of the 601 recipes in the data set contained a level 3 recipe and only 35 of 601 recipes contained level 2 recipes; the remainder were level 1 recipes (see Table 3.3).

As described in section 3.2.4, recipes were recorded for homemade main dishes, or if foods were prepared in large quantities and contained more than four or five ingredients where only a fraction of the dish was consumed by the individual. Recipes that were prepared in single-portion quantities were recorded on the dietary recall as basic foods rather than on a recipe form. It is likely that preparation activity has occurred when the recipe code of a food is greater than zero (recipe foods). However, the opposite cannot be assumed, i.e. that preparation activity has not occurred where the recipe code is zero (basic foods). For example, two slices of bread, mayonnaise, tomato, lettuce, and sliced luncheon meat consumed together is most likely indicative of the assembly of a sandwich, which requires a certain amount of work although generally does not require a formal recipe. For this reason basic foods, in addition to recipe foods, would also have to be incorporated into the method of estimating food preparation.

4.1.4 Numbers of Foods

Intuitively, it would seem that the higher the number of ingredients in a recipe, the more complex the food preparation is likely to be. One indication of this is that level 2 and level 3 recipes seem to be more complex recipes than level 1 recipes, i.e. they require more work, because of the extra steps involved in their preparation. Level 2 and level 3
recipes also tended to have high numbers of ingredients recorded. For example, the one level 3 recipe in the data set had the highest number of ingredients of any recipe recorded (26 ingredients). Similarly, the higher the number of foods recorded at eating occasions containing only basic foods, the more likely complex preparation is to have occurred.

4.1.5 Time of Consumption

It has already been suggested that the presence of a recipe is a good indication of complex food preparation. A high number of basic foods consumed together at a given eating occasion also appears to be a good indication of food preparation. Another indication of the complexity of food preparation is the time of consumption. While simple preparation activity occurs throughout the day, more complex activity tends to occur primarily in the afternoon and evening hours. In the morning hours, only simple (if any) preparation activity tends to occur (recipes tend to occur in the afternoon and evening hours). It appears that the higher the number of ingredients in a recipe, the more likely it is to occur in the afternoon hours (Figure 4.2).
4.1.6 Food Group Codes

Generally, different types of foods tend to be associated with different amounts of preparation before consumption. For example, chicken is cooked and onions are cut before consumption, whereas ready-to-eat breakfast cereals do not require preparation.

Based on some broad assumptions, theoretically it is possible to classify each one of the 148 CDP Food Groups according to the level of preparation that is often associated with their consumption. Each food within these food groups could then be classified with an estimated amount of work required before consumption. Consequently, the amount of preparation involved in a dish could be estimated by summing the work entailed for each ingredient. By this means, the level of complexity of preparation for each recipe in the data set could be assessed.
To ease the process of making assumptions about the preparation required for various food groups, some were initially considered for exclusion from this process. Exclusion of certain food groups was considered on the basis that they rarely required preparation before consumption. Beverages and commercially prepared foods (e.g. breakfast cereal, ice cream) seemed fairly straightforward in terms of the amount preparation associated with their consumption (very little, if any).

However, even these food groups are not always straightforward in terms of the preparation generally involved. For example, some beverage groups may be used as ingredients in recipes (usually added in small quantities). To determine if a beverage had been drunk or used in a recipe, a volume cut-point for each beverage would then need to be established. Above the cut-point it could be assumed that the liquid was consumed as a beverage, and below which it could be assumed that it was consumed as part of a recipe. Similarly, judgments would have to be made for commercially prepared foods. Concerns about the need to make so many arbitrary assumptions led to the decision not to exclude either commercially prepared foods or beverages from analysis.

Likewise, it is not possible to make accurate generalizations for any individual food group in terms of the preparation required before consumption without imposing a significant amount of error on the assumptions. For example, cheese could be eaten melted on a slice of bread, or it could be eaten unheated by itself. Many vegetables or fruits can be eaten raw or cooked; some vegetables and many fruits can be eaten whole, and do not require subdivision.
Since preparation activity decidedly could not be generalized for individual food groups or foods, the context in which they are used was then considered. In some cases, combinations of foods are an indication of the amount of preparation involved in their consumption. However, infinite combinations of foods exist, especially due to the ethnic variability in the sample. Moreover, many foods and food combinations recorded on the recalls may be not recognizable to the author. To try to estimate and then designate a level of preparation to combinations of foods would likely result in imposing a cultural bias on the estimation, and would therefore be erroneous. For these reasons, it was decided not to incorporate food group codes into the classification scheme for food preparation activity.

4.2 Food Preparation Complexity Quantification

Although the rationale for the factors discussed in section 4.1 to be good indicators of food preparation is sound, there is no way of quantifying the precise level of food preparation associated with each factor or combination of factors without being able to directly assess food preparation activity. Direct assessment, or quantification of the work involved in food preparation is the most vigorous and accurate method of estimating this activity. Therefore the factors discussed in section 4.1 were not used as direct assessors of food preparation, but were used to strengthen the method of assessment that will be discussed in the forthcoming sections.

To assess the amount of work involved in food preparation activity in this sample, ‘food preparation activity’ was first defined. In the context of this thesis, food preparation
activity has been defined as work in the physical sense of the word. In order to quantify this activity, the work entailed in food preparation first needs to be specified. The work involved in food preparation has been described as a series of activities, or food preparation techniques, that were performed on a food before its consumption. The more techniques performed, the more work was done and hence the higher the complexity of the preparation activity. This rationale was used to develop the scoring system to quantify food preparation activity.

Ideally, the food preparation involved in each food or dish in the data set would be manually assessed and quantified. However, this task is not feasible or practical since it would involve an in depth review of each of the 459 dietary recall forms as well as the associated recipe forms. Therefore, a sample of eating occasions was scored and these scores were used to develop a multiple regression equation to predict food preparation activity for each eating occasion in the data set (as discussed in section 4.6).

4.3 Scoring System

The work, or preparation activity, involved in a sample\(^2\) of 150 eating occasions was manually assessed and quantified to develop the regression equation discussed in section 4.6. Scoring was based on food preparation techniques categorized by Sweetman & MacKeller (38).

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\(^2\) Sampling methods discussed in section 4.4.
4.3.1 Scoring Categories

The categories of food preparation techniques that were used to assess food preparation are as follows:

i. washing

ii. subdivision and fractionation

iii. combining and mixing

iv. heating

v. removal of heat

Within these food preparation categories, Sweetman & MacKeller described specific techniques of food preparation. A summary of the techniques that were used to quantify food preparation is presented in Appendix A. The preparation categories were useful in that many of the techniques they contained were recorded on the dietary recalls by the interviewers, to indicate the preparation entailed before consumption of foods. For example, cooked foods were usually indicated on the recalls using many of the same descriptions of techniques of heating that are presented in Appendix A. Subdivided foods were also usually indicated using similar descriptions of subdivision and fractionation presented in Appendix A.

4.3.2 Method of Scoring

A scoring system was developed whereby scoring was accomplished by referring to the dietary recall forms, rather than the data stored in the software programs CANDI or SAS, in order to extract as much detail as possible. Food preparation complexity scores were
assigned to individual foods within eating occasions according to the number of food preparation techniques the foods had undergone (see Appendix A). A point was assigned for each technique applied to each food, and scores were summed over each eating occasion (see Appendix C for an example of an application of the scoring system).

In this assessment, there is no upper limit to the number of points that could be assigned to a single food. For instance, if a chicken was skinned, de-boned and chopped, it received a score of three for the subdivision and fractionation category. If it was then boiled and combined in a recipe, it would have been given an additional point for each of the heating and combining categories. Therefore, there is no ceiling on the score of an individual food: its score is dependent on the amount of work involved. Consequently there is also no ceiling on the score of an eating occasion: its score is the summation of the scores of all foods it contains.

4.3.3 Assumptions about Food Preparation

Some assumptions were made consistently of certain foods as to the preparation that they had undergone before consumption in order to accurately score foods (see Appendix B). These assumptions were made so that even if descriptions of preparatory techniques were absent from the dietary recall forms, foods could still receive the scores they deserved. For example if 'chicken' was recorded on a recipe form without any techniques describing its preparation, it was assumed that the chicken was cooked and combined with the other ingredients, thus it would have received a score of two. If pasta was recorded on the recall form with pasta sauce directly above or below it, it would have
received one point for heating and one point for combining (with the sauce), even if these techniques had not been stated on the recall. The assumptions were necessary because the interviewers were not likely to have recorded preparation techniques in circumstances where preparation is understood.

4.3.4 Applying the Scoring System to a Sample of Eating Occasions from the Pilot Study

This scoring system was first applied to a random sample of 49 eating occasions within dietary recalls from the pilot study (i.e. recalls that were not among the 459 recalls of the original study). The objective of this first trial of the scoring system was to confirm that this methodology would differentiate eating occasions by complexity of preparation. Also, this trial helped to establish the assumptions discussed above, that were necessary for accurate scoring.

The initial trial of the scoring system with the recalls from the pilot study demonstrated two important points. Firstly, as previously discussed, the range of scores that individual foods could receive was broad. Therefore when scores of individual foods were summed across eating occasions, the upper range of scores for eating occasions was virtually limitless. Secondly, an eating occasion with a high complexity score was quite a rare event. Intuitively, this makes sense: most eating occasions within a day do not entail preparation. Many eating occasions throughout the day include only beverages or snacks. This knowledge was important in developing an appropriate method of sampling eating
occasions from the entire data set (discussed in section 4.4) to which the scoring system was applied.

4.4 Stratification of the Data Set

4.4.1 Rationale for Stratification

After application to the pilot sample, the scoring system was then applied to a stratified random sample of 150 eating occasions within the data set. In order to capture a broad range of complexity scores, stratification was necessary. If a purely random sample was drawn (as with the pilot study), the majority of eating occasions selected would likely have received low scores, as discussed above. Since one of the objectives of the scoring was to capture the range of preparation complexity that had occurred within the data set, eating occasions were stratified into three groups based on estimations of preparation activity (high, medium and low preparation involved, Figure 4.3). These estimations were in turn based on the number of foods present as recipe ingredients or basic foods (i.e. foods not in a recipe) within an eating occasion, and also on the time of day of the eating occasion. The criteria used to differentiate among the three stratifications groups (high, medium, and low food preparation) were developed from a detailed examination of individual dietary recalls and based on the rationale discussed in section 4.1.
2095 Eating Occasions

'high preparation' group

'low preparation' group

'medium preparation' group

FIGURE 4.3 THREE CATEGORIES OF EATING OCCASIONS USED FOR STRATIFICATION

4.4.2 Stratification Groups

4.4.2.1 High Level of Preparation:

Eating occasions with the following criteria were classified in the 'high' category:

i. A recipe was present at an eating occasion with a high number of recipe foods, defined as seven or more ingredients; or

ii. A high number of basic foods, defined as ten or more basic foods, were consumed together at an eating occasion; or

iii. A recipe was present at an eating occasion with more than three and fewer than seven ingredients, and also, more than six basic foods after 12pm were consumed together.

Fairly complex preparation had occurred at eating occasions classified in this category.

This complex preparation could have been in the form of a 'main dish', such as a stew, or pasta dish, or desserts prepared from scratch, such as cakes or cookies. Several smaller dishes prepared at one eating occasion are often as much work as a single larger dish, and therefore this type of preparation behavior was also classified as highly complex.
according to the above-listed criteria. For example, cooked rice with bean curry and a salad would have been classified at this level.

4.4.2.2 Medium Level of Preparation:

Eating occasions with the following criteria were classified in the 'medium' category:

i. A recipe was present at an eating occasion with more than three and fewer than seven ingredients; or

ii. More than six and fewer than ten basic foods were consumed together at an eating occasion after 12pm.

At this level, an eating occasion contained foods that required some preparation before consumption, or some partially prepared foods that were combined with other foods requiring preparation. Fewer ingredients had been combined in recipes that were contained within these eating occasions than in recipes within those classified at the high level. For example, an eating occasion classified at this level could have contained a ready-made frozen hamburger that was cooked, and a green salad, the ingredients of which required washing and chopping. An eating occasion at this level could also have contained a baked chicken breast and boiled potatoes. An example of a recipe at this level is rice with onion, soya sauce and an egg added to it.

4.4.2.3 Low Level of Preparation:

Eating occasions with the following criteria will be classified in the 'low' category:

i. A recipe was present with up to three ingredients; and/or
ii. Up to six basic foods after 12pm, or any number of basic foods before 12pm were consumed together.

Eating occasions classified in this category were those in which the foods consumed were either in their raw form, or they required very minimal preparation before consumption. For example, pouring a bowl of cereal, toasting a piece of bread, boiling an egg all require minimal preparation. Eating occasions that were classified in this category also included beverages, snacks, ready-made foods that do not require preparation (e.g. baked goods), frozen foods (e.g. frozen pizza, fish sticks) that were pre-prepared and only heating was necessary for their consumption. Recipes were included in eating occasions classified in this category; however, they were very simple with few ingredients (less than four). An example of a recipe within an eating occasion classified at this level is macaroni and cheese ‘dinner’.

Fifty eating occasions were randomly selected from each of the three preparation categories (involving high, medium or low preparation), and the scoring system was applied to this sample of 150 eating occasions. Only eating occasions that contained foods with food preparation codes of ‘H’ were included in the pools from which the samples were selected. Eating occasions when no recipe was present and no basic foods were consumed (only commercial, program, or ‘other’ foods were consumed) were omitted from the selection process. These eating occasions were not selected since the foods they contained would have certainly received complexity scores of zero.
4.5 Results of Scoring

The distribution of complexity scores from the 150 eating occasions is illustrated in Figure 4.4. Table 4.1 presents a summary of the mean, median, minimum and maximum scores for each of the stratification groups. Figures 4.5, 4.6 and 4.7 illustrate the distribution of complexity scores for each of the stratification groups (high, medium and low complexity of preparation). No analyses were conducted to determine differences in scores between the groups since these groups were used only to stratify the data in order to over-sample from the higher end of preparation complexity.

![Figure 4.4 Distribution of All Complexity Scores (n=150 Eating Occasions)]
**Figure 4.5** Distribution of Complexity Scores in Stratum 1, Low Level of Preparation (n=50 eating occasions)

**Figure 4.6** Distribution of Complexity Scores for Stratum 2, Medium Level of Preparation (n=50 eating occasions)

**Figure 4.7** Distribution of Complexity Scores in Stratum 3, High Level of Preparation (n=50 eating occasions)
Table 4.1 Summary of Complexity Scores for the Stratification Groups

<table>
<thead>
<tr>
<th>Stratum</th>
<th>Mean Score ± SD</th>
<th>Minimum, Median, Maximum Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Preparation</td>
<td>2.88 ± 3.17</td>
<td>0, 2, 14</td>
</tr>
<tr>
<td>Medium Preparation</td>
<td>11.76 ± 5.50</td>
<td>1, 11.5, 25</td>
</tr>
<tr>
<td>High Preparation</td>
<td>28.62 ± 13.70</td>
<td>3, 25.5, 76</td>
</tr>
</tbody>
</table>

4.6 Developing a Regression Equation to Estimate Food Preparation Across the Entire Data Set

4.6.1 Rationale for Regression of Complexity Scores

Although the complexity scores are likely to be the most accurate and rigorous method of approximating food preparation activity, only 150 of the 2095 eating occasions in the total sample were scored. Ideally, each eating occasion in the data set would be assigned a score. However, because the scoring system is extremely labour-intensive, it is not feasible to manually review each recall form and assign complexity scores to the 12909 foods contained within 2095 eating occasions in the data set. Instead, the 150 eating occasions were used to develop a regression equation to predict complexity from readily accessible variables. The equation was then used to generate scores for each eating occasion in the entire data set.
4.6.2  Determining the Independent Variables

The first step in developing the regression equation for complexity of preparation was to determine the independent variables to include in the model. The following sections present descriptions of the variables best able to predict preparation scores. However, evaluations of the distributions of the variables are informal: statistical analyses were not conducted since these variables were explored only to determine appropriate independent variables for the regression equation. The variables that were considered were those that were previously discussed in section 4.1 as good indicators of food preparation activity. Those are:

a. The presence of a recipe
b. The number of recipe foods
c. The number of basic foods
d. The time of consumption
e. Any possible interactions between any of the above variables

4.6.2.1  The Presence of a Recipe

As discussed in section 4.1.3, the presence of a recipe was thought to be a very good indicator of the complexity of preparation. To establish this, the distribution of scores of the 150 eating occasions to which the scoring system was applied was examined for eating occasions including recipes (Figure 4.8) versus those without recipes (Figure 4.9).
As was expected, the scores for eating occasions where a recipe was present appeared to be higher than scores for eating occasions where a recipe was not present (see figures 4.8 and 4.9). The mean score for eating occasions with a recipe present (n=92) was $20.57 \pm 14.06$, and for eating occasions where a recipe was not present (n=58), the mean was $4.67 \pm 4.77$. The minimum, median and maximum scores respectively for eating occasions that contained a recipe were 0, 18.5 and 76, and for eating occasions that did not contain
a recipe, those respective scores were 0, 3 and 19. The distribution of scores for eating occasions not containing a recipe was right-skewed, indicating that most of the scores were low. The distribution of scores for eating occasions containing a recipe appears much more broad and wide-ranging, and certainly the scores appears higher.

4.6.2.2 Number of Recipe Foods

A relationship between the number of ingredients in a recipe and the complexity of the preparation involved in the eating occasion was also expected (as discussed in section 4.1.4). This relationship is illustrated in Figure 4.10.
Figure 4.10 Number of Recipe Foods vs. Complexity Score (n=150 Eating Occasions)
There appears to be a fairly linear relationship between the number of recipe foods in an eating occasion and the complexity scores. This indicates that the number of recipe foods would likely be a good variable to use to predict complexity scores in the regression model.

4.6.2.3 Number of Basic Foods

A relationship between the complexity score of an eating occasion and the number of basic foods reported to be consumed within an eating occasion was also expected (as discussed in section 4.1.4). It was also expected that the relationship between the numbers of basic foods and complexity scores would be weaker than the relationship between the numbers of recipe foods and complexity scores (also discussed in section 4.1.4). Figure 4.11 illustrates the relationship between food preparation complexity scores and the number of basic foods contained in an eating occasion. Figure 4.12 illustrates the relationship between the complexity scores and the number of basic foods contained in eating occasions where there was no recipe present.
Figure 4.11 Number of Basic Foods vs. Complexity (n=150 Eating Occasions)
Figure 4.12 Number of Basic Foods vs. Score in Eating Occasions without a Recipe Present (N=58 Eating Occasions)
There does not appear to be a strong relationship between the number of basic foods in an eating occasion, regardless of the presence of a recipe, and the complexity score (see Figure 4.11). However, there does appear to be a relationship between the number of basic foods in an eating occasion and the complexity score when a recipe is not present within an eating occasion (see Figure 4.12). The number of basic foods was therefore also thought to be a useful variable for predicting complexity scores at eating occasions where there was not a recipe present.

4.6.2.4 Time of Day

The time of day variable was thought to be useful in predicting complexity scores since food preparation tends to occur more often in the afternoon and evening hours, as discussed in section 4.1.5. Figures 4.13 and 4.14 illustrate the distributions of the complexity scores of the sample of 150 eating occasions in the AM and PM hours respectively.
The mean complexity score for eating occasions in the AM was 6.15 ± 6.82 and for eating occasions in the PM hours was 17.43 ± 14.44. The minimum, median and maximum scores respectively for eating occasions in the AM hours were 0, 3.5 and 32, and for eating occasions in the PM hours, these scores were 0, 15 and 76. Both
distributions presented in Figures 4.13 and 4.14 range broadly. However, it appears from these distributions demonstrate that food preparation tends to occur more often and more complexly in the PM hours compared to the AM hours.

4.6.3 Developing the Appropriate Model

In order to develop a regression model to predict complexity scores across the entire data set, the four variables discussed in section 4.6.2 were all included initially as independent variables (the presence of a recipe; the number of recipe foods; the number of basic foods and the time of day variable). In addition, interaction terms were included for: the presence of a recipe x the number of basic foods; the number of basic foods x the number of recipe foods; the time of day x the presence of a recipe; the time of day x the number of recipe foods and the time of day x the number of basic foods. The variables that did not contribute significantly (p<0.05) to the model were successively removed until the most appropriate regression equation was achieved. Non-significant interaction terms were removed first, followed by non-significant main effects terms. The final model that was used to predict complexity scores in this sample is presented in Figure 4.15.
## ANALYSIS OF VARIANCE

<table>
<thead>
<tr>
<th>Source</th>
<th>DF</th>
<th>Sum of Squares</th>
<th>Mean Square</th>
<th>F Value</th>
<th>Prob&gt;F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>2</td>
<td>22040.10802</td>
<td>11020.05401</td>
<td>260.340</td>
<td>0.0001</td>
</tr>
<tr>
<td>Error</td>
<td>147</td>
<td>6222.43198</td>
<td>42.32947</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C Total</td>
<td>149</td>
<td>28262.54000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Root MSE: 6.50611
Dep Mean: 14.42000
C.V.: 45.11866

R-square: 0.7798
Adj R-sq: 0.7768

### Parameter Estimates

| Variable      | DF | Parameter Estimate | Standard Error | T for H0: Parameter=0 | Prob > |T| |
|---------------|----|--------------------|----------------|------------------------|--------|
| Intercept     | 1  | -0.227873          | 1.06702773     | -0.214                 | 0.8312 |
| Recipe Foods  | 1  | 2.088269           | 0.09151685     | 22.818                 | 0.0001 |
| Basic Foods   | 1  | 1.178762           | 0.21001210     | 5.613                  | 0.0001 |

### REGRESSION EQUATION

predicted score = 2.09*(number of recipe foods) + 1.18*(number of basic foods)

**Figure 4.15** Regression Model Used to Predict Complexity Scores
4.6.4 Examining the Goodness of Fit of the Regression Equation through Residuals

To assess the aptness of the regression model (Figure 4.15), three plots were examined. The residuals of the dependent variable (predicted complexity score) were plotted against the predicted scores, as well as against both independent variables. The aptness of the model was assessed by examining the residuals for any patterns in the error variance when plotted against each of the variables (39).
FIGURE 4.16 RESIDUALS VS. PREDICTED SCORES FROM THE REGRESSION EQUATION

(N=150 EATING OCCASIONS)
Figure 4.17 Residuals vs. Number of Recipe Foods (N=150 Eating Occasions)
Figure 4.18 Residuals vs. Number of Basic Foods (n=150 Eating Occasions)
Figure 4.16 indicates that the variance of the predicted scores appears to be fairly equally distributed above and below the zero line. It also appears that the variance in the scores may increase as the values for the predicted scores increases; however, there are very few points at the high end, so it is difficult to determine a definite pattern. Similarly, figure 4.17 shows a relatively even spread above and below the zero line. There may also be more variance at the high end of the scale in this plot as well; however, again, there are very few eating occasions with extremely high numbers of foods. Figure 4.18 shows that as the numbers of basic foods in the eating occasion increase, the residuals of the predicted score remain fairly constant above and below the zero line. The regression equation was applied with the awareness that its predictive power may be weaker at the higher end of the complexity scale: the higher the predicted score, the more error within it.

4.7 Assessing the Predictive Capacity of the Regression Equation

A second independent assessment of food preparation was undertaken to assess the predictive capacity of the regression model. A second sample of 150 eating occasions was selected as a stratified random sample without replacement (excluding those chosen for the first sample). A second evaluator used the same detailed method of assessment as was applied to the first sample of eating occasions (described in section 4.3.2).

Although the method of assessment was the same, the method of stratification used to derive the second sample was different in several respects. Firstly, eating occasions were chosen on the basis of the total number of home-prepared foods rather than the number of
recipe foods and basic foods present. Secondly, rather than using the stratification groups described earlier, 75 eating occasions were randomly chosen from the top quartile and 75 from the bottom three quartiles of the distribution of eating occasions by total number of home-prepared foods. This method allowed an over-sampling from the high end of the distribution without forcing eating occasions into groups using variables that are now known to be highly correlated with complexity scores.

One problem arose that made it impossible for the evaluator to score all of the selected 150 eating occasions. The times that were reported on the paper files of six eating occasions were entered incorrectly into the CANDI software system files, such that the times on the two sets of files did not correspond. These six eating occasions were omitted from evaluation, and a total of 144 eating occasions were scored according to complexity of preparation.

To determine how well the regression equation predicts complexity, the scores assigned to the eating occasions from the second assessment were compared with the predicted scores generated from the regression equation for the same eating occasions. To compare predicted and assigned scores, both the Pearson and Spearman rank correlation coefficients were calculated. In addition, predicted and assigned scores were plotted against each other to illustrate the linear correlation between the variables (Figure 4.19).

Both Pearson and Spearman rank correlation coefficients indicate that there is good agreement between the predicted and assigned scores with values of 0.87 and 0.92
respectively. However, Figure 4.19 illustrates that the agreement between predicted and assigned scores appears to be fairly linear. The plotted values appear to be clustered more tightly at the lower end of the scoring and more dispersed at the higher end, indicting that the regression equation is weaker when scores are higher. However, very few points at the high end makes it difficult to determine if a small number of outliers is giving the impression of a pattern.
Figure 4.19 Assigned Score vs. Predicted Score\(^1\) of 144 Eating Occasions, Independently Assessed

\(^{1}\) Predicted scores are from the application of the regression equation derived in section 4.5.3
4.8 Complexity of Preparation

The regression equation developed in section 4.5 was used to estimate the complexity of food preparation that occurred at each eating occasion in the data set. After a score was generated for each eating occasion, scores were summed across the three 24-hour dietary recalls for each participant. The summation was used to estimate the complexity of food preparation that the women had engaged in during the three days of recorded intake data. Three-day means of complexity scores were also calculated for each woman.

4.9 Frequency of Food Preparation

In addition to estimating the complexity of preparation, the complexity scores were used to determine the frequency of at-home "preparation from scratch" for each woman. An operational definition of 'preparation from scratch' was developed by re-examining the relationship between complexity of preparation and number of foods in a recipe. Although the range of the complexity of recipes is broad, most recipes entail a certain amount of preparation from scratch. The likelihood of a recipe being prepared from scratch depends on the number of ingredients used. Recipes with two or three ingredients include items such as condensed soup mixed with water, macaroni and cheese 'dinner', or any beverages that need to be mixed with sugar and water (e.g. fruit drinks). Recipes with four or more ingredients tend to include mostly raw ingredients, implying that preparation from scratch has occurred. Recipes with four ingredients include dishes like vegetable stir-fries that include two vegetables, oil and a spice for flavouring, or rice and bean dishes that include rice, beans, onions and a spice. While heating a jar of store-bought spaghetti sauce would not be classified as preparation from scratch, if the cook
added two vegetables and some meat, or vegetables and spices, the work entailed would be classified as preparation from scratch. Therefore four ingredients in a recipe was used as an indicator for the occurrence of preparation from scratch.

To relate this indicator of preparation from scratch to complexity scores, the regression equation was applied to calculate the complexity score for a hypothetical eating occasion with four recipe foods and no basic foods. This hypothetical eating occasion would receive a score of $8.36 \pm 0.4$. Hence, it was assumed that the preparatory work involved in any eating occasion with a score of eight or greater, regardless of the presence of a recipe, is likely to be equivalent to the work involved in a recipe containing four or more ingredients. Therefore, a cut-point of eight was used to distinguish between eating occasions where food preparation activity from scratch occurred and where it did not. Eating occasions at or above the cut-point were classified as involving preparation from scratch, and those below the cut-point were classified as not involving preparation from scratch. By summing the eating occasions with scores at or above the cut-point, the frequency of preparation from scratch over the three days was determined for each participant. Three day means of the frequency scores were also calculated for each participant.

4.9.1 Assessing the Error Associated with the Preparation Frequency Variable

Once the cut-point was established it was necessary to determine how much variance lay around it. The scores assigned to the 144 eating occasions by way of the scoring system
in the second evaluation of food preparation (see section 4.6) were used to estimate the magnitude of the error surrounding the cut-point. Table 4.2 shows a 2 by 2 contingency table that compares the predicted scores (derived from the regression equation) and the assigned scores (from the scoring system) in terms of the number of eating occasions above and below the cut-point for each scoring method. The predicted and assigned scores of only i i of the 144 eating occasions did not agree. In eight cases the predicted scores indicated that preparation from scratch had occurred while the assigned score did not, and in three cases the reverse was true. This is an indication that the error that occurs around the cut-point with the predicted scores is likely that of over-estimation.

**Table 4.2 Comparison of Predicted versus Assigned Scores in Relation to the Cut-Point for Preparation from Scratch**

<table>
<thead>
<tr>
<th>Assigned Scores</th>
<th>&lt; 8</th>
<th>≥ 8</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Predicted Scores</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 8</td>
<td>67</td>
<td>3</td>
<td>70</td>
</tr>
<tr>
<td>≥ 8</td>
<td>8</td>
<td>66</td>
<td>74</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>75</td>
<td>69</td>
<td>144</td>
</tr>
</tbody>
</table>
4.10  **Summary of the Food Preparation Variables**

The second objective of this study was to describe the food preparation activity occurring in this sample. To accomplish this, the two food preparation variables were applied: food preparation frequency score and food preparation complexity score. The difference between the food preparation frequency and food preparation complexity variables is subtle, since the former is derived from the latter. Food preparation frequency is a measure of how often individuals have prepared food from scratch over a three-day period. Only eating occasions when a defined level of preparation had occurred were included in an individual’s frequency score. Once eating occasions had met the standard, they were included irrespective of how complex the preparation was. In that respect, the frequency scores give a better indication of preparation from scratch, because they eliminate all eating occasions where only minimal amounts of work were done before the foods were consumed.

Complexity scores, in contrast, are average scores over the three days of intake data that include all preparation events, irrespective of whether or not preparation from scratch had occurred. Complexity scores do not indicate whether the preparation occurred at one time point (i.e. preparing a complex meal), or over the entire day (i.e. many smaller meals and snacks). However, the complexity variable was included in analyses because it was deemed important not to exclude participants who had prepared complex meals but had not prepared food from scratch very often.
4.11 Applying the Food Preparation Variables in Analyses

The third objective was to examine the relationships between food preparation and other variables of interest, including total food intake, food selection and socioeconomic and behavioural characteristics.

4.11.1 Total Energy Intake and Food Selection Patterns

In examining the relationships between food preparation and energy intake and food selection, analyses were carried out with both food preparation variables and food group and nutrient intake variables. The relationship between the food preparation variables and energy intake were examined first. Because the food preparation variables are dependent on the number of foods consumed, a correlation between food preparation and energy was thought to be highly likely.

Another reason to determine the relationship between food preparation activity and energy intake is that energy intake was related to food security status in this sample and hence was often compromised (36). Energy intake was also related to other variables of interest, such as food group consumption and nutrient intake. A positive relationship between energy and food preparation activity would necessitate controlling for the confounding effect of energy when examining the relationship between food preparation and these variables (further discussed in section 5.2).

The relationships between consumption patterns of the various food groups and food preparation activity were then examined. To accomplish this, the food group variables
were regressed on the food preparation variables. To control for the confounding effect of energy, mean energy intake was included as a covariate in the model. A multiple regression analysis was run in SAS using the regression procedure (proc reg). The relationships between food preparation and nutrient intakes were examined in the same manner.

4.11.2 Food Security Status

In the primary study, household food insecurity was classified based on the USDA food security module (Hamilton, 1997). The questionnaire was designed to assess food security over the past 30 days and the past 12 months. Participants were classified over the past 12 months as either food secure; food insecure with no hunger evident; food insecure with moderate hunger evident, or food insecure with severe hunger evident. Households classified as food insecure with moderate hunger evident include participants who reported reduced food intake among adult members to the extent that implies that the adult members had repeatedly experienced physiological hunger. Households classified as food insecure with severe hunger evident include participants who reported reduced food intake to such an extent that implies that the adult members of the household had repeatedly experienced physiological hunger, and also that the child members of the household had experienced physiological hunger. Ninety-four percent of households in the sample reported food insecurity on the 12 month scale (35). The USDA food security model was not sensitive enough to distinguish between participants at the upper end of the 30-day scale (those classified as food secure and those classified as food insecure with no hunger evident). Therefore over the past 30 days, participants were classified in
one of three categories: having no hunger evident; food insecure with moderate hunger evident; food insecure with severe hunger evident.

To examine the relationship between food preparation activity and food security status, an analysis of covariance was run using the SAS General Linear Model (GLM) procedure. Food security status over the past 30 days was run as a categorical variable in the model. As food security status is associated with total energy intake (36), mean energy was run as a covariate in the model to control for its confounding effect.

In order to achieve the maximum statistical power, the three 30 day food insecurity categories were collapsed into two groups: those who were classified as having no hunger evident, and those who were classified as food insecure with hunger evident. In addition, only the participants whose three dietary recalls fell within a period of 30 days were included, to correspond with the time-frame of the food security status questionnaire. Therefore, analyses were conducted using a sample size of 145 for this variable.

4.11.3 Household, Personal and Food Acquisition Behavioural Characteristics

Exploratory analyses were undertaken with several other variables to look for possible associations with food preparation activity. These fell under the broad categories of household and personal characteristics, as well as food acquisition behaviours. These variables are listed in Tables 4.3, 4.4 and 4.5. The analyses were exploratory in nature because the limited sample size and considerable heterogeneity in the sample with respect
to many variables of interest meant that we lacked statistical power to test differences between subgroups.

**Table 4.3 Summary of Household Characteristics Analyzed in Relation to Food Preparation Behaviours**

<table>
<thead>
<tr>
<th>Household Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whether any member of the household was employed</td>
</tr>
<tr>
<td>Whether the woman worked outside the home</td>
</tr>
<tr>
<td>Presence of a partner in the household</td>
</tr>
<tr>
<td>Total number of people in the household</td>
</tr>
<tr>
<td>Total number of children in the household</td>
</tr>
<tr>
<td>Household income</td>
</tr>
</tbody>
</table>

**Table 4.4 Summary of Household Characteristics Analyzed in Relation to Food Preparation Behaviours**

<table>
<thead>
<tr>
<th>Personal Characteristics of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immigration status</td>
</tr>
<tr>
<td>Education level</td>
</tr>
<tr>
<td>Region of origin</td>
</tr>
<tr>
<td>Self-reported health</td>
</tr>
<tr>
<td>How often the participant felt alone</td>
</tr>
<tr>
<td>Whether the participant smoked</td>
</tr>
</tbody>
</table>
**Table 4.5** Summary of Food Acquisition Behaviours Analyzed in Relation to Food Preparation Behaviours

<table>
<thead>
<tr>
<th>Food Acquisition Behaviours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency per month that any household member purchased food from a restaurant</td>
</tr>
<tr>
<td>Frequency per month that food is purchased at a large store</td>
</tr>
<tr>
<td>Frequency per month that food was purchased at a convenience store</td>
</tr>
<tr>
<td>Frequency per month that food was purchased at a small store</td>
</tr>
<tr>
<td>Method most likely used to travel home with groceries</td>
</tr>
</tbody>
</table>

### 4.11.3.1 Household Characteristics

Household characteristics were analyzed based on the premise that they perhaps influenced the time that the women had available to prepare foods from scratch. These characteristics may also have influenced household resources. Whether a member of the household held full-time or part-time employment, particularly the woman herself, may have influenced participants’ time demands. Time constraints due to employment may have affected household preparation behaviours and patterns. The relationship between food preparation behaviours and employment of any members of the household was therefore examined.

The presence of a male partner in the household was also examined in relation to household food preparation activity since it may have influenced women’s food preparation behaviours. Women in families tend to take on the main role of preparing and
acquiring food (40). In this sample, approximately 85% of participants did the household grocery shopping, and the vast majority also did the household food preparation. Women in families also tend to cater to food preferences of family members (40). These food preferences might influence food preparation behaviours. This is perhaps particularly applicable to households where a male partner is present, where certain expectations of food preparation (real or perceived) may have been upheld (32).

The number of people and the number of children in the household may have limited participants’ time available to prepare food from scratch. The number of people and children in the household likely also had an impact on the household resources, which may in turn have influenced household food preparation practices.

The relationship between household income and food preparation activity was examined based on the premise that household income might influence the types and amounts of foods purchased and this in turn might influence preparation behaviours. To examine the relationship between food preparation and income, the food preparation variables were regressed on after-shelter income through a simple regression analysis. After-shelter income represents total income for the month minus shelter costs. Since some families lived in rent-geared-to-income housing and others lived in market rental housing, this was a better estimate of their disposable income than total monthly income was.
4.11.3.2 Personal Characteristics

It was also relevant to examine relationships between food preparation practices and certain qualities of the women themselves. Whether immigration status and region of origin affected preparation behaviours were two questions of interest. It is generally thought that the amount of cooking we do as a society has declined in recent decades, as discussed in section 1.1. If a decline in food preparation activity is a cultural attribute of North Americans in general, perhaps it could be demonstrated through analyses such as these.

Among this sample, there was a broad range of education levels. Since education was shown to be negatively associated with body mass index (BMI) in the original study, perhaps eating patterns are different among levels (35). Education has also been shown to be linked to food consumption patterns and nutrient intake levels in several studies (45). If food preparation activity is also associated with consumption patterns, a link between education level and food preparation behaviours might be observed. Analyses were therefore run to examine any differences in preparation behaviours among levels of education.

The relationship between smoking and food preparation activity was examined because smokers are known to have different eating patterns than non-smokers. Studies have shown that non-smokers tend to consume more fruits and vegetables, polyunsaturated fats (in preference to other types of fats), and whole-grain bread compared to smokers (43).
Other studies have shown that non-smokers tend to have higher intakes of vitamin C compared to those of smokers (43).

Many studies have shown that self-rated health is a strong predictor of morbidity and mortality and is strongly correlated with health problems (44). The self-rated health variable is of particular importance in this population because people living in poverty in Ontario are much more likely to report fair or poor health than others are (44). Examining the relationship between food preparation activity and self-rated health could indicate whether preparation behaviours influence health (or vice-versa).

The relationships between household and personal characteristics and food preparation activity were examined in an unbalanced analysis of variance (ANOVA) using the GLM procedure in SAS, with the exception of household income, which was run as a simple regression analysis using the REG procedure in SAS. Each of the above mentioned variables was run as categorical variables in the analyses.

4.11.3.3 Food Acquisition Behaviours

The rationale for examining food preparation in relation to reported food acquisition behaviours is that food preparation activity is dependent on the numbers and types of foods consumed. The numbers and types of foods in the household in turn may be determined in part by certain food acquisition patterns.
The frequency per month that any household member purchased food at a restaurant might have influenced food preparation behaviours. The more often food is purchased at a restaurant, the less participants are likely to be preparing food at home.

The frequency per month that food was purchased at a large supermarket, a convenience store or a small market might also influence food preparation behaviours. These factors might indicate types of foods available in the household. If participants were only able to purchase food at one large shopping trip per month, fewer foods might be available at the end of the month, particularly fresh fruits and vegetables. The availability of certain types of food in the household would certainly influence food preparation complexity (and perhaps frequency) since complexity scores are often high when these foods are present in recipes.

The method most likely used to travel home with groceries purchased from a supermarket might also influence the types of foods that were purchased. This variable was also examined for an association with food preparation behaviours.

The relationships between these food acquisition behaviours and food preparation activity were examined through an unbalanced ANOVA using the GLM procedure in SAS. These variables were run as categorical variables in the models.
CHAPTER 5: RESULTS AND DISCUSSION

In this chapter, the results and discussion of analyses will be presented. The distribution of the preparation scores for the entire data set will first be presented, as well as the distribution of the food preparation variables used in analyses, including a brief discussion of the normality of the distributions. The complexity and frequency of preparation in the data set will then be described. The relationship between food preparation and total food intake will be presented and discussed, followed by the examination of the relationship between food preparation and food group and nutrient intakes. Following this, results of the analyses between food preparation activity and personal, and household characteristics, household food security statuses and food acquisition behaviours will then be presented and discussed.

5.1 Food Preparation Activity

5.1.1 Preparation Complexity

The distribution for complexity scores across eating occasions is illustrated in Figure 5.1. This highly right-skewed distribution indicates that complex food preparation activity is a relatively rare event. Approximately 45% of eating occasions had scores of three or less. These eating occasions likely consisted of beverages such as teas or coffees and/or snacks that required very little preparation. Only 30% of eating occasions had scores that indicated that preparation from scratch had occurred (complexity score ≥ 8).
Once complexity scores were summed by participants across the 3 days of data, the distributions appeared more normal. Figure 5.2 illustrates the 3-day totals of complexity scores for participants (n=153). Figure 5.3 illustrates the 3-day means of complexity scores for participants. Since these distributions are reflections of each other, only one of these variables (3-day means of complexity score) was used in subsequent analyses. The terms 'complexity score' and 'preparation complexity' will be used interchangeably to describe the 3-day mean complexity score variable from this point forward.

**Figure 5.1** DISTRIBUTION OF PREDICTED COMPLEXITY SCORES FOR EATING OCCASIONS (N=2095)
Approximately half of the participants in the sample had complexity scores of greater than 30 (Figure 5.3). The average complexity score in this sample was 32.8 ± 15.9. The median score was approximately 30 and the minimum and maximum scores were approximately zero and 100 respectively.
5.1.2 Preparation Frequency

Figure 5.4 presents the distribution of the number of eating occasions per participant estimated to entail preparation from scratch (i.e. complexity score of eating occasions ≥ 8) over the three days of recorded dietary intake. The average number of times that women consumed foods prepared from scratch over the three days was $3.7 \pm 1.8$. The median number was three, the minimum zero and the maximum eight. A 3-day mean for the frequency of preparation from scratch was calculated and used in subsequent analyses with nutrients and food groups. The 3-day total frequency of preparation was used in all other analyses.

![Bar chart showing the distribution of the number of eating occasions per participant involving preparation from scratch over 3 days (n=153)](image)

**Figure 5.4 Distribution of the Number of Eating Occasions per Participant Involving Preparation from Scratch over 3 Days (n=153)**

The 3-day total of the frequency of preparation was used to describe the number of participants who had prepared food from scratch on one, two, all three, or none of the days of recorded intake. Figure 5.5 shows that almost all women (97%) prepared food from scratch at least once on one of the three days. Most women (57%) prepared food
from scratch at least once on each of the three days. It should be noted that only four women (3%) in the sample did not prepare food from scratch at all over the three days that were examined.

![Pie chart showing the distribution of days participants engaged in at home food preparation.](chart)

**Figure 5.5** Percentage of Participants who Engaged in At Home Food Preparation on 0, 1, 2, or 3 Days over the Three Days of Recorded Dietary Intake (N=153)

### 5.1.3 Assessing Normality of the Food Preparation Variables

Prior to using the two food preparation variables in analysis, normality of the distributions for each food preparation variable (Figures 5.3 and 5.4) was assessed using the Shapiro-Wilk statistic. This statistic compares the distribution of interest to a normal distribution through correlation and determines if the correlation differs significantly from one. A value of one indicates a completely normal distribution, and the more the
correlation differs from one, the more skewed the distribution (39). The preparation complexity variable had a Shapiro-Wilk statistic value of 0.97 (p=0.015), and the frequency variable had a value of 0.94 (p=0.001). Although both values were statistically significantly different from one, departure from normality was minor, so the decision was made to proceed without transformation of the distributions of the food preparation variables. It should be noted however that normality of these variables is only an issue if they are used in analysis of variance.

5.2 Total Food Intake (Energy)

The first question explored through statistical analysis was the relationship between food preparation and energy intake. As mentioned in section 4.11.1, because the food preparation variables are dependent on the number of foods reported consumed, a correlation between food preparation and energy was thought to be highly likely.

**Table 5.1 Correlation of 3-Day Mean Energy Intake with Food Preparation Variables (n=153 Women)**

<table>
<thead>
<tr>
<th></th>
<th>Pearson r</th>
<th>p-value</th>
<th>Spearman r</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparation Complexity</td>
<td>0.42</td>
<td>0.0001</td>
<td>0.48</td>
<td>0.0001</td>
</tr>
<tr>
<td>Preparation Frequency</td>
<td>0.47</td>
<td>0.0001</td>
<td>0.52</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
There is in fact a significant relationship between food preparation and energy intake (Table 5.1). The positive relationship between energy and food preparation activity was expected, since the food preparation complexity scores were dependent on the number of foods reported consumed at an eating occasion. The more foods that were consumed, the higher the complexity and frequency scores were. Also, in general, the more foods that are consumed, the higher energy intake is. Therefore, energy intakes tended to increase as frequency and complexity scores increased, suggesting that the higher the energy intake, the greater the likelihood of consuming foods prepared from scratch and the greater the complexity of the preparation involved. As noted in sections 4.11.1, one of the implications of this finding is that it is necessary to control for energy in subsequent analyses of variables that are also correlated with energy (discussed in section 4.9).

5.3 Food Selection and Dietary Quality

5.3.1 Food Groups

Food group consumption in this sample is summarized in Table 5.2. With the exception of the meat and meat alternates food group, the group mean of 3-day means for individuals of the number of servings consumed of each of the food groups analyzed was below the recommendations made by Canada's Food Guide (41).
To examine the relationships between the number of servings of the various food groups and food preparation activity, food groups were regressed on both food preparation complexity and food preparation frequency scores (Table 5.2). The models were also run including 3-day mean energy intake as a covariate to control for the differences in total energy intake.

1 Recommendations taken from Canada's Food Guide.
### Table 5.3 Regression Analysis of the Relationship between Food Preparation Complexity and Food Group Consumption. (n=153 Women)

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Model 1&lt;sup&gt;1&lt;/sup&gt; β ± SE (p-value)</th>
<th>Model 1&lt;sup&gt;1&lt;/sup&gt; R²</th>
<th>Model 2&lt;sup&gt;2&lt;/sup&gt; R²</th>
<th>Model 3&lt;sup&gt;3&lt;/sup&gt; β ± SE (p-value)</th>
<th>Model 3&lt;sup&gt;3&lt;/sup&gt; R²</th>
<th>Increment in R²&lt;sup&gt;4&lt;/sup&gt; Attributed to Food Preparation After Adjustment for Energy Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits &amp; Vegetables</td>
<td>0.07 ± 0.01 (&lt;0.01)</td>
<td>0.15</td>
<td>0.21</td>
<td>0.04 ± 0.01 (&lt;0.01)</td>
<td>0.26</td>
<td>0.05</td>
</tr>
<tr>
<td>Grain Products</td>
<td>0.06 ± 0.01 (&lt;0.01)</td>
<td>0.19</td>
<td>0.47</td>
<td>0.02 ± 0.01 (&lt;0.01)</td>
<td>0.50</td>
<td>0.03</td>
</tr>
<tr>
<td>Meat &amp; Meat Alternates</td>
<td>0.03 ± 0.01 (&lt;0.01)</td>
<td>0.13</td>
<td>0.34</td>
<td>0.01 ± 0.01 (&lt;0.05)</td>
<td>0.36</td>
<td>0.02</td>
</tr>
<tr>
<td>Dairy Products</td>
<td>0.01 ± 0.01 (&lt;0.05)</td>
<td>0.04</td>
<td>0.312</td>
<td>-0.002 ± 0.003 (0.58)</td>
<td>0.313</td>
<td>0.001</td>
</tr>
</tbody>
</table>

<sup>1</sup> Regression Model 1: Food Group = Preparation Complexity  
<sup>2</sup> Regression Model 2: Food Group = Mean Energy Intake  
<sup>3</sup> Regression Model 3: Food Group = Preparation Complexity + Mean Energy Intake; the coefficient displayed is that for preparation complexity.  
<sup>4</sup> Increment in R² attributed to Food Preparation = R² (Model 3) – R² (Model 2)

There is a significant positive relationship between complexity scores and consumption of the fruit and vegetables, grain products, the meat and meat alternates and the dairy products food groups. Once energy intake is controlled for, the strength of the relationships examined in Table 5.3 weakens. When energy is taken into account, for every unit of increase in the complexity of preparation, there is an increase of approximately only 0.04 servings of fruits and vegetables, 0.02 servings of grain products, 0.01 servings of meat and meat alternates and no significant increase in the servings of dairy products.
The complexity scores do not explain the variation in consumption of these food groups to a great extent once the confounding effect of energy intake is taken into account. The mean complexity scores explain approximately 5% of the variance in consumption of the fruit & vegetable food group, 3% of the variance in consumption of the grain product group, and 2% of the variance in the meat and meat alternates group once energy intake is controlled for.

**Table 5.4 Regression Analysis of the Relationship between 3D Mean Food Preparation Frequency and Food Group Consumption. (N=153 Women)**

<table>
<thead>
<tr>
<th>Food Group</th>
<th>Model 1 (\beta \pm SE) (p-value)</th>
<th>Model 1 (R^2)</th>
<th>Model 2 (R^2)</th>
<th>Model 3 (\beta \pm SE) (p-value)</th>
<th>Model 3 (R^2)</th>
<th>Increment in (R^2) Attributed to Food Preparation After Adjustment for Energy Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits &amp; Vegetables</td>
<td>1.79 ± 0.34 (0.01)</td>
<td>0.16</td>
<td>0.21</td>
<td>1.03 ± 0.36 (0.01)</td>
<td>0.26</td>
<td>0.05</td>
</tr>
<tr>
<td>Grain Products</td>
<td>1.63 ± 0.27 (0.01)</td>
<td>0.19</td>
<td>0.47</td>
<td>0.55 ± 0.25 (0.01)</td>
<td>0.49</td>
<td>0.02</td>
</tr>
<tr>
<td>Meat &amp; Meat Alternates</td>
<td>0.82 ± 0.15 (0.01)</td>
<td>0.17</td>
<td>0.34</td>
<td>0.35 ± 0.15 (0.05)</td>
<td>0.37</td>
<td>0.03</td>
</tr>
<tr>
<td>Dairy Products</td>
<td>0.24 ± 0.10 (0.05)</td>
<td>0.03</td>
<td>0.31</td>
<td>-0.12 ± 0.10 (0.58)</td>
<td>0.32</td>
<td>0.01</td>
</tr>
</tbody>
</table>

1. Regression Model 1: Food Group = Preparation Frequency  
2. Regression Model 2: Food Group = Mean Energy Intake  
3. Regression Model 3: Food Group = Preparation Frequency + Mean Energy Intake; the coefficient displayed is that for preparation frequency.  
4. Increment in \(R^2\) attributed to Food Preparation = \(R^2\) (Model 3) - \(R^2\) (Model 2)

As with complexity, food preparation frequency appears to be significantly and positively related to consumption of the fruit and vegetable, grain product, meat and meat alternates, and dairy products food groups. Once energy was controlled for, the strength of the
associations diminishes markedly (Table 5.4). For every unit of increase in the 3d mean frequency of preparation from scratch, there is an increase of approximately only 1 serving of fruits and vegetables, 0.6 servings of grain products, 0.3 servings of meat and meat alternates and no significant increase in servings of dairy products.

The preparation frequency variable, like the complexity variable, only accounts for approximately 4% of the variance in consumption of the fruit and vegetable food group once the effect of energy intake is controlled for. Approximately only 2% of the variance of consumption grain product food group and only 3% of the meat and alternates food group, is accounted by preparation frequency, once the effect of energy is taken into account.

In summary, food preparation frequency and complexity were found to elicit a modest positive effect on consumption of fruits and vegetables, grain products and meat and meat alternates, but not dairy products, once the confounding effect of energy was controlled for. There is likely no relationship between consumption of dairy products and food preparation perhaps because many of these types of foods do not require preparation before consumption. However, consumption of dairy products in this sample was extremely low overall (see Table 5.2), so perhaps there was not sufficient variation to detect a relationship with food preparation activity.

In contrast with many dairy products, various vegetables require a certain amount of preparation before consumption: usually vegetables are at least washed, often subdivided and/or cooked in some way. Fruits also often require a minimum amount of preparation
before consumption, although they are not usually cooked. The significant association between food preparation and consumption of grain products and meat and meat alternates also likely relates to the minimum amount of preparation often required before the consumption of these types of foods. For example, most meat requires cooking, as do legumes. Pastas and rice also require cooking before consumption. The associations found between these food groups and the food preparation variables indicate that (to a small extent) the more frequently people were preparing foods from scratch, the higher their consumption of fruit and vegetables, grain products and meat and meat alternates groups. It also indicates that the more complex participants’ preparation patterns were, the higher their intakes of these food groups.

In conclusion, although the associations described above were statistically significant, once the effect of energy was controlled for, only a very minute proportion of the variance in consumption of food groups was explained. The increment in $R^2$ attributed to the food preparation variables in the regression models ranged from only approximately 1% to 4% (see Tables 5.3 and 5.4). Neither food preparation frequency nor complexity appears to contribute considerably to explaining consumption patterns of food groups. The amount of energy consumed appears to be far more powerful in explaining the number of servings of food groups consumed (Tables 5.3 and 5.4). The more energy participants were consuming, the higher their consumption of fruits and vegetables, grain products and meat and meat alternates tended to be.
Although the associations between food group consumption and preparation activity are significant, the strengths of these relationships are weak, as indicated by their coefficients in the regression models. For example, an increase in the 3-day mean frequency of preparation increases the servings of fruits and vegetables by approximately only 1. In addition, the frequency of preparation from scratch appears to be more strongly related to food group consumption than the complexity of preparation; however, the 3-day mean preparation complexity score is approximately 32, while the 3-day mean frequency of preparation is only 1 (i.e. the units for the complexity score are much smaller: individual preparation techniques occur much more frequently over the day than preparation of entire meals from scratch). When the units are considered, over the day, complexity of preparation tends to be slightly more strongly related to food group selection patterns than the frequency of preparation. However, since associations with both variables are small, neither the complexity nor the frequency of preparation is likely to impact food group consumption patterns greatly.

5.3.2 Nutrients

Although some food groups generally tend to be higher in certain micronutrients than others, micronutrients do not categorize neatly into food groups. For this reason micronutrient intake was also examined with respect to both complexity and frequency of food preparation activity. The relationship between macronutrient intakes and food preparation behaviours were also examined.
Micronutrients selected for analysis with food preparation activity were chosen on the basis of their prevalence of inadequacy\(^2\) within this sample: micronutrients with a higher prevalence of inadequacy were of most interest (Table 5.5).

\(^2\) Prevalence of inadequacy was estimated by Tarasuk and Beaton (1999), using the probability approach developed by Beaton.
TABLE 5.5 MEAN INTAKES, ESTIMATED USUAL INTAKES, MEAN REQUIREMENTS, AND PREVALENCE OF INADEQUACY FOR SELECTED NUTRIENTS (N=153 WOMEN)*

<table>
<thead>
<tr>
<th>Nutrient (units)</th>
<th>Mean Intake ± SD</th>
<th>Estimated Usual Intake¹</th>
<th>Requirement² (Mean ± SD)</th>
<th>Prevalence of Inadequacy³</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate (g/d)</td>
<td>220 ± 97.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Protein (g/d)</td>
<td>59.0 ± 26.9</td>
<td>64.6 ± 22.2</td>
<td>41.2 ± 5.2</td>
<td>14.5%</td>
</tr>
<tr>
<td>Fat (g/d)</td>
<td>49.1 ± 28.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Vitamin C (mg/d)</td>
<td>92.5 ± 72.8</td>
<td>106 ± 63.3</td>
<td>20 ± 5</td>
<td>3.0%</td>
</tr>
<tr>
<td>Vitamin A (RE/d)</td>
<td>925 ± 1199</td>
<td>1058 ± 759</td>
<td>600 ± 100</td>
<td>28.4%</td>
</tr>
<tr>
<td>Folate (μg/d)</td>
<td>174 ± 96.5</td>
<td>189 ± 72.4</td>
<td>132 ± 35</td>
<td>22.5%</td>
</tr>
<tr>
<td>Iron (mg/d)</td>
<td>10.0 ± 5.34</td>
<td>10.7 ± 4.05</td>
<td>See text.</td>
<td>38.2%</td>
</tr>
<tr>
<td>Magnesium (mg/d)</td>
<td>210 ± 92.3</td>
<td>224 ± 79.3</td>
<td>180 ± 10</td>
<td>31.2%</td>
</tr>
<tr>
<td>Zinc (mg/d)</td>
<td>7.99 ± 4.06</td>
<td>8.62 ± 3.03</td>
<td>4.6 ± 2.0</td>
<td>12.2%</td>
</tr>
<tr>
<td>Calcium (mg/d)</td>
<td>506 ± 305</td>
<td>532 ± 261</td>
<td>n/a</td>
<td>n/a</td>
</tr>
</tbody>
</table>

¹ The observed distribution of intakes, based on 3 x 24 hr recalls, was adjusted to estimate the distribution of usual intakes, taking into account sequence effects and within-person variance.

² Mean requirement estimates are based on the 1990 Canadian requirement estimates for all nutrients except iron. Basal iron requirement was estimated using data from the FAO/WHO 1988 report, assuming iron absorption of 15%.

³ Predicted % of women with usual intakes below own requirement.


The relationships between nutrient intakes and food preparation activity are presented in Tables 5.6 and 5.7.
There are significant positive relationships between food preparation complexity and carbohydrate intake, protein and fat intakes, vitamin C intake, vitamin A intake, folate intake, iron intake, magnesium intake, zinc intake and calcium intake (Table 5.6). However, once energy intake is taken into account, the strengths of the relationships between food preparation complexity and nutrient intakes weaken, and significance is lost for both fat and protein intakes (Table 5.6). For each unit of increase in the complexity of preparation there is a unit increase of 0.02 in carbohydrate intake, 0.04 for vitamin C intake, 0.02 for vitamin A, 0.03 for folate, 0.001 for iron, 0.02 for magnesium, 0.003 for zinc and 0.001 for calcium intake.

Preparation complexity explains very little of the variance in nutrient intakes once the confounding effect of energy intake is taken into account. Complexity scores explain approximately 1% of the variation in consumption of carbohydrates once the effect of energy intake is controlled for. Complexity scores account for approximately 14% of the variance in vitamin C intake, 11% in vitamin A intake, 3% in folate intake, 4% in magnesium intake and 1% in iron, zinc and calcium intakes once the effect of energy is controlled for.
**Table 5.6 Regression Analysis of the Relationship between Food Preparation Complexity and Nutrient Intakes. (N=153 Women)**

<table>
<thead>
<tr>
<th>Nutrient (units)</th>
<th>Model 1&lt;sup&gt;1&lt;/sup&gt; (\beta \pm SE) (p-value)</th>
<th>Model 1 (R^2&lt;sup&gt;1&lt;/sup&gt;&lt;/sup&gt;</th>
<th>Model 2 (R^2&lt;sup&gt;2&lt;/sup&gt;&lt;/sup&gt;</th>
<th>Model 3&lt;sup&gt;1&lt;/sup&gt; (\beta \pm SE) (p-value)</th>
<th>Model 3 (R^2&lt;sup&gt;3&lt;/sup&gt;&lt;/sup&gt; After Adjustment for Energy Intake</th>
<th>Increment in (R^2&lt;sup&gt;4&lt;/sup&gt;&lt;/sup&gt; Attributed to Food Preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate (g/d)</td>
<td>0.10 ± 0.01 (&lt;0.01)</td>
<td>0.23</td>
<td>0.82</td>
<td>0.02 ± 0.01 (&lt;0.01)</td>
<td>0.83</td>
<td>0.01</td>
</tr>
<tr>
<td>Protein (g/d)</td>
<td>0.05 ± 0.01 (&lt;0.01)</td>
<td>0.17</td>
<td>0.66</td>
<td>0.01 ± 0.005 (0.07)</td>
<td>0.67</td>
<td>0.01</td>
</tr>
<tr>
<td>Fat (g/d)</td>
<td>0.01 ± 0.002 (&lt;0.01)</td>
<td>0.09</td>
<td>0.685</td>
<td>-0.02 ± 0.002 (0.23)</td>
<td>0.688</td>
<td>0.003</td>
</tr>
<tr>
<td>Vitamin C (mg/d)</td>
<td>0.04 ± 0.006 (&lt;0.01)</td>
<td>0.24</td>
<td>0.13</td>
<td>0.04 ± 0.01 (&lt;0.01)</td>
<td>0.27</td>
<td>0.14</td>
</tr>
<tr>
<td>Vitamin A (RE/d)</td>
<td>0.002 ± 0.0003 (&lt;0.01)</td>
<td>0.20</td>
<td>0.13</td>
<td>0.002 ± 0.0003 (&lt;0.01)</td>
<td>0.24</td>
<td>0.11</td>
</tr>
<tr>
<td>Folate (μg/d)</td>
<td>0.06 ± 0.01 (&lt;0.01)</td>
<td>0.16</td>
<td>0.33</td>
<td>0.03 ± 0.01 (&lt;0.05)</td>
<td>0.36</td>
<td>0.03</td>
</tr>
<tr>
<td>Iron (mg/d)</td>
<td>0.004 ± 0.001 (&lt;0.01)</td>
<td>0.20</td>
<td>0.68</td>
<td>0.001 ± 0.0004 (&lt;0.05)</td>
<td>0.69</td>
<td>0.01</td>
</tr>
<tr>
<td>Magnesium (mg/d)</td>
<td>0.05 ± 0.01 (&lt;0.01)</td>
<td>0.27</td>
<td>0.64</td>
<td>0.02 ± 0.004 (&lt;0.01)</td>
<td>0.68</td>
<td>0.04</td>
</tr>
<tr>
<td>Zinc (mg/d)</td>
<td>0.01 ± 0.002 (&lt;0.01)</td>
<td>0.19</td>
<td>0.63</td>
<td>0.003 ± 0.002 (&lt;0.05)</td>
<td>0.64</td>
<td>0.01</td>
</tr>
<tr>
<td>Calcium (mg/d)</td>
<td>0.003 ± 0.001 (&lt;0.01)</td>
<td>0.17</td>
<td>0.55</td>
<td>0.001 ± 0.0004 (&lt;0.05)</td>
<td>0.56</td>
<td>0.01</td>
</tr>
</tbody>
</table>

<sup>1</sup> Regression Model 1: Nutrient = Preparation Complexity

<sup>2</sup> Regression Model 2: Nutrient = Mean Energy Intake

<sup>3</sup> Regression Model 3: Nutrient = Preparation Complexity + Mean Energy Intake; the coefficient displayed is that for preparation complexity.

<sup>4</sup> Increment in \(R^2\) attributed to Food Preparation = \(R^2\) (Model 3) - \(R^2\) (Model 2)
### TABLE 5.7 REGRESSION ANALYSIS OF THE RELATIONSHIP BETWEEN 3D MEAN FOOD PREPARATION FREQUENCY AND NUTRIENT INTAKES. (N=153 WOMEN)

<table>
<thead>
<tr>
<th>Nutrient (units)</th>
<th>Model 1 $^1$ $\beta \pm SE$ (p-value)</th>
<th>Model 1 $R^2$</th>
<th>Model 2 $R^2$</th>
<th>Model 3 $^3$ $\beta \pm SE$ (p-value)</th>
<th>Model 3 $R^3$</th>
<th>Increment in $R^2$ Attributed to Food Preparation After Adjustment for Energy Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate (g/d)</td>
<td>2.55 ± 0.37 (&lt;0.01)</td>
<td>0.24</td>
<td>0.824</td>
<td>0.45 ± 0.20 (&lt;0.05)</td>
<td>0.825</td>
<td>0.001</td>
</tr>
<tr>
<td>Protein (g/d)</td>
<td>1.34 ± 0.20 (&lt;0.01)</td>
<td>0.23</td>
<td>0.65</td>
<td>0.36 ± 0.15 (&lt;0.05)</td>
<td>0.66</td>
<td>0.01</td>
</tr>
<tr>
<td>Fat (g/d)</td>
<td>0.31 ± 0.06 (&lt;0.01)</td>
<td>0.14</td>
<td>0.69</td>
<td>-0.02 ± 0.04 (0.66)</td>
<td>0.69</td>
<td>0</td>
</tr>
<tr>
<td>Vitamin C (mg/d)</td>
<td>1.07 ± 0.16 (&lt;0.01)</td>
<td>0.23</td>
<td>0.13</td>
<td>0.88 ± 0.18 (&lt;0.01)</td>
<td>0.26</td>
<td>0.13</td>
</tr>
<tr>
<td>Vitamin A (RE/d)</td>
<td>0.04 ± 0.01 (&lt;0.01)</td>
<td>0.14</td>
<td>0.12</td>
<td>0.03 ± 0.01 (&lt;0.01)</td>
<td>0.18</td>
<td>0.06</td>
</tr>
<tr>
<td>Folate (µg/d)</td>
<td>1.78 ± 0.28 (&lt;0.01)</td>
<td>0.20</td>
<td>0.33</td>
<td>0.94 ± 0.29 (&lt;0.01)</td>
<td>0.38</td>
<td>0.05</td>
</tr>
<tr>
<td>Iron (mg/d)</td>
<td>0.12 ± 0.02 (&lt;0.01)</td>
<td>0.26</td>
<td>0.68</td>
<td>0.04 ± 0.01 (&lt;0.01)</td>
<td>0.70</td>
<td>0.02</td>
</tr>
<tr>
<td>Magnesium (mg/d)</td>
<td>0.05 ± 0.01 (&lt;0.01)</td>
<td>0.27</td>
<td>0.64</td>
<td>0.44 ± 0.12 (&lt;0.01)</td>
<td>0.67</td>
<td>0.03</td>
</tr>
<tr>
<td>Zinc (mg/d)</td>
<td>0.35 ± 0.05 (&lt;0.01)</td>
<td>0.22</td>
<td>0.62</td>
<td>0.10 ± 0.04 (&lt;0.05)</td>
<td>0.64</td>
<td>0.02</td>
</tr>
<tr>
<td>Calcium (mg/d)</td>
<td>0.07 ± 0.01 (&lt;0.01)</td>
<td>0.17</td>
<td>0.551</td>
<td>0.02 ± 0.01 (0.14)</td>
<td>0.552</td>
<td>0.001</td>
</tr>
</tbody>
</table>

$^1$ Regression Model 1: Nutrient = Preparation Frequency  
$^2$ Regression Model 2: Nutrient = Mean Energy Intake  
$^3$ Regression Model 3: Nutrient = Preparation Frequency + Mean Energy Intake; the coefficient displayed is that for preparation frequency.  
$^4$ Increment in $R^2$ attributed to Food Preparation = $R^2$ (Model 3) – $R^2$ (Model 2)

The frequency of preparation from scratch is significantly and positively related to carbohydrate, vitamin C, vitamin A, folate, iron, magnesium and zinc intakes (Table 5.7).

There does not appear to be relationships between preparation frequency and fat, protein...
or calcium intakes. Frequency of preparation, again like complexity of preparation, explains very little of the variance of the intakes of these nutrients once the confounding effect of energy intake is controlled for. When energy intake is taken into account, preparation frequency explains less than 1% of the variation in the consumption of carbohydrate, approximately 12% of the variance in vitamin C intake, 6% of the variance in vitamin A, 5% in folate intake, 2% in iron intake, 3% in magnesium intake, 1% in zinc intake.

Again, once energy is controlled for, the strength of the associations diminishes, and fat and calcium intakes lose significance (Table 5.7). For every unit of increase in the mean frequency of preparation, there is a unit increase of 0.5 for carbohydrate intake, 0.4 for protein intake, 0.9 for vitamin C, 0.3 for vitamin A, 0.9 for folate, 0.04 for iron, 0.4 for magnesium and 0.1 for zinc intake.

In summary, most of the variance in consumption of the macronutrients was explained by energy intake (Tables 5.6 and 5.7), as macronutrient intake is highly correlated with energy intake. Micronutrient intake is also significantly correlated with energy intake. However, a greater proportion of the variance in intake was explained by food preparation for certain of the micronutrients compared to the macronutrients. Intake of vitamin C and vitamin A were positively associated with both food preparation complexity and frequency. This could be the case if many foods that are rich in vitamins C and A tended to be prepared before being consumed. For example, foods rich in vitamin A, such as carrots and liver always require at least some minimum amount of...
preparation, whether it be washing and peeling or cooking. Similarly, foods rich in vitamin C, as many fruits and vegetables are, are also often associated with at least a minimum level of preparation.

There were also positive (albeit weak) associations between food preparation activity and consumption of the other micronutrients (with the exception of calcium), perhaps because foods rich in these micronutrient require a minimum amount of preparation before consumption. Once energy was controlled for, the relationship between calcium intake and food preparation disappeared, likely because the dietary calcium typically consumed often comes from dairy products, which do not generally require preparation. In short, if a nutrient is rich in many foods that require preparation before their consumption, it will likely be more strongly associated with food preparation.

Preparation complexity tended to explain a higher amount of the variance in micronutrient intake than preparation frequency did, particularly in the case of vitamin A and vitamin C consumption. This may be because the more complex the dishes are, the more foods are being used in preparation. Likely more foods being used also means that more different types of foods are being used. The more different types of foods are used, the more likely the inclusion of a food rich in these nutrients (or many foods containing in these nutrients). For example, complexly prepared recipes often include many different types of vegetables, which are rich in micronutrients. Therefore, it is more likely that there will be higher intakes of micronutrients at eating occasions where a complex dish has been prepared.
As with the food groups, although many of the associations between food preparation and nutrient intake were significant, their coefficients in the regression models indicate that the strengths of the relationships are likely too weak to impact dietary intake to any great extent. For example, vitamin A intake increases on average only 0.03 RE/d for each time preparation from scratch occurs on average per day. In these analyses, the 3-day mean frequency of preparation also appears to be more strongly related to food preparation than the complexity of preparation; however, this is due to the units of these variables, as discussed in section 5.3.1. Over the entire day, on average, preparation complexity tends to be slightly more strongly related to nutrient intakes than the frequency of preparation. However, it should be noted again that all associations are weak and food preparation activity (both complexity and frequency) is not likely to impact nutrient intakes to the extent that prevalence of inadequacies is affected.

5.3.3 Food Preparation and Food Security

Approximately 93.5% of participants reported some degree of household food insecurity over the past 12 months. Once the groups were collapsed, as described in section 4.9.2, 43% of the sample was classified as having no hunger evident, and 57% was classified as food insecure with hunger evident over the past 30 days. The relationships between food insecurity and food preparation complexity and frequency were then examined. Table 5.8 presents the results of the analysis of covariance when it is considered in conjunction with mean energy intake.
### Table 5.8 Examination of the Relationship Between Food Preparation Activity and Food Security Status* (N=145 Women)

<table>
<thead>
<tr>
<th>Food Security Status</th>
<th>n</th>
<th>Mean Complexity ± SD</th>
<th>F-value*, 2 df (p-value)</th>
<th>3d Total Mean Frequency ± SD</th>
<th>F-value*, 2 df (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Hunger Evident</td>
<td>62</td>
<td>38.1 ± 17.1</td>
<td>5.63 (0.02)</td>
<td>4.1 ± 12.0</td>
<td>2.02 (0.16)</td>
</tr>
<tr>
<td>Food Insecure with Hunger Evident</td>
<td>83</td>
<td>29.6 ± 14.2</td>
<td></td>
<td>3.4 ± 1.7</td>
<td></td>
</tr>
</tbody>
</table>

* Analysis of Covariance (PROC GLM) Model: Food Preparation Variable = Food Security Status + Mean Energy

1 F-value for the Food Security Status parameter

Food preparation complexity, but not frequency, is significantly associated with food security status (Table 5.8) once energy intake is taken into account. Participants who were classified as having no hunger evident had higher mean complexity scores than those who were classified as food insecure with hunger evident. However, food security status contributes only 4% in explaining the variation in food preparation complexity in the model once the confounding effect of energy is controlled for.

These results indicate that participants who were classified as food insecure with hunger evident tended to prepare foods from scratch as often as those who were classified as having no hunger evident. However, the group that was classified as food insecure with hunger evident had significantly lower complexity scores than those with classified with no hunger evident. This indicates that the ‘hunger evident’ group tended to include fewer foods into dishes that they prepared, likely because the amount of food available for preparation was compromised.
It is not surprising that the complexity score is more sensitive to food deprivation than the frequency score is. The complexity score is a better approximation of the number of foods that an individual has consumed: food preparation complexity is indicative of the number of 'home-prepared' foods consumed. An individual could theoretically have high frequency scores without consuming a large number of foods. The lower complexity score in this case is an indication that the number of foods reported consumed is compromised with decreased food security status.

5.3.4 Food Preparation and Sociodemographic, Household, Health and Behavioural Characteristics

The relationships between food preparation complexity and frequency and certain household characteristics are presented in Table 5.9. Table 5.10 presents the relationships between food preparation activity and certain behavioural and health characteristics of the participants.

There is no apparent association between food preparation activity and the presence of a male partner in the household (Table 5.9). Also, there appears to be no relationships between food preparation activity and the number of people living in the household, or the number of children living in the household (Table 5.9). In addition, whether or not the woman worked outside the home was not found to have an effect on food preparation behaviour (Table 5.9). If there was a difference in time constraints between these two groups, it did not appear to factor into their preparation activities. It should be noted here
that the group of households in which the woman worked was very small, and perhaps this influenced the ability to detect any differences.

Food preparation behaviours seem to be affected by the presence of employment in the household (Table 5.9). In households where a member was employed full-time outside of the home, preparation complexity scores, but not frequency scores, are significantly higher than in households where no one was employed outside the home or where a member was employed only part-time. This may be a result of time-constraints or of attempting to comply with different schedule demands within the household. Very few participants in this study reported that their household depended on full-time employment as a source of income (approximately 10%). It is therefore difficult to make any assertions or look for any behaviour patterns.
### Table 5.9 Analysis of Variance of the Relationship between Food Preparation Activity and Household Characteristics* (n=153 Women)

<table>
<thead>
<tr>
<th>Household Characteristic Levels</th>
<th>n</th>
<th>Mean Complexity ± SD</th>
<th>F value, df (p-value)</th>
<th>3d Total Mean Frequency ± SD</th>
<th>F value, df (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Whether any Member of the Household was Employed</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>116</td>
<td>31.3 ± 20.5</td>
<td>3.58, 2 (0.03)</td>
<td>3.5 ± 1.8</td>
<td>1.99, 2 (0.14)</td>
</tr>
<tr>
<td>Yes</td>
<td>15</td>
<td>42.8 ± 15.3</td>
<td></td>
<td>4.3 ± 1.7</td>
<td></td>
</tr>
<tr>
<td>Part Time</td>
<td>22</td>
<td>33.6 ± 13.7</td>
<td></td>
<td>4.1 ± 2.0</td>
<td></td>
</tr>
<tr>
<td>Whether the Woman Worked Outside of the Home</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>135</td>
<td>32.8 ± 16.5</td>
<td>0.00, 1 (0.99)</td>
<td>3.6 ± 1.9</td>
<td>0.03, 1 (0.87)</td>
</tr>
<tr>
<td>Yes</td>
<td>18</td>
<td>32.9 ± 11.1</td>
<td></td>
<td>3.7 ± 1.6</td>
<td></td>
</tr>
<tr>
<td>Presence of a Partner in the Household</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>99</td>
<td>31.9 ± 14.8</td>
<td>0.83, 1 (0.36)</td>
<td>3.5 ± 1.7</td>
<td>2.67, 1 (0.10)</td>
</tr>
<tr>
<td>Yes</td>
<td>54</td>
<td>34.4 ± 17.9</td>
<td></td>
<td>4.0 ± 2.0</td>
<td></td>
</tr>
<tr>
<td>Total Number of People in the Household</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>31.5 ± 13.5</td>
<td>0.18, 3 (0.97)</td>
<td>3.46 ± 1.79</td>
<td>0.15, 3 (0.93)</td>
</tr>
<tr>
<td>3</td>
<td>53</td>
<td>32.6 ± 15.1</td>
<td></td>
<td>3.68 ± 1.86</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>33.4 ± 17.1</td>
<td></td>
<td>3.63 ± 2.01</td>
<td></td>
</tr>
<tr>
<td>≥5</td>
<td>36</td>
<td>33.1 ± 17.8</td>
<td></td>
<td>3.78 ± 1.73</td>
<td></td>
</tr>
<tr>
<td>Total Number of Children in the Household</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>41</td>
<td>33.1 ± 14.1</td>
<td>0.16, 3 (0.92)</td>
<td>3.8 ± 1.9</td>
<td>0.40, 3 (0.75)</td>
</tr>
<tr>
<td>2</td>
<td>60</td>
<td>32.7 ± 16.1</td>
<td></td>
<td>3.5 ± 2.0</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>31</td>
<td>33.8 ± 19.6</td>
<td></td>
<td>3.8 ± 1.6</td>
<td></td>
</tr>
<tr>
<td>≥4</td>
<td>21</td>
<td>30.7 ± 13.9</td>
<td></td>
<td>3.6 ± 1.8</td>
<td></td>
</tr>
</tbody>
</table>

* Analysis of Variance (PROC GLM) Model: Preparation Variable = Household Characteristic

In addition to the variables presented in Table 5.9, a regression analysis was conducted to examine the relationship between food preparation activity and shelter-adjusted household income (as discussed in section 4.11.3.1). No relationships between food preparation activity and shelter-adjusted household income were observed (model: food
preparation complexity = after-shelter income, 1 df, $F = 0.188$, $p = 0.67$; model: 3-day total food preparation frequency = after-shelter income, 1 df, $F = 0.039$, $p = 0.8441$).

No relationship was detected between food preparation activity and whether or not the participant felt alone (Table 5.10). There is also no observed association between level of education and food preparation activity (Table 5.10). Women who were better educated appeared just as likely to prepare foods from scratch as often and as complexly as other groups.

Although not statistically significant, there is a trend towards an association between food preparation complexity and immigration status (Table 5.10). The trend indicates that participants who had immigrated within the last five years tended to have higher complexity scores than those who had immigrated more than five years ago and those who had not immigrated. This may be an indication that recent immigrants tend to retain preparation practices of their environment of origin that are perhaps more complex than those that generally tend to occur in their current environment. After immersion in Canadian culture for an extended period of time, people may tend to acquire food preparation behaviours typical of their surrounding culture, whereby their preparation practices may become less complex, but no less frequent. However, there may be other factors that are linked to recent immigration, such as region of origin or employment status, that are difficult to separate out of this variable. Further research is necessary to definitively association food preparation behaviours to immigration status.
It is not possible to make any firm assertions about the relationship between the region of origin and food preparation behaviours. The sample was so heterogeneous in terms of ethnicity that some of the group sizes were very small. However, there does appear to be some association between region of origin and complexity of preparation. Participants originating from Asia tended to have higher complexity scores than other groups. Perhaps the higher scores reflect the complexity of the preparation associated with those cultures. However, the group size of those originating from Asia was 11, so true differences may have been difficult to detect. Since the cell sizes were so small, it is not possible to tease apart these other effects from the variable of interest. And again, region of origin may also be interrelated with other variables. Future studies might examine any relationships between ethnicity and food preparation behaviours.

Women who smoked tended to prepare food from scratch less often and less complexly than those who did not smoke. However, the differences in preparation frequency between groups were small: participants who did not smoke prepared food from scratch approximately 4 times over the 3 days, while those who did prepared from scratch approximately 3 times. Different food preparation behaviours may be a reflection of different eating patterns because, as shown in sections 5.2 and 5.3, food preparation behaviours are linked to the types and amounts of foods consumed, and smokers are known to have different eating patterns than non-smokers (43).
Participants who rated themselves to be in better health tended to prepare foods from scratch more often, but did not prepare more complex meals. This indicates that food
preparation behaviours are associated with self-rated health, or vice-versa. However, it should be noted again that the differences observed between groups are relatively small. Further research is required to determine the direction and implications of the relationship.

5.3.5 Food Preparation and Food Acquisition Behaviours

Table 5.11 presents the relationships between food preparation frequency and complexity and certain food acquisition behaviours.

The frequency per month that household members bought food at restaurants was thought to perhaps influence food preparation activity. There does not appear to be a relationship, and this is not surprising since many participants reported that their household did not purchase food from restaurants often (50% reported that they never bought food from restaurants; another 36% reported that they did only once or twice per month).

There was an association between preparation activity and the frequency per month that food was purchased at a supermarket or large grocery store. Preparation frequency tended to be higher in households that shopped at these stores more than once per month. Although the complexity scores are not different among groups, the trend reflects the results of the frequency scores. However, it should be noted again that because food preparation activity was so common across this sample, the differences between groups were small. While the groups that shopped at large grocery stores more than once per month had a mean frequency score of approximately four, the group that reported
shopping at these stores once per month or less still had a mean score of three. The former groups were preparing from scratch on average only once more over the three days the latter group was.

Shopping patterns at other types of stores do not appear to be associated with food preparation behaviours. In general, where or how often households bought food made little difference in terms of their food preparation activity.
Table 5.11 Analysis of Variance of the Relationship between Food Preparation and Food Acquisition Behaviours (N=153 Women)

<table>
<thead>
<tr>
<th>Food Acquisition Behaviour Levels</th>
<th>n</th>
<th>Mean Complexity ± SD</th>
<th>F value', df (p-value)</th>
<th>Mean Frequency ± SD</th>
<th>F value', df (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency per Month of Restaurant Food Purchase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>77</td>
<td>35.0 ± 16.7</td>
<td>1.51, 2 (0.23)</td>
<td>3.81 ± 1.90</td>
<td>0.54, 2 (0.582)</td>
</tr>
<tr>
<td>Once or Twice</td>
<td>55</td>
<td>30.8 ± 14.3</td>
<td></td>
<td>3.47 ± 1.73</td>
<td></td>
</tr>
<tr>
<td>Three or More Times</td>
<td>21</td>
<td>29.9 ± 16.6</td>
<td></td>
<td>3.57 ± 1.96</td>
<td></td>
</tr>
<tr>
<td>Frequency per Month of Supermarket Food Purchase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Once a Month or Less</td>
<td>44</td>
<td>27.2 ± 14.6</td>
<td>2.97, 2 (0.05)</td>
<td>3.1 ± 1.8</td>
<td>4.33, 2 (0.01)</td>
</tr>
<tr>
<td>Two or Three Times</td>
<td>58</td>
<td>33.9 ± 15.4</td>
<td></td>
<td>3.9 ± 2.0</td>
<td></td>
</tr>
<tr>
<td>Once a Week or More</td>
<td>51</td>
<td>36.3 ± 16.7</td>
<td></td>
<td>3.8 ± 1.6</td>
<td></td>
</tr>
<tr>
<td>Frequency per Month of Convenience Food Purchase</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>66</td>
<td>34.4 ± 17.04</td>
<td>1.68, 3 (0.17)</td>
<td>3.8 ± 1.9</td>
<td>0.85, 3 (0.47)</td>
</tr>
<tr>
<td>Once a Month or Less</td>
<td>25</td>
<td>26.4 ± 14.7</td>
<td></td>
<td>3.2 ± 2.1</td>
<td></td>
</tr>
<tr>
<td>Two or Three Times</td>
<td>26</td>
<td>34.2 ± 16.4</td>
<td></td>
<td>3.5 ± 1.7</td>
<td></td>
</tr>
<tr>
<td>Once a Week or More</td>
<td>36</td>
<td>33.1 ± 13.7</td>
<td></td>
<td>3.8 ± 1.6</td>
<td></td>
</tr>
<tr>
<td>Frequency per Month of Food Purchase from Meat Market, Produce Stand, Farmers’ Market or Bakery</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>49</td>
<td>29.7 ± 14.4</td>
<td>1.74, 3 (0.16)</td>
<td>3.4 ± 1.9</td>
<td>1.12, 3 (0.34)</td>
</tr>
<tr>
<td>Once a Month or Less</td>
<td>43</td>
<td>31.9 ± 16.0</td>
<td></td>
<td>3.8 ± 1.8</td>
<td></td>
</tr>
<tr>
<td>Two or Three Times</td>
<td>31</td>
<td>37.8 ± 14.6</td>
<td></td>
<td>4.1 ± 1.8</td>
<td></td>
</tr>
<tr>
<td>Once a Week or More</td>
<td>30</td>
<td>33.8 ± 18.8</td>
<td></td>
<td>3.5 ± 1.8</td>
<td></td>
</tr>
<tr>
<td>Means of Transportation from Grocery Shopping</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Walk</td>
<td>72</td>
<td>34.4 ± 17.8</td>
<td>1.13, 4 (0.34)</td>
<td>3.8 ± 1.9</td>
<td>0.73, 4 (0.57)</td>
</tr>
<tr>
<td>Drive in Own Car</td>
<td>21</td>
<td>34.2 ± 13.2</td>
<td></td>
<td>3.7 ± 1.3</td>
<td></td>
</tr>
<tr>
<td>Get a Ride</td>
<td>14</td>
<td>31.7 ± 17.7</td>
<td></td>
<td>3.6 ± 2.6</td>
<td></td>
</tr>
<tr>
<td>TTC</td>
<td>18</td>
<td>33.7 ± 19.0</td>
<td></td>
<td>3.7 ± 2.0</td>
<td></td>
</tr>
<tr>
<td>Taxi</td>
<td>27</td>
<td>27.0 ± 12.0</td>
<td></td>
<td>3.1 ± 1.6</td>
<td></td>
</tr>
</tbody>
</table>

* Analysis of Variance Model: Complexity of Preparation = Food Acquisition Behaviour
CHAPTER 6: GENERAL DISCUSSION AND CONCLUSIONS

6.1 Summary of Findings

This study showed that preparation from scratch was occurring frequently in the majority of households. Most participants (57%) prepared food from scratch at least once on each of the three days of recorded dietary recalls. Only 3% (4 participants) did not prepare food from scratch at all over the 3 days of recalls. The mean complexity score was approximately 30 per day. Energy intake was found to be significantly positively correlated with both food preparation complexity and frequency.

Food preparation frequency and complexity were significantly positively related to consumption of fruits and vegetables, grain products and meat and meat alternates and dairy products. However, when the confounding effect of energy intake was taken into account, the associations with dairy products lost significance and the other relationships appeared much weaker. Many nutrients were also significantly related to food preparation activity, particularly vitamin A and vitamin C. However, these relationships were also fairly weak when energy was taken into account.

Once energy was controlled for, food preparation complexity, but not frequency was significantly associated with food security status. There were no differences in the frequency of preparation between food security categories; however, the group that was classified as food insecure with hunger evident tended to prepare less complex dishes (i.e. tended to use fewer ingredients in preparation) compared to the group classified as having no hunger evident.
Exploratory analyses between food preparation variables and various household, individual and behavioural characteristics revealed few significant associations, perhaps because of sample size limitations. Whether a member of the household was employed was significantly related to food preparation complexity, but not frequency. There was a trend towards a positive association between complexity of preparation and ethnicity. There appeared to be an inverse association between self-rated health and food preparation activity. Also, smokers appeared to prepare from scratch less frequently and less complexly than non-smokers did. As well, there was an association between the frequency at which participants shopped at a large grocery store or supermarket and the frequency of preparation from scratch.

6.2 Implications of Findings
Improving food preparation behaviours through nutrition education programs has been suggested in order to improve dietary quality, and to perhaps allow families to make better use of household resources, thereby perhaps influencing food security status. The implication of these programs is that the food preparation skills of these families are poor and therefore the food preparation activity level in these households is low. However, to date, there has been no quantitative measurement of food preparation activity at the household level, nor any attempt to relate preparation activity to food security status or dietary quality. Therefore, this study was designed to quantitatively assess the food preparation activity occurring at an individual level in households reporting food insecurity and examine these relationships.
The results of this study showed that participants were preparing food from scratch frequently (all but 4 participants prepared from scratch at least once over the three days of recalls, as discussed above). In addition, the mean complexity score of 32 indicates that preparation activity was fairly complex since this score implies that 32 preparation techniques were carried out over the day. From these results, it appears that in this sample food preparation activity is not lacking or even low.

Many nutrition education programs targeting food preparation behaviours of low-income families teach cooking classes to a small group of participants and measure their success through reported changed food group selection patterns (25-33). The goal of many of these programs is to increase consumption of food groups, particularly of fruits and vegetables. The findings of this study indicate that although food preparation behaviours are significantly related to food selection patterns, the strength of these relationships is likely too weak to make an impact on dietary quality. For example, for each unit increase in the 3-day mean frequency of preparation from scratch, there was an increase of only 1 in the mean number of servings of fruit and vegetables once energy intake was taken into account (Table 5.4). Therefore, to affect fruit and vegetable consumption to any great extent, the amount of preparation from scratch is not feasible. Although the complexity of preparation is slightly more strongly related to food group consumption patterns, it is also so weakly related to food group consumption patterns that it is not likely that increasing the complexity of preparation could affect the diet a great deal. The same is true of the nutrients examined. The small impact that preparation activity does have on intake patterns may be linked to total food intake since the more food preparation participants
undertook, the more foods they were consuming (and vice-versa), and also because the complexity of preparation (an indication of the number of foods consumed) tended to be more strongly related to intake patterns than frequency.

Likewise, it is not likely that nutrition education programs targeting food preparation skills could influence the food security status of households such as the ones studied here. In this sample, food preparation frequency was not depressed in households whose food security status was lower, but fewer ingredients were used in preparation—perhaps indicative of household food availability.

While some other variables examined were significantly related to food preparation activity, the directions of the relationships are not known. So, for example, it cannot be argued that increased food preparation activity improves self-rated health, since the relationship might in fact be the reverse. In addition, the non-significant relationships found between food preparation and other variables in this study might prove to be significant in another study that was designed for such examinations (i.e. with larger sample sizes). Further research is necessary to determine the direction and implications of these results.

6.3 Generalizability of Findings

There were several characteristics common to each of the participants in this sample that may have influenced observed food preparation behaviours, and thus may limit extrapolations from this sample to other low-income groups. These women were all
recruited from food banks and for this reason they may not be representative of all low-income families. They may, for example, have been more likely to have been experiencing food insecurity. In addition, the sample was highly variable in terms of ethnicity, likely due to the high prevalence of recent immigrants in this sample, which may or may not be representative of the low-income population in Toronto.

Generalizability is further limited by the fact that this sample was comprised only of women living in families, i.e. no participant was living alone. Therefore there may be a tendency for participants to prepare food from scratch more often, and in larger quantities. Another characteristic is that each of the participants had at least one child under the age of 15 living with them. This may certainly have influenced food preparation behaviours. Perhaps people are more likely to prepare meals from scratch if they are responsible for feeding children. Also, most of the women from this study were stay-at-home mothers, which also may have positively influenced food preparation activity. However, these women were all recruited from food banks and so this sample may not be representative of all low-income families.

6.4 Limitations in Estimating Food Preparation Activity

A central objective of this study was to develop a methodology to quantitatively assess food preparation activity. What follows is a detailed examination of possible sources of error in this methodology, arising from particular features of the data collection, data entry and data processing systems and from the use of regression methods to predict food preparation.
6.4.1 Errors in Data Entry

Because eating occasions were used as the unit of analysis in the development of food preparation scores, error within the eating occasions would affect preparation scores predicted by the regression equation (Figure 4.15). This error arose from mistakes in data entry that occurred during the original study. As discussed in section 3.5, many of the entry errors were corrected in the CANDI system. However, it was not possible to correct all the entry errors. Some recipes or groups of foods were entered at incorrect times such that eating occasions were divided into two different times. This error would occasionally result in preventing the participant from receiving the appropriate score, since incorrectly subdivided eating occasions would receive lower scores than if they were combined. Due to the nature of data entry in CANDI (a default time was entered if the time was accidentally omitted), the reverse did not occur as often: eating occasions were rarely erroneously combined. If entry errors had any effect on estimating food preparation activity, they would act to systematically lower preparation scores.

6.4.2 Limitations in the Scoring System

The scoring system described in section 4.3 was used to assess food preparation activity from the dietary recalls of a sample of eating occasions. The two potential limitations in the scoring system are a result of this study being a secondary analysis of data: the original study was not designed to assess food preparation. First, incomplete information regarding food preparation was recorded at the time of the interview (e.g., no data on cooking time, or preparation time were recorded). Preparation techniques not adequately described or recorded would not have been accounted for in the scoring system. Second,
the omission of (non-nutritive) foods at the time of the interview would limit the scoring system. Although it is not possible to determine the extent of the error, the error resulting from these mistakes is more likely to be systematic than random. For example, it is more likely that foods were omitted (accidentally or otherwise) than added. Likewise, it is more likely that details about food preparation techniques were left out when they occurred, rather than added on when they did not. If these omissions had any effect on our ability to capture the true preparation activity in this sample, they would more likely affect the recipe foods more than the basic foods, and they would act to systematically depress the scores. Although these errors were quite likely to have occurred, there is no way of knowing to what extent (if any) they did.

There would also likely be some error associated with the assumptions that were made throughout the scoring process. These errors may have biased scores in either direction: more or less work may have actually been required to prepare the foods recorded on the recalls if assumptions were made about them (see Appendix B).

6.4.3 Limitations in Derivation of Variables Used to Predict Food Preparation Activity

To predict food preparation activity in this study through the regression equation (Figure 4.15), the variables used were restricted to readily-available variables processed by CANDI and CDP (such as the recipe codes and place of preparation codes), that could be imported into SAS for analysis. Therefore, the variables used in the regression model were limited to those available in the software systems.
There was likely some error associated within the variables—the number of recipe foods and the number of basic foods—used in the regression equation to predict preparation scores (Figure 4.15). Data entry errors may have affected the numbers of recipe foods and numbers of basic foods. As discussed above, most entry errors were corrected, but it was not possible to correct all errors. If foods were omitted during data entry, this would limit our ability to predict food preparation activity in the sample by underestimating activity. Another possible source of error associated with the number of recipe foods and number of basic foods comes from the commercial foods that CANDI automatically coded as recipes (e.g. bagels), most of which were corrected; however, some mistakes may have been overlooked. These errors would act to augment actual scores by crediting participants with recipes that were not home-prepared.

6.4.4 Error within the Regression Equation Used to Predict Preparation Scores

Although we were limited in terms of our ability to capture the true preparation activity that occurred in this sample, 78% of the variation in food preparation activity is explained in the regression model (Figure 4.15). From the residual plots illustrated in Figures 4.16, 4.17 and 4.18, it does not appear that there are any patterns: the points are fairly evenly distributed about zero. This indicates that the regression equation does not tend to systematically over or under-estimate preparation. However, the error in the residuals may tend to increase as the value of the predicted scores increases (Figure 4.16), indicating that the predictive power of the regression equation tends to decrease as the predicted scores increase. Despite this error, food preparation scores are predicted well by
the numbers of recipe foods and the numbers of basic foods recorded, as indicated by the high correlation of predicted scores (from the regression model) and scores assigned in the second application of the scoring system for assessment of food preparation activity (see section 4.7).

6.4.5 Error within the Complexity and Frequency of Preparation Scores

As mentioned above, the predictive capacity of the regression equation decreases as the scores increase. This is of less concern for the frequency of preparation scores, where the cut-point of the scores is fairly low (8). The increasing variance in Figure 4.16 is of more concern with the complexity scores. However, eating occasions that contained a high number of foods (where the variance around the complexity score was highest) were so rare that it is not likely that this would have affected the results to a great extent. These types of eating occasions were uncommon even in the sample of 150 eating occasions that were scored for food preparation activity, despite the weighting applied to oversample from the high end of the distribution (see Figures 4.10 and 4.11).

Some error likely exits around the cut-point of eight that was used to determine the frequency of preparation from scratch. The type I and type II error that surrounds the cut-point of 8 is unavoidable since it would have occurred at any score where the cut-point was chosen. However, there would have been more error if the cut-point had been chosen higher up the scale, given what is known about the variance within the regression equation. Although it is impossible to determine the magnitude of the error surrounding this cut-point, the comparison between the predicted and assigned scores in section 4.6
gave an indication. As mentioned in that section, only 11 of 144 eating occasions were classified (as entailing preparation from scratch) differently when predicted and assigned scores were compared. If this is representative of the entire sample, only 8% of eating occasions were classified incorrectly. It is assumed that the assigned scores are the closer assessment of the actual amount of preparation than the predicted scores are. According to the results from the second assessment of preparation activity, the regression equation tends to over-estimate actual complexity scores; however, there may have been inter-evaluator differences in scoring that contributed to the differences between predicted and assigned scores. We have not conducted a study to assess inter-evaluator variation, so there is no way of knowing whether or not there were differences. Since the correlation between predicted and assigned scores was so high, these potential differences did not seem of great concern. In addition, that the regression equation appears to over-estimated food preparation activity is acceptable since the criteria for an eating occasion entailing preparation from scratch were very stringent (see section 4.3.2).

### 6.4.6 Adequately Controlling for Amount of Food

The relationship between energy and food preparation was important because in this sample, energy intakes may have been compromised due to food insecurity, and virtually every household in this sample was classified as food insecure over a 12 month period (27). It was therefore extremely important to control for the effect of energy in analyses in order to ensure that low preparation activity was not due to low energy intakes.
As discussed in section 6.2, in general, the more foods people consume, the higher their energy intake is. However, the correlation between energy intake and the number of foods consumed is only approximately $r = 0.5$. Therefore, it is not always the case that a higher number of foods consumed results in higher energy intake. Theoretically, an individual could consume a high number of foods without consuming a lot of energy. For example, since vegetables tend to contain few calories per serving, many may be consumed without contributing greatly to overall energy intake. The same is true of fruits: many fruits consumed throughout the day would likely not contribute to a great extent to overall energy intake. This is an example of how it is that the correlation between numbers of foods consumed and energy intake is not one-to-one. This is important since fruits and vegetables tend to be considered relatively nutrient-rich foods and many also tend to be relatively expensive. Also, fewer of these foods might be purchased when household resources are particularly low. Higher numbers of fruits and vegetables consumed may be indicative of more sufficient household resources.

Since energy intake and the number of foods consumed are not perfect reflections of each other, it is important to understand what effect the numbers of foods consumed has on the diet and on preparation behaviours. If less food is consumed, food preparation activity will be depressed since it is a measure of the amount of food (in numbers of foods) being consumed. Since the food preparation variables are dependent on the amount of food consumed, when food consumption is low, the preparation variables will not be a measure of activity, but a measure of the extent of compromised food intake. Since the
correlation of energy and total numbers of foods consumed is not one-to-one, controlling for energy intake will not completely control for low food intake.

The numbers of foods consumed has important implications in terms of dietary quality. Unless people are eating the same foods many times throughout the day, a higher number of foods likely indicate more variety, which usually translates into better dietary quality. Tables 5.3, and 5.6, show that the complexity of preparation is more strongly associated with food intake patterns than frequency of preparation is, which seems intuitive since the complexity variable is a better indication of the total number of foods consumed. Therefore in some cases, women who are consuming higher numbers of foods throughout the day may have better dietary quality, and this may not be taken into account simply by controlling for energy intake.

It is also known that the number of foods consumed is affected by food security status, since the preparation complexity variable is based on the number of recipe foods and the number of basic foods reported consumed (see section 5.3.3). Therefore, it is known that the factor by which the food preparation variables are measured (numbers of foods) may itself be compromised in this sample. If food is limited so will the preparation of it be. Therefore, it would be best to attempt to separate the work involved in food preparation activity from the amount of foods consumed by controlling for the numbers of foods consumed. It is important that the food preparation variables are measuring food preparation activity, or work, rather than food availability or deprivation. However, it is

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3 Canada’s Food Guide recommends consuming a widely varied diet to ensure that nutrient requirements are met.
extremely difficult to disentangle these two effects since food preparation activity is dependent on food. If we attempted to control for the numbers of foods in the same manner as was done for energy intake, essentially the same variable would be on both sides of the equation, therefore spreading the variance such that no results would be seen.

At this point, it is important to recall that the mean number of servings consumed of all groups (except for the meat and meat alternates group) was below the recommendations made in Canada’s food guide (see section 5.3). Both the fruit and vegetable and grain products groups were positively associated with food preparation and also had low reported intakes (the meat and meat alternates food group consumption was relatively close to the Food Guide’s recommendations, although still lower). If consumption of food groups is low, it cannot be assumed that it is due to reduced preparation activity. Low preparation activity associated with low food intake could be an indication of fewer foods being available in the household for consumption and hence for preparation. As discussed in the section above, assumptions should not be made regarding how food preparation actually influences food intake behaviours until food is no longer a limiting factor in the preparation variable.

6.5 Applications of the Methodology to Other Populations

This sample is distinct because of the extent of poverty as well as food insecurity that exists within it. Other populations might be more likely to purchase more pre-prepared foods from stores that tend to be more expensive than other foods. The study by FCPMC (discussed in section 2.2) showed that lower-income consumers almost never eat a store-
prepared meal, whereas higher-income consumers did so once or twice a week (22). Other population groups might also be more likely to purchase food from restaurants than participants from this sample were. Also discussed in section 2.2, FAMEX data from Statistics Canada show that lower-income households tend to spend less money on restaurant-purchased foods (21). For these reasons food preparation activity in this sample may be relatively high compared to that of other population groups. Conversely, in the general population where food insecurity is not so prevalent, food is not likely to be a limited resource, and so the amount of food in the household is no longer a limiting factor when estimating food preparation activity or examining the associations between food preparation and food selection or dietary quality.

Although this methodology was developed using CANDI, CDP and SAS software systems, this methodology is applicable to other to populations using other software programs. However, this methodology depends on several requirements of the software systems. The first is the storage of information regarding which foods had been consumed together (which has been referred to as the eating occasion in this study). The second is a method of retrieving more than just nutrient content of the foods, i.e. a way of counting the number of foods consumed at each eating occasion. In addition, information similar to that contained in the ‘place of preparation’ codes is necessary to determine which foods were ‘home-prepared’. Although the recipe code is likely not a necessity in estimating food preparation in other studies, it proved to be very useful in this one. Different variables might be recorded in other studies (e.g. direct information regarding
food preparation) and the software systems used to analyze the data would have to be able to retrieve this information.

Some modifications would be necessary to the methodology for subsequent applications to other populations. Even if the same software systems were used to analyze the data in a separate study and the same variables were used as indicators of food preparation, these variables would likely have different relationships to each other. In this data set, according to the regression equation, each recipe food increased the preparation score by two points whereas each basic food increased the score by only one. In another sample, this ratio might be different: recipe foods might be a more important indication of food preparation compared to basic foods, changing the ratio of increase in score of recipe foods to basic foods to 3:1 or 4:1. Conversely, recipe foods might be a less important indication of food preparation compared to basic foods, changing the ratio of increase in score of recipe foods to basic foods to 1:1 or 1:2. Therefore a separate regression equation would have to be derived in order to apply this methodology to other populations. However, it is likely that different variables would have to be used to assess food preparation in other samples. For example, the presence of a recipe might not be such a useful indicator of food preparation, particularly for single-person households, including households of elderly persons. In addition, in this sample it was the participants themselves who were primarily responsible for preparing foods in the household. Therefore the participants could accurately describe the recipes included with the dietary recall forms and the details about preparation techniques used on the recorded foods. If
other household members' recalls were examined, we might not have been able to receive as accurate or detailed results, thereby underestimating the preparation that occurred.

To determine the appropriate regression equation and the appropriate independent variables within it, a sample of eating occasions from the population to be studied would have to be scored in terms of food preparation activity. Assumptions regarding the preparation behaviours of the population in question could be added to those developed in this study if necessary. However, the scoring system described in section 4.3 is universal such that it could potentially be applied to any population.

6.6 Conclusions

This study was the secondary analysis of dietary recall data from a study by Tarasuk and Beaton (35, 36). The first objective of this study was to develop a methodology to assess food preparation activity from dietary recall data. This was accomplished by quantifying food preparation activity from a stratified random sample of 150 eating occasions from the dietary recalls, through the development and application of a scoring system based on descriptions of food preparation techniques by Sweetman and MacKeller (38). The scores were then regressed on the number of recipe foods and number of basic foods recorded on the recalls within eating occasions. The multiple regression equation was then developed and applied to the entire sample of recalls to generate preparation scores for each eating occasion in the data set. These scores were summed across days by participant, and the sums were used to estimate the 3d mean complexity of preparation and frequency of preparation from scratch for each participant.
The second objective of this study was to describe the preparation activity occurring in this sample of low-income women from families using food banks. Preparation from scratch appeared to be fairly common in this sample, and the complexity scores indicate that preparation over the day was fairly complex. The mean complexity score in this sample was approximately 32, which indicates that on average participants were applying 32 preparation techniques to the foods they were consuming each day. On average, participants prepared one dish from scratch per day. Only 4 participants did not prepare any foods from scratch over the 3 days that were examined in this study, and over half of the sample had prepared foods from scratch at least once per day over the three days.

The third objective in this study was to examine the relationships between food preparation activity and total energy intake, food selection patterns and food security status. Exploratory analyses were also run between food preparation activity and household characteristics, personal and behavioural characteristics and food acquisition behaviours. Few conclusions can be drawn from these exploratory analyses due to the small sample sizes. However, there did appear to be a relationship between smoking and preparation behaviours, as well as relationships between food preparation activity and self-rated health, employment status of the household members, and region of origin of the participant. Future studies are needed to further examine these relationships.

Both the frequency and complexity of food preparation in this study were shown to be significantly positively related to total energy intake, and also to consumption patterns of food groups and nutrient intakes. However, once the confounding effects of energy intake were controlled for in analyses, associations between food preparation and food group
selection and nutrient intakes weakened markedly and some lost significance altogether. The complexity of preparation tended to be slightly more strongly related to nutrient intakes and food group selection than the frequency of preparation. However, these relationships were likely too weak to make an impact on dietary quality or the prevalence of inadequacies of nutrient intakes.

Food preparation activity was found to be significantly related to food security status. Participants who were classified as food insecure tended to prepare foods from scratch less frequently and less complexly than those classified as having no hunger evident, although once energy was controlled for, only the latter association remained significant. Those who were classified as food insecure with hunger evident were preparing less complex dishes (i.e. incorporating fewer foods into preparation) than those who were classified as having no hunger evident, but they were not preparing foods from scratch any less frequently.
REFERENCES


10. Travers KD. “Do You Teach Them How to Budget?”: Professional Discourse in the Construction of Nutritional Inequities from


## APPENDIX A

### PREPARATION TECHNIQUES AS DESCRIBED BY SWEETMAN & MACKELLER (1932)

<table>
<thead>
<tr>
<th>Preparation Category</th>
<th>Preparation Techniques</th>
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<tbody>
<tr>
<td><strong>Washing</strong></td>
<td>e.g. washing fruits and vegetables, lentils, beans etc.</td>
</tr>
<tr>
<td><strong>Subdivision and Fractionation</strong></td>
<td>Cutting, dicing, chopping, mincing, shredding, grating, grinding, paring, peeling, pressing, skinning, de-boning</td>
</tr>
<tr>
<td><strong>Combining and Mixing</strong></td>
<td>Beating, blending, cutting (e.g. cutting fat into a mixture), creaming, folding, kneading, marinating, stirring, whipping</td>
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<tr>
<td><strong>Heating</strong></td>
<td>Methods in which air is the cooking medium: broiling, roasting, baking</td>
</tr>
<tr>
<td></td>
<td>Methods in which water is the cooking medium: boiling, simmering, stewing, steeping</td>
</tr>
<tr>
<td></td>
<td>Methods in which steam is the cooking medium: steaming, “waterless” cooking, pressure cooking</td>
</tr>
<tr>
<td></td>
<td>Methods in which fat is the cooking medium: pan broiling, deep frying, sauté</td>
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<tr>
<td></td>
<td>Methods in which there is more than one cooking medium: braising, pot-roasting</td>
</tr>
<tr>
<td><strong>Removal of Heat</strong></td>
<td>Refrigeration, freezing</td>
</tr>
</tbody>
</table>
APPENDIX B

ASSUMPTIONS MADE ABOUT FOOD PREPARATION DURING APPLICATION OF THE SCORING SYSTEM

1) All meats, with the exception of luncheon meats have been cooked, unless otherwise indicated.
2) Eggs have been cooked, unless otherwise indicated.
3) All fruits and vegetables have been washed unless they have an inedible peel or have been peeled.
4) All fruits and vegetables that have an inedible peel, or are customarily peeled, have been peeled.
5) Fruits and vegetables, with the exception of commercial juice, have been subdivided or fractionated if the number of portions recorded on the dietary recall form is a fraction of the food.
6) All vegetables in recipes have been subdivided, unless otherwise indicated.
7) Vegetables whose peels are customarily removed, such as carrots, onions, potatoes etc. have been peeled, unless otherwise indicated.
8) Fruits with inedible peels (e.g. cantaloupe, kiwi, avocado, etc.) have been peeled.
9) Vegetables whose seeds are customarily removed, such as pumpkins, have been seeded.
10) The combinations of vegetables typical of a green salad (e.g. lettuce, tomatoes, cucumbers, etc.) have been combined, unless they appear to have been used as garnish e.g. for a hamburger.
11) Vegetables were cooked, unless otherwise indicated, or unless they appear to be a part of a raw-vegetable salad.
12) Canned vegetables and soups have been heated.
13) Frozen foods have been heated, unless they are foods that are customarily consumed in their frozen state (e.g. ice cream).
14) Pasta, rice, cereal grains and flour have been cooked.
15) Oil has been heated, unless it appears to be a part of a salad dressing, e.g. combined with vinegar.
16) If water is not drained off a food that has been cooked in it (e.g. as with rice), the rice will be treated as a combined ingredient.
17) Any foods that reasonably appear to have been combined at an eating occasion will be scored accordingly.
18) Hot beverages, such as tea, coffee and hot chocolate were heated.
19) Sugar and milk consumed in small quantities at the same eating occasion as coffee or tea were combined in the beverage.
20) Any food measured in teaspoons or tablespoons was combined with others.
21) Condiments or spices were combined with other foods.
22) Condiments and spices in recipes have been ‘combined’ but not ‘heated’, unless specified.
AN EXAMPLE OF AN APPLICATION OF THE SCORING SYSTEM

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