The Food Choice Map as a Diet Assessment Tool for Older Adults

By

Jillian Einarson, B.Sc.

A Thesis Submitted to the Faculty of Graduate Studies of

The University of Manitoba

In Partial Fulfilment of the Requirements

For the Degree of

MASTER OF SCIENCE

Department of Human Nutritional Sciences

University of Manitoba

Winnipeg, Manitoba, Canada

Table Of Contents

Acknowledgements..i

Abstract..ii

List of Tables and Figures...iii

Chapter 1: Introduction...**1**

Chapter 2: Literature Review..**3**

I. Demographics of Older Adults...3

II. Nutrition and Older Adults...4

III. Cognitive Function and Memory...15

IV. Dietary Assessment...16

V. Dietary Assessment Methods...19

VI. Low Energy Reporting..27

VII.Qualitative Methods..29

VIII. Mixed Methods..30

Chapter 3: Materials and Methods...**31**

I. Aim & Approach...31

II. Research Objectives...31

III. Study Design..31

IV. Methods...33

V. Statistical Analysis...39

Chapter 4: Results...**40**

I. Quantitative Results..40

Demographic Characteristics...40

Differences in Recall Between the FCM and Average 24 HRs.........................48

I. Contribution of Foods to Diet Structure..48

II. Level of Processing..49

III. Differences in Energy and Nutrient Intakes Between Methods.........50

Dietary Risk...52

Incidence of Low Energy Reporting...53

II. Qualitative Results…………………..……………………..……………..56

Memory..56

Concrete versus Abstract Thinking..58

Perception of Control...60

Chapter 5: Discussion……….……………………………..........……………...**63**

Chapter 6: Conclusion………………………………….……………………...**71**

I. Limitations………………………………………...……………….……..71

II. Future Research……………………………………….……….………...72

Literature Cited……………………………………..…………..…..……....**74**

Appendices………………………………...……………………..…..…......**82**

Contribution of Foods to Dietary Structure..82

Differences in Reports of Nutrient Intakes between the Methods..................90

24 Hour Recall……………………………………...………………..98

Demographic Questionnaire………………………..…………………....99

Food Choice Map Script..101

Poster………………………...…………………………………………..103

Mini Mental State Examination...104

Acknowledgements

I would like to gratefully acknowledge everyone who assisted and supported me in the process of conducting and completing my thesis research. To my supervisor, Dr. Gustaaf Sevenhuysen, as well as my advisory committee, Dr. Carla Taylor, Dr. Jim House and Dr. Verena Menec for their continued support. I would like to thank the statistical advisory centre at the University of Manitoba for their assistance with the statistical analysis portion of this research. I would like to thank my family and friends for their support as well as my participants who shared their time to be a part of this research.

Abstract

Currently no ideal method for the assessment of dietary intake of individuals or groups exists. All diet assessment methods have their limitations; much debate exists as to which method is best. The goal is to design an assessment tool that is comprehensive in that it reflects dietary variety but that is not too burdensome for participants. The FCM integrates an interview tool with a computerized program that quantifies food and nutrients in real time. The present study was undertaken to determine if the FCM is appropriate to use with community living older adults. This exploratory study used a mixed method approach to determine differences in recall between the FCM and three 24 HRs. Quantitative findings show significant differences between the methods in reports of energy, zinc, and calcium intakes and consumption of "other" foods. Qualitative findings show that the abstract thinking required to complete the FCM may be difficult for this population.

List of Figures and Tables

Tables:

Chapter 2: Literature Review

Table 1. Dietary Reference Intakes..5

Table 2. Factors that Increase Nutritional Risk in Older Adults……………………....6

Chapter 3: Materials and Methods

Table 3. Values of the Physical Activity Levels..29

Table 4. Inclusion/Exclusion Criteria……......………………..…………………….33

Table 5. Interview Format……………………....……………………..................…34

Chapter 4: Results

Table 6. Number of Participants in Each Body Mass Index Category.......................44

Table 7. Differences in Intakes of Dietary Components……....…………………….50

Table 8. Level of Processing of the Diet……………………..………………...…51

Table 9. Differences in Nutrient and Energy Intakes Between the Methods………...52

Table 10. Reports of Energy Intakes.....…………………………………..…….53

Table 11. Nutrient Intakes Compared to the Dietary Reference Intakes…...........…54

Table 12. Characteristics of Low Energy Reporters........………………..………55

Table 13. Characteristics of High Energy Reporters..56

Figures:

Chapter 3: Materials and Methods

Figure 1. Qualitative Analysis……………………………………………………....39

Chapter 4: Results

Figure 2. Histogram of the Age of Participants…………………………………......41

Figure 3. Histogram of the Participants Gender……………………………………42

Figure 4. Histogram of the Weights of Participants………...…………………..…..42

Figure 5. Histogram of the Heights of Participants …………………………..…...43

Figure 6. Histogram of the Participants Body Mass Index……………………...........44

Figure 7. Histogram of the Level of Education of Participants…………..................45

Figure 8. Histogram of the Participants Residence…………………………...........46

Figure 9. Histogram of the Number of Daily Medications.......................................47

Figure 10. Histogram of the Number of Daily Nutritional Supplements…………...48

Figure 11. Body Mass Index of Low Energy Reporters...56

Chapter 1

Introduction

Worldwide older adults are a growing segment of the population (Guigoz et al., 2002) as it is predicted that the number of people aged 60 years and older will increase by 22% by the year 2050 (Martin et al., 2007). In Canada, the number of older adults (aged 65 years and older) is projected to rise from 4.3 million to 8 million between 2006 and 2026. The proportion of older adults in the Canadian population is expected to increase from 13.2% to 21.2% during this time period (Statistics Canada, 2007). Research has consistently shown the impact of nutrition on the quality of life of older adults (Kuczmarski et al., 2005). Older adults are a diverse group facing many challenges including an increased risk of malnutrition (Marian & Sacks, 2009; Statistics Canada, 2007). A need exists for continuous nutrition educational interventions, nutritional observation and ongoing research endeavors to reduce the risk of chronic diseases in the aging population; this would result in lower health care and societal costs (Kamp et al., 2010; Levy-Milne, 2004). However, all current methods of dietary assessment contain sources of error, which greatly impact on the accuracy of their measurements (Gibson, 1990; 2005; Bazelmans et al., 2007; Tooze et al., 2007). Thus, a dietary assessment method that can minimize errors and improve reliability and validity would provide a better measure of nutrient intakes of older adults.

Memory is an important consideration when assessing the diets of older adults. Age-related cognitive decline may lead to misreporting of dietary intakes and inadequate nutrient intakes may lead to decline in cognition (Gonzalez-Gross et al., 2001). The use of a dietary assessment method that encourages better memory recall in older adults is needed to obtain more reliable intake data.

With advancing age, a balanced diet may be more difficult to achieve due to decreased energy requirements and stable nutrient requirements, often resulting in nutrient inadequacies (Levy-Milne, 2004). The Food Choice Map (FCM) is a new dietary assessment technique that has been previously validated in college-aged women for folate and vitamin B12 status (Shuaibi et al., 2008). However, no study has explored the FCM for use with older adults. This current study aims to fill significant gaps in the literature on dietary assessment methods, as it used a mixed method approach to evaluate the effectiveness of the FCM in the dietary assessment of adults aged 65 years and older.

Chapter 2

Literature Review

I. Demographics of Older Adults

Older adults aged 65 years and over are living longer and they are increasing as a proportion of the total population in Canada and worldwide (Levy-Milne, 2004; Statistics Canada, 2007). In Canada, the life expectancy at age 65 for men and women is now 82.4 years and 85.8 years, respectively (National Advisory Council on Aging, 2006). Recent statistics released from Statistics Canada state that "by 2036 the number of seniors is projected to reach between 9.9 million and 10.9 million, more than double the level of 4.7 million in 2009." (Statistics Canada, 2010).

Approximately 95% of adults aged 65 years and older reside in the community (Kuczmarski, et al., 2005), and may be responsible for obtaining, preparing, consuming and storing their own food. Nutritional risk refers to risk factors leading to nutrition problems and is common in community-living older adults, the incidence ranging from 25% to 65% depending on the population being assessed (Keller et al., 2004). Research has indicated that the prevalence of nutritional supplement use is increasing in the older population, as studies indicate that supplement use ranges from 30-70% in Canadian older adults (Levy-Milne, 2004).

Vatanparast and colleagues (2010) conducted a study to determine the association between demographic variables and vitamin and mineral supplement use in Canadians, using data from the 2004 Canadian Community Health Survey (CCHS). Results indicated that increased age, being female, increased household income, high education and being food secure positively associated with supplement use. Sixty percent of women and forty percent of men aged 51 years and older reported using supplements and they tended to have a higher level of education and household income. Participants in the highest income households had 1.6 times the odds of taking supplements than those in the lowest income households and those with at least secondary graduation had 1.4 times the odds of taking supplements when compared to those who had not completed secondary school (Vatanparast et al., 2010). It is necessary to measure demographic characteristics of the population under study to determine potential confounding variables and to measure associations between demographics and food recall.

II. Nutrition and Older Adults

The link between aging and nutrition is found in the origin of language. The German word ‘alt’, meaning ‘old’, derives from the Latin words ‘alere’ meaning ‘well-fed’ and ‘altus’, ‘grown up’ (Staehelin, 2005). A well-established connection exists between nutritional health and quality of life in older adults. Research has indicated that older adults experience problems of both overnutrition and obesity and undernutrition and micronutrient deficiencies (Levy-Milne, 2004). As eating well can help older adults manage the stresses of aging, dietary intake plays a pivotal role in healthy aging (Krinke, 2002). Centenarians can be seen as an excellent example of the impact of nutritional status on health status and longevity. Research has indicated that centenarians have elevated high-density lipoprotein levels, high levels of vitamins A and E, and increased unsaturated/saturated fatty acid ratios (Kuczmarski, et al., 2005).

Dietary reference intakes (DRIs) are nutrient reference standards that were developed by the Institute of Medicine for use in Canada and the United States (American Dietetic Association, 2011). The DRIs are useful for the assessment of both individual and group dietary intakes. They include the following 6 categories: estimated average requirement (EAR), recommended daily allowance (RDA), adequate intake (AI), tolerable upper intake level (UL), estimated energy requirement (EER), and acceptable macronutrient distribution range (AMDR) (American Dietetic Association, 2011). Table 1 provides a detailed description of each of the various DRI categories.

Table 1. Dietary Reference Intakes

Dietary Reference Intake (DRI)	Description
Estimated Average Requirement (EAR)	The median usual intake value that is estimated to meet the requirement of half of the healthy individuals in a life-stage and gender group.
Estimated Energy Requirement (EER)	The estimated dietary energy intake that is predicted to maintain energy balance in healthy, normal weight individuals of a defined age, gender, weight, height, and level of physical activity consistent with good health.
Recommended Daily Allowance (RDA)	The average daily dietary intake level that is sufficient to meet the nutrient requirement of nearly all (97-98%) healthy individuals in a particular life-stage and gender group.
Adequate Intake (AI)	The recommended average daily nutrient intake level based on observed or experimentally determined estimates of nutrient intake by a group of apparently healthy people who are assumed to be maintaining an adequate nutritional state.
Tolerable Upper Level (UL)	The highest level of continuing daily nutrient intake that is likely to pose no risk of adverse health effects in almost all individuals in the life stage group for which it has been designed.
Acceptable Macronutrient Distribution Range (AMDR)	The range of intakes for a particular energy source that is associated with reduced risk of chronic disease while providing adequate intakes of essential nutrients. Set for protein, carbohydrates and fats.

(American Dietetic Association, 2011)

It is important that older adults have dietary intakes that meet the DRIs to ensure that the body has sufficient nutrients to maintain its function, prevent deficiency and the secondary symptoms associated with deficiency (Keller et al., 2004). The consumption of recommended amounts of food and nutrients promotes the health and functionality needed for the prevention of chronic diseases. Ensuring that nutritional intake is balanced can delay the onset of chronic diseases that are associated with over consumption (Keller et al., 2004). On the other hand, poor dietary intakes are common in some older adults and these can frequently result in weight loss in this population (Martin et al., 2007). A summary of nutrition risk factors can be seen in Table 2.

"Anorexia of aging" is a common problem with older adults (Marian & Sacks, 2009) and researchers have identified many nutritional challenges that older adults must overcome in order to age well. These include adapting to the normal physiological changes that occur during aging such as changes in appetite, thirst, taste and chewing ability (Martin et al., 2007). As well older adults may have slower gastric emptying, altered hormonal responses, and a lower basal metabolic rate reducing their dietary intakes (Drewnowski & Shultz, 2001). Socioeconomic factors such as poverty and loss of a spouse may limit food availability and motivation in this population (Martin et al, 2007). The decline of visual and auditory senses, as well as osteoarthritis has an impact on mobility, which may decrease an older adult's ability to purchase and prepare food (Guigoz et al., 2002; Marian & Sacks, 2009). The impact of numerous chronic health conditions and consumption of medications, both prescription and nonprescription, affect both food choices and nutrient status (Kamp et al., 2010; Krinke, 2002). Recent studies show that 85% of adults aged 65 years and older have at least one chronic disease that affects the absorption, transport, metabolism, and excretion of nutrients (Marian & Sacks, 2009).

Table 2. Factors that Increase Nutritional Risk in Older Adults (65 years and older)

Presence of chronic disease	Renal dysfunction
Polypharmacy	Reduced vision
Poor oral health	Malabsorption
Dysgeusia	Diminished olfactory senses
Dysphagia	Financial constraints
Poor dentition	Dementia
Ill fitting dentures	Depression
Gingivitis	Lack of transportation
Xerostomia	Functional limitations
"Anorexia of aging"	Recent bereavement
Prescribed therapeutic diets	Feeding dependency
Gastric dysmobility	Lack of socialization
Achlorhydria	Isolation/living alone

Adapted from Marion & Stacks, 2009

Weight loss is not a normal consequence of aging and usually represents an underlying disease process leading to poor health outcomes (Martin et al., 2007). Unintentional weight loss and low weight in the older adult can result in adverse outcomes including frailty, loss of independence, and functional decline. The maintenance of a healthy weight has been shown to decrease early admission to long-term care facilities, length and number of hospitalizations, and health care costs for older adults (Martin et al, 2007).

Body mass index (BMI) is a calculation of the ratio of weight to height, which is used to measure the risk of developing health conditions related to being underweight or overweight (Health Canada, 2003). The Canadian weight classification system uses the following categories: underweight (BMI < 18.5), normal weight (BMI 18.5-24.9), overweight (BMI 25-29.9) and obese (BMI 30+) (Health Canada, 2003). A high BMI often indicates a high level of body fat and this is associated with an increased risk of developing diabetes, elevated blood pressure, heart disease, gallbladder disease and some cancers. A low BMI is related to an increased risk of undernutrition, eating disorders and development of osteoporosis (Health Canada, 2003; Martin et al., 2007).

There are certain nutrients and dietary components that are of great importance to older adults with respect to healthy aging and chronic disease prevention. These include vitamin D, calcium, folic acid, vitamin B_{12}, vitamin C, zinc, dietary fiber and sodium. Vitamin D has many important roles in human health, including enhancing calcium absorption to maintain bone mineral density (Health Canada, 2010). Studies have shown that deficiency of vitamin D can also result in increased muscle weakness (Janssen et al., 2002). This is a concern with older adults as muscle weakness can compromise functional mobility, leading to a higher risk of falls and fractures (Janssen et al., 2002).

Older adults are at a particularly high risk of having inadequate vitamin D levels due to many factors. These include poor dietary intake, malabsorption, obesity, inadequate sun exposure, high latitude, medications that impair vitamin D activation or enhance clearance, and hepatic or renal failure (Marion & Sacks, 2009). Natural food sources of vitamin D are limited and only a few foods such as milk, soy beverages and some brands of margarine are fortified with this vitamin. Therefore Health Canada recommends that older adults, aged 50 years and older, take a daily supplement of 400 IU to improve vitamin D status (Health Canada, 2010). The RDA for vitamin D for men and women aged 9-70 years is 600 IU/day and this increases to 800 IU/day for those aged 70 years and older (Health Canada, 2010). Inadequate vitamin D status is commonly seen in older adults. Studies have indicated that more than one-third of the population of the United States, particularly older adults, is deficient in this nutrient based on serum levels of < 50nmol/L (Cherniack et al., 2008; Marion & Sacks, 2009).

Calcium has many important functions in the body and is well known for its essential role in bone mineral density, which promotes skeletal health and prevents osteoporosis (Vatanparast et al., 2009). Other important functions of calcium include signal transmission for heart contractions, enzyme activation, and nerve stimulation (Marion & Sacks, 2009). The RDA for calcium for men and women aged 50-71 years is 1000 mg/day and 1200 mg/day, respectively. This increases to 1200 mg/day for all adults over the age of 71 years (Health Canada, 2010). Inadequate dietary intakes of calcium have been linked to such health conditions as obesity, colon cancer and hypertension (Vatanparast et al., 2009).

Vatanparast and colleagues (2009) conducted a study to determine trends in calcium intake from foods consumed by Canadian adults. They examined survey data from three time periods: nutrition Canada 1970-72, provincial nutrition surveys 1990-99 and the Canadian Community Health Survey 2004. Data from 2004 show that the mean intakes of calcium were less than the RDA for most adults and the greatest prevalence of deficiency was seen with older adults (over 51 years of age). Mean calcium intakes did increase over time from 1970 to 2004 but this was only a modest increase considering the increase in calcium fortification of foods.

Folate is a water-soluble B-complex vitamin found naturally in foods. Folate acts as a coenzyme in single-carbon transfers in the metabolism of amino and nucleic acids

(Marion & Sacks, 2009). Folate plays an essential role in homocysteine metabolism as it functions as a coenzyme, together with vitamin B_{12}, to synthesize methionine from homocysteine. Therefore, concentrations of plasma homocysteine are elevated when inadequate amounts of folate are available to donate the methyl group that is necessary for this conversion to methionine. Deficiency of folate, vitamin B_{12} and vitamin B_6 are associated with increased concentrations of circulating homocysteine, due to their essential roles in its metabolism. Research has indicated that high levels of homocysteine increases the risk of developing heart disease and stroke (Marion & Sacks, 2009) and that circulatory system diseases are the number one cause of death of older adults in Canada (Public Health Agency of Canada, 2005).

The RDA for folate intake for both men and women 51 years of age and older is 400 mcg (Institute of Medicine, Food, and Nutrition Board, 1998). Foods that are a natural source of folate include dark green vegetables such as broccoli and spinach as well as dried legumes such as chickpeas, lentils, and beans (Mahan & Escott-Stump, 2004). In 1998, the U.S. Food and Drug Administration implemented the mandatory fortification of breakfast cereals and grains with folic acid. Since then folate status has improved in all age groups in the United States (Smith et al., 2008). However, this mandatory fortification has created concern about the impact of excess dietary intake of folate masking the hematologic signs of vitamin B_{12} deficiencies. An even greater concern exists about the increased risk for cognitive impairment that results with normal or elevated folate concentrations combined with low vitamin B_{12} levels (Smith et al., 2008). In a study conducted by Smith and colleagues (2008) older adults experienced a 70% increase in risk for developing cognitive decline with normal folate status and low vitamin B_{12} levels. The severity of this decline was more pronounced when increased plasma concentrations were combined with low plasma vitamin B_{12} (Smith et al., 2008).

Vitamin B_{12} deficiency is common among older adults, as studies indicate that 10-15% of people aged 60 years and older have low serum values (Malouf & Sastre, 2009). This inadequacy is primarily due to the loss of intrinsic factor or the reduction in the secretion of gastric acid that is required to release this vitamin from food (Malouf & Sastre, 2009). Intrinsic factor is a specific binding protein for vitamin B_{12} that is produced by cells in the stomach lining and it facilitates absorption of this nutrient in the small intestine (Mahan & Escott-Stump, 2004). Therefore, Health Canada recommends that adults aged 51 years and older consume foods fortified with vitamin B_{12} or a daily supplement to ensure that intakes meet the AI of 2.4 mcg/day (Mahan & Escott-Stump, 2004).

Along with folate, vitamin B_{12} is needed for the methylation of homocysteine to methionine. Methionine is then activated into S-adenosyl-methionine, which donates its methyl group to methyl acceptors, including myelin, neurotransmitters and membrane phospholipids (Graham et al., 1997; Marion & Sacks, 2009). This cycle promotes the integrity of both nervous and haematopoietic systems and B_{12} insufficiency leads to the intracellular accumulation of homocysteine, which can have toxic implications on neurons (Malouf & Sastre, 2009). Deficiency of vitamin B_{12} can have neurological consequences with cognitive and depressive symptoms. Skarupski and colleagues (2010) conducted a large population based study in the United States looking at the impact of B vitamins on depression. Results indicated that higher intakes of vitamin B_{12} (and B6) were associated with a reduced chance of developing depressive symptoms over an average of 7 years (Skarupski et al., 2010).

Vitamin C has many important functions in the body including facilitating iron absorption and the synthesis of collagen, norepinephrine, and carnitine (Mahan & Escott-Stump, 2004). It also has an important role as an antioxidant as it undergoes single-electron oxidation, preventing oxidative damage (Marion & Sacks, 2009). The RDA for vitamin C for men and women aged 51 years and older is 90 mg/day and 75 mg/day respectively (Institute of Medicine, Food and Nutrition Board, 2000). Vitamin C is found in a variety of fruits and vegetables and deficiency is rare in all age groups aside from older adults. A study looking at differences in older adult supplement users and non-users found that 25% of older adults (51 years and older) were deficient in intakes of vitamin C from food alone (Sebastian et al., 2009).

Zinc is a mineral that is required by over 300 enzymes in the body for regulatory functions and therefore it has an important role in many metabolic pathways (Staper & Rash, 2009). Zinc is important for supporting growth and development and it is essential for the metabolism of carbohydrates, fats and proteins. It strengthens the immune system and it aids in proper wound healing (Mahan & Escott-Stump, 2004). The RDA for zinc intake for men and women aged 51 years and older is 11 mg/day and 8 mg/day respectively (Institute of Medicine, Food and Nutrition Board, 2000). Serum zinc levels tend to decline with increasing age due to low dietary intake of foods rich in zinc as well as the consumption of foods that negatively affect the bioavailability of zinc (Stewart-Knox et al, 2008). Consequences of zinc deficiency may include alterations in taste acuity, delayed wound healing and decreased immune function, all of which are particularly important to older adults (Stewart-Knox et al., 2008; Marion & Sacks, 2009). Immune function decreases with age and deficiency of this mineral can negatively impact cell-mediated immunity, which elevates the risk of infections (Marion & Sacks, 2009).

Stewart-Knox and colleagues (2008) conducted a double blind randomized controlled intervention trial to determine taste acuity in response to zinc supplementation of 15 mg and 30 mg/day compared to placebo. Taste acuity tends to decrease with age, in particular for salt. Results indicated that taste acuity for salt was increased in the participants taking a daily supplement of 30 mg of zinc compared to the placebo.

Zinc status may also have a role in the progression of macular degeneration (Marion & Sacks, 2009; Staper et al., 2009). Results from the Age-Related Eye Disease Study (AREDS) show that zinc supplementation combined with antioxidants resulted in a modest decrease in risk of worsening visual acuity compared to the placebo (Evans, 2006). However, more trials are needed to determine the effect of zinc supplementation on the progression of macular degeneration.

Dietary fiber has many important roles in the body, and low intakes have been linked to gastrointestinal disease, cancer (colorectal, stomach, prostate, and breast), coronary heart disease and metabolic disorders such as diabetes, hyperglycemia, and obesity (Dharmarajan et al., 2003). Dietitians of Canada recommend that adult males and females consume 38 g/day and 25 g/day respectively (Dietitians of Canada, 2010). Older adults tend to have low intakes of dietary fiber and this trend was apparent in the results of the National Health and Nutrition Study. Results indicated that participants over 70 years old consumed less than half of the recommended amount for daily fiber intake (Dharmarajan et al., 2003).

The consumption of dietary fiber could potentially impact disease risk through different mechanisms that function to regulate and maintain body weight (McKeown et al., 2009). Soluble fiber is found mostly in fruit and vegetables and research has shown that this type of fiber may slow gastric emptying as well as impact the action and secretion of insulin. Insoluble fiber is found mostly in cereals and may function to activate the release of gut hormones that are essential in regulating food intake (McKeown, et al., 2009). In a cross-sectional analysis conducted by McKeown and colleagues (2009), high consumption of whole grain foods was associated with a significantly lower percentage of abdominal fat in a dose dependant manner.

Sodium is a required nutrient in the diet as it is important for the regulation of fluids and blood pressure as well as the proper functioning of nerves and muscles. The AI for sodium intake for adult men and women is 1,500 mg/day, however, dietary intakes tend to be above the upper limit (UL) of 2,300 mg/day (Health Canada, 2008). Studies indicate that 2/3 of Canadian woman and 90% of Canadian men have dietary intakes over the UL (Barr, 2010).

Results from the British Columbia Nutrition Survey (BCNS) provide a good indication of how Canadian older adults are doing with respect to their health and nutritional status. This province-wide comprehensive nutrition survey included 1823 participants aged 19-84 years and focused on the nutritional health of seniors (Levy-Milne, 2004). Results indicated that 63% of older adults residing in B.C. are classified as overweight or obese and less than 2% are underweight. Approximately 62% of this population is at an increased risk for health problems when compared to waist circumference risk categories (Levy-Milne, 2004).

The nutrients identified with the highest levels of inadequacy in the BCNS were folate, vitamins B6, B12 and C, as well as magnesium and zinc for both sexes and protein for men (Levy-Milne, 2004). In addition, approximately 62% of older men and 25% of older women were above the UL for sodium (2.3 g/day). This is a great concern as 38% of participants report hypertension (Levy-Milne, 2004). Perhaps this is a consequence of low dietary zinc intakes and zinc's proposed impact on salt taste acuity (Stewart-Knox et al., 2008).

Dietary intake information in the BCNS was obtained by home interviews with the use of a food frequency questionnaire (FFQ), 24-hour recall (24 HR), and a general nutrition questionnaire focusing on physical activity, healthy weight, body image, and food security (Levy-Milne, 2004). The accuracy of these dietary assessment methods is debatable, as reported mean energy intakes were below the estimated requirements. This is indicative of low energy reporting, which is a common error in this age group and with these current dietary assessment tools (Levy-Milne, 2004). Reports from Statistics Canada indicate that cancer and heart disease are the leading causes of death among older adults and that arthritis/rheumatism and high blood pressure are the most prominent chronic conditions (Statistics Canada, 2007). Interestingly, all of these conditions have nutritional implications.

III. Cognitive Function and Memory

The frequency and extent of decline in cognitive function is highly variable among older adults. Research has indicated that some cognitive decline is a normal consequence of aging, particularly functions related to memory and information processing speed (Maylor, 2005; Durga et al., 2007). In particular, many studies have illustrated declines in episodic memory including an increased susceptibility to false memories (Maylor, 2005) that may bias the measurement of habitual dietary intakes.

Many tools exist that are used to assess changes in cognition in older adults. The Mini-Cog is a simple and brief questionnaire that is used to assess cognition in primary care and senior care settings (Kaufer et al., 2008). Both the Montreal Cognitive Assessment and the Mini Mental State Examination (MMSE) have been used in many research studies to assess changes in cognition in older adults (Toglia et al., 2011). The MMSE, which was developed my Folstein and colleagues in 1975, is considered to be the gold standard of cognitive screening tools (Folstein et al., 1975; Kaufer et al, 2008). This tool has been used clinically as well as in many studies to evaluate cognitive status and changes in cognition over time (Potvin et al., 2011). Potvin and colleagues used the MMSE to determine changes in cognition over time when evaluating the impact of anxiety and depression on cognitive decline in a group of older adults residing in the community (Potvin et al, 2011).

Decline in memory is an important consideration when choosing a diet assessment method for use with older adults. The FCM (Shuaibi et al., 2008) has the potential to enable better memory recall as it is visual and participatory and has been successfully used to assess dietary intakes in other cultures (Sevenhuysen & Gross, 2003).

IV. Dietary Assessment

Currently, no ideal method to assess the dietary intake of individuals or groups exists. Because all dietary assessment methods have their limitations, none can be considered to be a 100% reliable reference measure of true dietary intakes (Bazelmans et al., 2007). Both random and systematic errors occur often in the measurement of dietary intakes and can be partially controlled by incorporating standardized procedures into each stage of the assessment process (Gibson, 2005). Such quality control measures include adequate training and retraining of interviewers and coders, use of a standardized interview protocol, pre-testing of methods and the use of pilot studies (Gibson, 2005). Increasing the sample size of the study often controls random errors, whereas systematic errors differ and may be associated with certain populations of respondents, specific interviewers and specific food products (Gibson, 2005).

Errors in current dietary assessment methods are widespread (Bingham, 2002). It is necessary to consider the impact of nonresponse bias in diet assessment research as non-participants may have different characteristics than those who participate in the analysis. Respondent bias may also occur in diet assessment studies as the respondent may not understand a question or may receive non-verbal cues from the interviewer that may alter their response (Gibson, 2005). The participants' need for social approval may greatly skew intake data in diet assessment methods and this may have an impact most on particular food items such as fresh fruits, vegetables and sweets.

Respondent memory lapses occur in diet assessment and often result in failure to report foods consumed and/or including foods that were not consumed during the recall day (Gibson, 2005). To reduce error associated with participant memory lapses, a multiple pass method is typically employed when conducting a 24-hour recall (24-HR), with the use of probing questions and memory aids for portion size estimates. Some researchers state that portion size estimation is the greatest potential source of error in diet assessment methods (Bingham, 2002; Gibson, 2005). The ability to accurately visually estimate portion sizes is highly variable among individuals; studies have shown this is independent of age, gender, body weight, and social status and is dependent on the size of the food item (Young & Nestle, 1995). Measurement aids are often used to assist in the accuracy of portion size estimation and include: household measures, drawings, photographs, food replicas, food models and even real food samples (Gibson, 2005). Research conducted by Foster and colleagues (2006) provides evidence that the use of food photographs is appropriate to estimate portion sizes when assessing one's diet.

Failure to report supplement usage in diet assessment often results in an underestimate of nutrient intakes and consequently overestimates of the prevalence of nutritional inadequacy (Gibson, 2005). Diet misreporting is a frequent problem in diet assessment and may be more prevalent in certain populations and with specific foods and beverages (Bingham, 2002; Mattisson et al., 2005). The overall bias in diet assessment studies is underreporting; this may stem from social desirability and subject burden associated with recording and reporting dietary intakes (Krebs-Smith et al., 2000).

Validity in dietary assessment methods refers to the degree to which a dietary method measures what it is intended to measure (Gibson, 2005). Methods designed to measure usual dietary intakes of individuals are difficult to validate because true intakes are always unknown. Even if two diet assessment methods yield similar results, there is no assurance that these results represent the respondents' true dietary intakes (Gibson, 2005). As the measurement of absolute validity of a diet assessment method is extremely time-consuming and unpractical in survey settings, the assessment of relative validity is commonly used (Gibson, 2005). Relative validity involves the comparison of a test method with a reference method that has more demonstrated validity (Bailey, 1978). In an ideal situation the reference method should be chosen so that the errors of the two methods being compared are independent; however, in practice this seldom occurs (Bingham, 2002; Gibson, 2005).

In the selection of a reference dietary assessment method, it is necessary to ensure that it has the same objective and measures the same parameters over the same time frame as the test method (Gibson, 2005). Spacing the administration of the test and reference diet assessment methods in validation studies is important to ensure that the completion of the first method does not influence the results of the second (Gibson, 2005).

To accurately measure the diet of individuals or groups at any life stage presents many challenges. It is important to choose a method that best matches the question to be answered and the population group to be assessed. It is important to recognize the challenges associated with assessing food and nutrient intakes of older adults (Adamson et al., 2009). Such limitations include: the participant may have no involvement or knowledge of food acquisition or preparation, he or she may not be able to accurately name or describe the foods consumed, and poor memory or declines in cognition may limit the ability to recall dietary intake (Adamson et al., 2009).

V. <u>Dietary Assessment Methods</u>

Diet assessment methods can generally be divided into two groups: quantitative daily consumption methods and methods that obtain retrospective data on food consumption patterns (Gibson, 2005). The former includes dietary recalls (24 HR) and food records (3 days, 7 days, and weighed) and measure the quantity of individual foods consumed during the measured time period. Retrospective methods include diet histories and food frequency questionnaires (FFQs), which are generally used to assess usual dietary intakes (Gibson, 2005). As each diet assessment method has its limitations, much debate exists as to which method of dietary assessment is best. The goal is to design an assessment tool that is comprehensive in that it reflects dietary variety but that is not too burdensome for the participants (Maynard & Blane, 2009). The choice of a dietary assessment tool is largely dependent on the design and objectives of the study (Gibson, 1990).

i. Food Records

The estimated food record method entails asking the participant to keep a record of all foods and beverages consumed for a specified period of time (usually 3 or 7 days). The respondent is instructed to record detailed descriptions of all foods and beverages including portion sizes, brand names, methods of preparation, and the amount of each raw ingredient present in a meal (Gibson, 1990; 2005). The use of standard household measures, counts of items and rulers are important for portion size estimates. Portion sizes are usually manually converted into grams and then manually entered into a nutrient analysis software program (Gibson, 1990).

In the estimated food record, errors may arise in the estimation of portion sizes by the participant, which result in imprecise nutritional intake data. Weighted food records are an alternative often used in dietary assessment and require participants to weigh and record every food and beverage consumed during a specified time period (Gibson, 1990; 2005). The weighted food record is the most precise method of dietary assessment currently available (Gibson, 2005). However, in order for this method of assessment to succeed, respondents must be highly motivated, numerate, and literate. Concern exists that participants may change their usual diet during the study period to simplify the weighing process, or to impress the investigator (Gibson, 1990). Weighted food records impose a great amount of burden on participants and may be unsuccessful in measuring true intakes as a result in changes to food intakes and inaccurate records (Foster et al., 2006). Food records are associated with higher respondent burden than 24 HRs and individuals may be less inclined to participate creating a respondent selection bias (Gibson, 2005).

ii. Food Frequency Questionnaire (FFQ)

The purpose of the FFQ is to provide information on usual dietary patterns and it is often used in used in large-scale nutritional epidemiological studies (Adamson et al., 2009; Kipnis et al., 2002). A FFQ questionnaire generally consists of an extensive list of foods and a set of frequency of use categories. It is not generally used to provide quantitative data on individual nutrient intakes (Gibson, 1990; Gibson, 2005). However, portion sizes can be quantified with the use of photographs and the participant can use these as a reference to rank the portion sizes of consumed items as small, medium, and large (Gibson, 2005). When portion sizes are depicted in the FFQ, nutrient intakes can be calculated and this method of assessment is referred to as semiquantitative FFQ (Gibson, 2005).

There are many advantages of using the FFQ as it is simple and quick to administer and relatively inexpensive compared to other dietary assessment methods (Willet & Hu, 2007). The FFQ imposes fewer burdens on participants than other methods and dietary information is readily collected and easily manipulated to rank participants in categories of intake levels (Gibson, 1990). However, years of diet assessment research with the FFQ have made its limitations in obtaining accurate dietary intakes apparent (Kipnis et al., 2002). The FFQ requires the participant to have a high level of conceptual ability which impacts on response rates and the quality of data obtained (Maynard & Blane, 2009).

iii. 24 Hour Recall (24 HR)

In the 24 HR recall method, study participants are asked to recall their exact food and beverage intake during the previous 24 hour time period. The design of a 24 HR is to assess actual nutrient intakes over a 24-hour period. The interviewer must record detailed descriptions of all foods and beverages consumed by the participant, including portion sizes, brand names, and cooking methods (Gibson, 1990; 2005). Food models, photographs, or household measures are typically used to estimate portion sizes. Multiple 24 HRs can be obtained to determine habitual intakes and involve recalls on multiple days of the week, with the inclusion of one weekend day. This is necessary to control for day-of-the-week effects on food and/or nutrient intakes (Gibson, 1990; 2005). Multiple 24 HRs are often used as a reference measurement to validate other assessment methods (Kipnis et al., 2002).

The 24 HR is a time efficient method that can be used with illiterate subjects with less subject burden than other methods (Gibson, 1990). However, it is important to consider the limitations of the 24 HR as its success in measuring true intakes depends on many factors. These include the subject's memory, motivation, ability to estimate accurate portion sizes and the interviewer's skills (Gibson, 1990).

A four stage, multiple pass interviewing method is often used when conducting a 24 HR dietary recall (Adamson et al., 2009; Gibson, 2005). In the first pass, a complete list of all foods and beverages consumed in the past 24 hours is obtained. The second pass involves obtaining a detailed description of each food and beverage consumed, with the inclusion of cooking methods and brand names if possible. It is important to use standardized probe questions at this stage to obtain more detailed information about the respondent's dietary intakes. In the third pass, estimates of portion sizes of each food and beverage are obtained using household measures or photographs. Results are entered on the data sheet and information on the ingredients of mixed dishes is obtained. The fourth pass involves a review of the 24 HR to ensure all items are recorded accurately and that any nutrient and mineral supplement information has been gathered (Gibson, 2005).

This method of dietary assessment is used often in research and has been used in some national nutrition surveys such as the U.S. National Health and Nutrition Survey (NHANES) (NCHS, 1994), the Continuing Survey of Food Intakes by Individuals (CSFII) (USDA, 1998), the Canadian Community Health Survey (CCHS) (Garriguet, 2007) and the Newcastle 85+ study (Adamson et al., 2009). Researchers recommend that all dietary interviews involving memory recall be conducted in the participant's home if possible. A familiar environment is important in encouraging participation and to improve recall of food consumption (Gibson, 2005).

iv. Food Choice Map (FCM)

The FCM is a unique diet assessment method for usual weekly intake that integrates an interview tool with a computerized program that quantifies food and nutrient intakes in real time (Shuaibi et al., 2008). The specialized interview structure of the FCM is designed to measure an individual's habitual dietary intake. Two advantages of the FCM interview in comparison with other assessment techniques are reduced error from participant memory lapses and automated data entry. Automated data entry is less expensive and time-consuming than the coding and data input associated with food records (Shuaibi et al., 2008). Calculations of nutrient and foods in the FCM-nutrient analysis program are made with food consumption data from 1462 food items, including international and ethnic foods (Shuaibi et al., 2008). Estimates of all the nutrients in the FCM database are from the Canadian Nutrient File 2001b with some supplementary data from the USDA and the professional literature (Health Canada, 2001; Shuaibi et al., 2008).

The FCM consists of several magnetic 1.3 cm^2 food pictures and a map board connected to a laptop with a FCM-nutrient analysis program (Shuaibi et al., 2008). The colour coded magnetic food pictures represent the food choices of the participant. Each picture has a barcode that is scanned into the portable laptop using a pen-style barcode scanner during the interview. Several food items associated with the magnetic picture will appear on the screen when scanned and the interviewer, with input from the participant, selects the best match for the food item (Shuaibi et al., 2008). See the appendices for the FCM interview script.

During the FCM interview, the participant and interviewer work interactively in placing the magnetic pictures on the food map board to visually represent the usual dietary intakes of the participant. The map is designed so the vertical placement of food pictures on the board represents time of day of consumption (early, snack 1, mid day, snack 2, end of day, late snack) and the horizontal placement of food pictures indicates the number of times per week that the food was consumed. All of the data collected on the respondent's dietary pattern is collected and entered into the database electronically at the time of the FCM interview, including the codes for frequency, time of day, food category, food item, and portion size (Shuaibi et al., 2008).

The administration of a FCM interview has a very specific protocol. To commence the interview the participant is asked to consider a food that they consume regularly. The magnetic pictures are then placed on the board according to the usual time of day and usual consumption frequency per week. The interviewer uses follow-up questions to build a visual record of typical meals and snacks. The participants are encouraged to actively participate in creating a visual map of food frequencies by placing the food symbols on a map with grid lines (Sevenhuysen & Gross, 2003). This may encourage subjects to become more engaged in the assessment and promote better memory recall. Previous study has shown that a FCM interview takes approximately fifty minutes to complete: 20 minutes to place the food pictures on the map, and 30 minutes to identify each food in the database and to estimate portion size (Shuaibi et al., 2008).

In the FCM interview, the estimation of portion sizes is aided by the use of *Portion Photos of Popular Foods* as a reference tool (Hess, 1997; Shuaibi et al., 2008). This reference book consists of life-size photos of many food items with several photos of the same food item displaying different portion sizes (small, medium, and large) or different measures (cups, spoons, and scoops) depending on the individual food item.

Both the design and methodology of the FCM interview is different from most existing methods as participants are asked to recall their overall food behaviours over a usual week. Data is collected on meal times and composition of meals with alternative and substitute foods in the FCM interview. This is unique from the commonly used recall method of recording specific foods eaten at a specific time period over a specified number of days (Shuaibi et al., 2008). Dietary intake data obtained in a FCM interview reflects the overall pattern of the participants' consumption. This pattern is characterized by frequencies of meal times, food items and meals throughout a usual week. The relative contribution of particular foods can be calculated, with the inclusion of alternatives and substitutions, and can be compared to total nutrient intakes (Shuaibi et al., 2008).

The FCM is flexible, as can be used to provide both qualitative and quantitative information about an individual's usual diet depending on the specific objectives of the study. A qualitative study using the FCM to determine usual intakes has been published (Sevenhuysen & Gross, 2003). Shuaibi and colleagues (2008) conducted a quantitative analysis of the FCM as a dietary assessment technique for use with college-aged women. The objective of this study was to validate the FCM in estimating folate and B12 intakes in comparison to serum folate and B12 concentrations in 95 female participants aged 18-25 years. This cross-sectional analysis compared two dietary assessments, the FCM and three day food records (3DFR), to serum levels of folate and vitamin B12. The method of triads was used to calculate validity coefficients among the three parameters (Shuaibi et al., 2008).

Results illustrated no significant difference between the two dietary assessment methods in the correlations with serum values of folate and vitamin B12. Specifically, the FCM-obtained folate intakes ($r = 0.43$, $p < 0.01$) showed a comparable moderate association with serum folate as the 3DFR-obtained folate intakes ($r = 0.39$, $p < 0.01$). In addition, the vitamin B12 intakes determined by both dietary assessment techniques showed a moderate association with serum vitamin B12 (FCM: $r = 0.40$, $p < 0.01$, 3DFR: $r = 0.44$, $p < 0.01$) (Shuaibi et al., 2008). It is important to consider that the validity coefficient (VC) for the FCM was higher than for the 3DFR for both folate (FCM = 0.97; 3DFR = 0.79) and vitamin B12 (FCM = 0.95; 3DFR = 0.85) suggesting that the FCM represented respondent status better for these two nutrients than the 3DFR. The data supports the conclusion that FCM is a valid method for estimating folate and vitamin B12 intakes of women aged 18-25. Further study in both sexes and with different age groups is needed to further support the applicability of the FCM (Shuaibi et al., 2008).

V. Low Energy Reporting

A common problem seen in diet assessment research is the participant underreporting his or her food intake. Underreporting of energy intakes has been observed in the results of numerous dietary assessment studies (Cook et al., 2000; Mattisson et al., 2005; Bazelmans et al., 2007; Tooze et al., 2007). Results of NHANES III indicated that 28% of women and 18% of men are energy intake underreporters (Briefel et al., 1997; Gibson, 2005). Underrecording and/or undereating are potential causes of low energy reporting in populations. In general, the term “low energy reporters” (LER) refers to respondents whose reported energy intakes are less than what could physiologically sustain metabolism during the assessment period (Krebs-Smith et al., 2000; Poslusna et al., 2009).

A few methods exist in measuring the occurrence of energy misreporting in diet assessment surveys. Most methods look at the ratio between energy intake (EI) and energy expenditure (EE). Different cut-off points have been used in studies to determine if misreporting of energy intake occurred (Posluna et al., 2009). If the ratio between EI and total energy expenditure (TEE) is less than 0.79 the respondent is considered to be a low energy reporter and if the ratio is more than 1.21 the respondent is classified as a high energy reporter (HER) (Barnard et al., 2002). The doubly labeled water (DWL) technique is considered to be the most accurate method of measuring energy expenditure (Poslusna et al., 2009) but is expensive, time consuming and imposes a greater burden on participants than other methods. TEE can also be calculated by using a formula that takes into account an individual's weight, height, age, and energy expenditure (Mahan & Escott-Stump, 2004; Institute of Medicine, Food and Nutrition Board, 2002). Calculating energy expenditure involves generating a physical activity level (PA) of the individual. See table 3 for a description of the different PA levels.

Table 3. Values of Physical Activity Levels

Activity	PAL
Sedentary	1.0-1.39
Low Active	1.4-1.59
Active	1.6-1.89
Very Active	1.9-2.5

Adapted from: Institute of Medicine, 2002

Some studies have assessed the incidence of LER by comparing reported energy intake and actual dietary intake obtained by direct observation of study participants. Another method used is comparing reports of energy intake to weight maintenance to determine if misreporting has occurred (Poslunsa et al., 2009).

Research findings have shown that LERs are most often women, obese, younger than 18, and older than 65 (Gibson, 2005; Bazelmans et al., 2007). Research has identified that cakes, pies, savory snacks, cheese, potatoes, meat products, soft drinks, fat-type spreads, and condiments are often under-reported (Krebs-Smith et al., 2000). Interestingly, these foods are often considered “bad” and may be underreported due to dietary restrictions or social desirability bias (Gibson, 2005).

VI. Qualitative Methods

The focus of qualitative research methods is on gathering non-numerical data. These methods derive insights directly from the participants whom the study is intended to benefit (Smith et al., 2004). It is important to keep in mind that the comments made within the interviews are based on individual opinions and that qualitative research is largely interpretive (Creswell, 2003). Qualitative methods are important in diet assessment research, as they provide the researcher with valuable information from the unique perspective of the participant. These methods employ a flexible approach for collecting rich descriptive data (Safman & Sobal, 2004) and are beneficial in interpreting diet assessment data. They are specifically useful in determining whether one’s habitual dietary pattern has been fully captured by the assessment (Maynard & Blane, 2009).

In 2004, Smith et al conducted a study of The Seattle Senior Farmers’ Market Nutrition Program using qualitative methods. This program was created to improve seniors' daily intake of fruits and vegetables and involved the delivery of fresh fruits and vegetables to homebound seniors in Seattle. To evaluate the effectiveness of this program, a qualitative study was conducted examining the impact of the program on the senior participants. This study used both quantitative and qualitative methods to overcome the limitations of using either method alone (Smith et al., 2004). Four major steps were used in the data analysis: evaluate transcribed interviews and notes; organize topics and subgroups; identify basic themes, support themes with quotes and triangulate; compare findings with quantitative study and apply findings to the model (Smith et al., 2004). Many common themes were revealed during data analysis including improved access to fresh produce, appreciation of variety and quality of product, increased interest in healthy eating and improved general quality of life (Smith et al., 2004).

VII. Mixed Methods

A mixed method type of analysis involves the sequential collection of quantitative and qualitative data to understand a research problem (Creswell, 2003). It is relatively new in research but has been used in many studies. Many approaches exist and it is important to consider the implementation, priority, integration and theoretical perspective when choosing the approach (Creswell, 2003). The sequential explanatory strategy involves the collection and analysis of quantitative data followed by the collection and analysis of qualitative data. In this approach the emphasis is typically on the quantitative data and the methods are mixed during the interpretation phase of the study (Creswell, 2003). A theoretical perspective is not necessary with this approach but is sometimes included. The qualitative results are usually used to help in explaining the quantitative findings (Creswell, 2003).

Chapter 3

Materials & Methods

I. Aim & Approach

The aim of this exploratory study was to investigate if the FCM is an appropriate dietary assessment tool to use with older adults. The approach used was a sequential explanatory strategy, including quantitative and qualitative methods for analysis. The methods were mixed at the interpretation stage.

II. Research Objectives

1. To identify whether the FCM interview results in differences in reports of foods consumed by older adults in comparison to mean values of three 24 HR's.
2. To explore older adults' perspective of the FCM as a diet assessment tool.
3. To explore and identify dietary risk in a group of community living Canadian older adults.
4. To determine the incidence and the role of demographic characteristics on low energy reporting in two diet assessment methods with Canadian older adults.

III. Study Design

This exploratory study examined the differences in recall of food and beverage consumption using two diet assessment tools: the FCM and the average values of three 24 HRs. Specifically, the relative validity of these two diet assessment techniques was explored in this analysis.

i. Participants

The sample size of this study was 20 older adults (65 years and older), with the inclusion of both men and women. The participants were recruited from the community from independent/assisted living facilities and recreation centers. Directors of independent/assisted living facilities in Winnipeg (i.e. Bethel Place, Sterling House, The Waverley) were contacted and posters advertising the project (see appendices) with a contact number for those interested were placed at various recreation facilities (i.e. ReFit Centre, Moksha Yoga Winnipeg, and Rady JCC). Study information business cards with a contact number were given to participants to remind them of appointments and to circulate in the community to aid with participant recruitment. Table 4 describes the inclusion and exclusion criteria for participation in this study.

Table 4. Inclusion/Exclusion Criteria

Inclusion	Exclusion
Men and Women > 65 years of age	Residing in a personal care home
Community-dwelling or residing in an assisted/independent living facility	Diagnosed dementia or Alzheimer's disease or < 24 score MMSE
Cognitively intact (> 24 score MMSE)	Diagnosed malabsorption syndrome (i.e. Celiac disease)
Able to speak/communicate	Dysphasia
Exhibits food choice	Adherence to a modified diet (i.e. pureed/minced foods)

ii. Interview Format

Study participants were randomly allocated to complete either the FCM interview or the multiple 24 HRs to control for potential bias. Table 5 describes the format that was used to interview all study participants.

Table 5. Interview Format

Interview Period	Group 1 (n=10)	Group 2 (n=10)
Interview 1	Informed consent Demographic form MMSE	Informed consent Demographic form MMSE
Interview 2	FCM	1st 24 HR 2nd 24 HR 3rd 24 HR
2 week waiting period		
Interview 3	1st 24 HR 2nd 24 HR 3rd 24 HR	FCM

Notes:

1. Participants were randomly allocated into two interview groups
2. The principal investigator, Jillian Einarson, conducted all dietary assessment interviews.
3. All interviews were conducted in a confidential setting, such as at the participants' homes.
4. All three 24 HR recalls were conducted during the same week, with the inclusion of 2 weekdays and 1 weekend day.

IV. Methods

i. FCM Nutrient Analysis Program

The FCM nutrient analysis program (Shuaibi et al., 2008) was used to analyze the food intake data obtained with both the FCM and the multiple 24 HRs. The calculations of nutrient and foods in this program are made with food consumption data from 1462 food items, including international and ethnic foods (Shuaibi et al., 2008). The estimates of all the nutrients in the FCM database are from the Canadian Nutrient File 2001b (Health Canada, 2001) and from supplementary data from the USDA and the professional literature (Shuaibi et al., 2008).

ii. <u>24 Hour Recalls</u>

The mean values of three 24 HRs were used as the reference method for comparison with the FCM, the test method. Two of the 24 HRs were conducted on weekdays and one on a weekend day to fully capture variability in dietary intakes. All three 24 HRs were conducted using the standard four stage multiple pass method (Gibson, 2005) and all diet assessment interviews were recorded using a digital voice recorder. In the first pass, a complete list of all foods and beverages consumed in the proceeding day were obtained. The second pass involved recording a detailed description of each food and beverage consumed. Probing questions were used to obtain information on cooking methods and brand names if possible. In the third pass, portion estimates were obtained for each food and beverage using *Portion Photos of Popular Foods* (Hess, 1997). This reference book was used to determine portion sizes for both diet assessment methods. The fourth pass involved reviewing the 24 HR to ensure all items were recorded correctly and that supplement use was documented.

A sample 24 HR form can be found in the appendices of this document. The data that was obtained during the three 24 HRs was entered into the 2007 Canadian Nutrient File database to yield results. These results generated from this analysis included each participant's dietary structure, level of processing of the usual diet, absolute nutrient intakes and nutrient intakes as a percentage of the DRIs. The mean values obtained from the three 24 HR were compared to the results of the FCM interview to determine if differences exist in recall. Parameters that were used as markers for comparison of recall included diet structure, level of processing, energy intakes, and absolute nutrient intakes.

iii. Initial Interview

At the initial interview the study procedure and the interview structure was explained to the participants. All study participants were required to sign an informed consent form and to complete a Mini-Mental State Examination (MMSE) **(**Kurlowicz & Wallace, 1975**)** at the first interview to screen for cognitive status. The MMSE is a questionnaire that consists of 30 questions designed to assess arithmetic, memory, and orientation. A score of 25 and over indicates normal or intact cognition, 21-24 indicates mild impairment, 10-20 indicates moderate decline in cognition and a score of 9 and under indicates severe cognitive impairment (Folstein et al., 1975). Participants who scored under 24 were excluded from participating in the study.

The Joint Faculty Research Ethics Board at the University of Manitoba under expedited review granted ethical approval for this study. Demographic information (i.e. age, sex, level of education, height, weight, supplement and medication use, smoking, alcohol consumption) was documented in the first interview on the demographic form by the interviewer (see appendices). Participants were asked to bring any nutritional supplements and/or medications that they were currently taking to the initial interview for the interviewer to record. Medication use was documented as some medications interfere with nutrient absorption and/or cognitive status and polypharmacy is an indicator of nutritional risk. Demographic information was utilized to describe the population under study and to determine the influence of demographic variables on dietary recall.

iv. <u>The Food Choice Map</u>

The administration of the FCM interview took approximately one hour and followed the protocol of Shuaibi and colleagues (2008). See the FCM script in the appendices for more details. The interview began by asking the participant to consider which food he or she consumes often and the magnetic pictures were placed on the food map board according to usual time of day and usual consumption frequency per week reported by the participant. Follow-up questions were used to build a visual map of meals and snacks with the inclusion of alternative items and substitutions. The participants were encouraged to actively participate by placing the magnetic pictures on the food map board. After all pictures were placed on the board, the *Portion Photos of Popular Foods* (Hess, 1997) was used as a reference to determine portion sizes. All information was scanned into the portable laptop at the time of the interview.

v. <u>Qualitative Component</u>

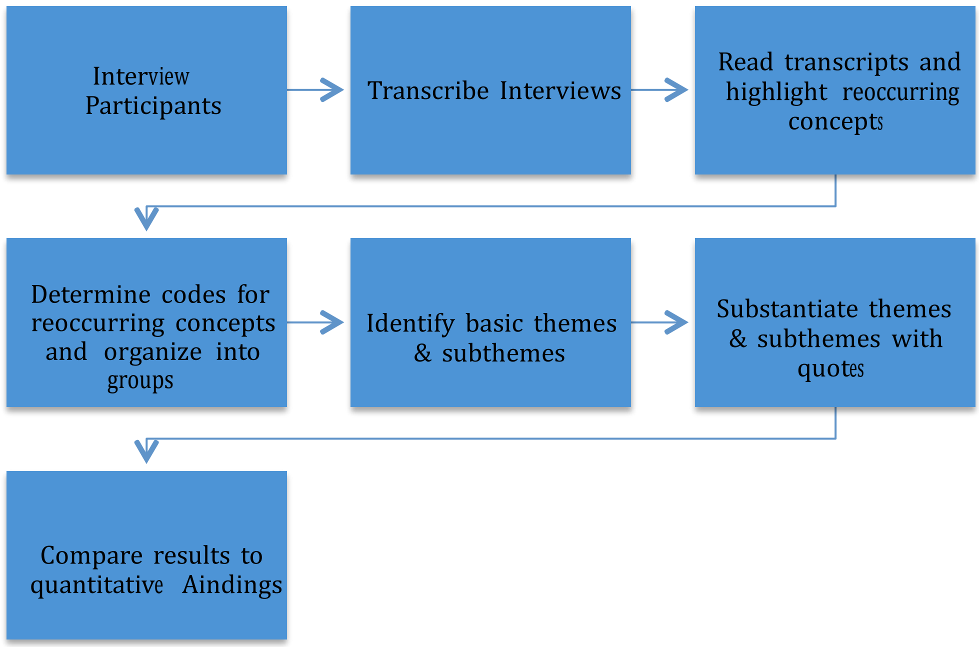
After the completion of the last diet assessment interview, participants were asked to reflect on their personal experiences with the two diet assessment methods. Participants were encouraged to share their thoughts about their experiences with the two different diet assessments. The following questions were used as a guide and to probe for additional information:

1. *Which assessment method do you prefer?*
2. *Which assessment method was harder/easier?*
3. *Which assessment method is useful?*
4. *Which assessment method is engaging?*

5. *Which assessment method do you think would have an impact on your food choices?*
6. *Do you think the FCM is a good diet assessment tool for seniors?*
7. *Any other thoughts?*

Responses to these questions and the diet assessment interviews were audio-recorded and were then transcribed to generate transcripts. Content analysis was then conducted and coding was used to organize the material into categories. From these categories the interviewer was able to identify reoccurring concepts. The reoccurring concepts were then grouped into themes and subthemes to gain insight into seniors' perspectives of the FCM for diet assessment. Figure 1 highlights the steps taken for the qualitative data analysis. Following the sequential explanatory strategy (Creswell, 2003), results from this qualitative analysis have been used to explain and enrich the quantitative results in assessing whether or not the FCM is an appropriate diet assessment tool to use with this population.

Figure 1. Qualitative Analysis



(Smith et al., 2004)

vi. <u>Feedback to Participants</u>

Thank-you cards were mailed to all study participants in the time period between the two interviewing periods to retain interest and participation in the study. Upon completion of all interviews the study participants received feedback about the results of their personal dietary assessment. All participants were mailed a package containing their average nutrient intakes from both diet assessments along with the recommended nutrient intakes for their age and sex. Food suggestions were given for nutrients that were deficient in their personal diet in order to educate and facilitate better nutrient intakes in this group of older adults. This feedback component creates an opportunity for future study on the impact of a nutrition intervention on the dietary intakes of older adults. More information about the results of the study is available to the participants upon request.

V. Statistical Analysis

All quantitative data was analyzed using the statistical software JMP (SAS, 2009). Matched pairs T tests were conducted to determine if significant differences existed in recall between the two diet assessment methods at a significance level of $p < 0.05$. All interviews were digitally recorded and these interviews were transcribed for the qualitative analysis. The transcripts were analyzed using content analysis, to determine frequencies of concepts, which formed re-occurring themes and sub-themes.

Chapter 4

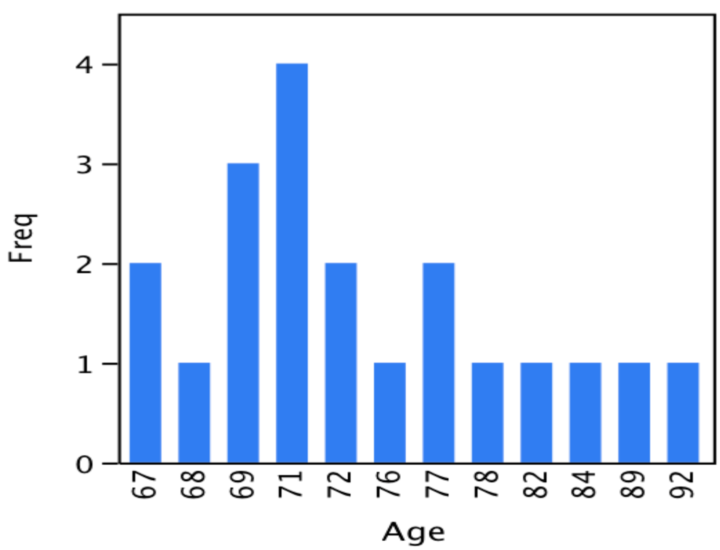
Results

I. Quantitative results

Demographic characteristics

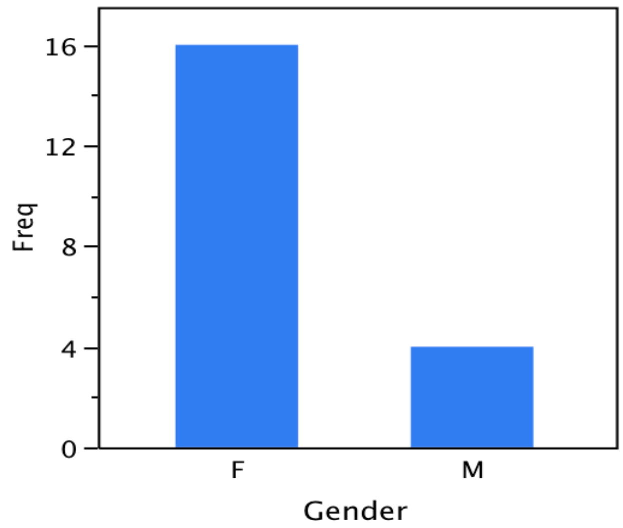
This study involved 20 older adult participants recruited from the community, who participated in both diet assessment methods over a one-month time period. The participants ranged in ages from 67-92 years. The mean age of the participants was 74.6 years with a standard deviation of 7.2.

Figure 2. Histogram of the Age of Participants



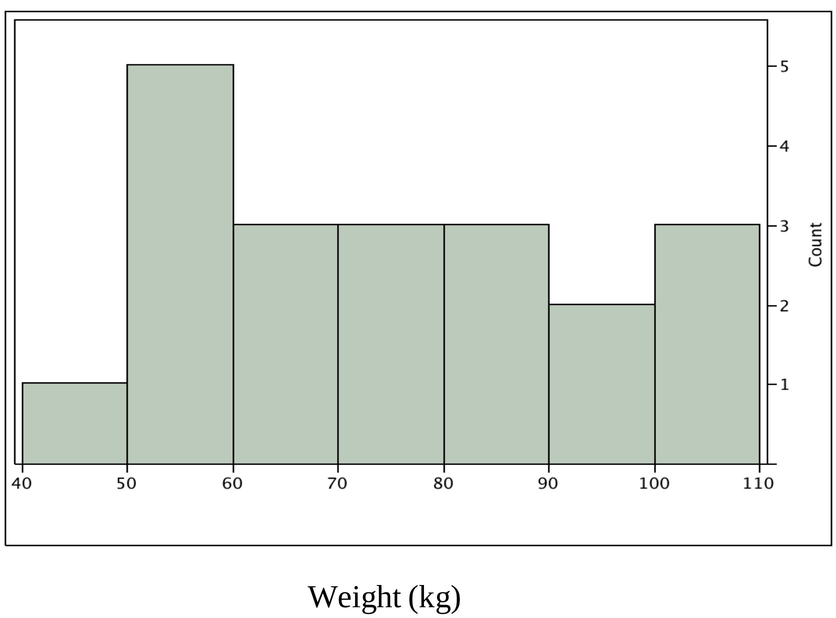
Both men and woman were included in this study, however more women were recruited. The sample consisted of 16 women and 4 men.

Figure 3. Histogram of the Participants Gender



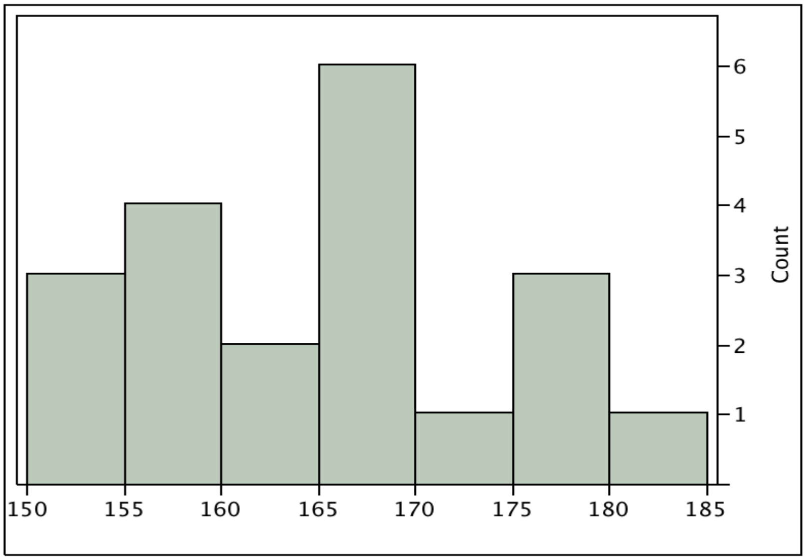
All participants reported their current weight to the interviewer. The mean weight of the participants was 74.9 kg with a standard deviation of 18.4 kg.

Figure 4. Histogram of the Weights of Participants



Self-reported height was also documented. The mean height of participants was 165.3 cm with a standard deviation of 8.2 cm.

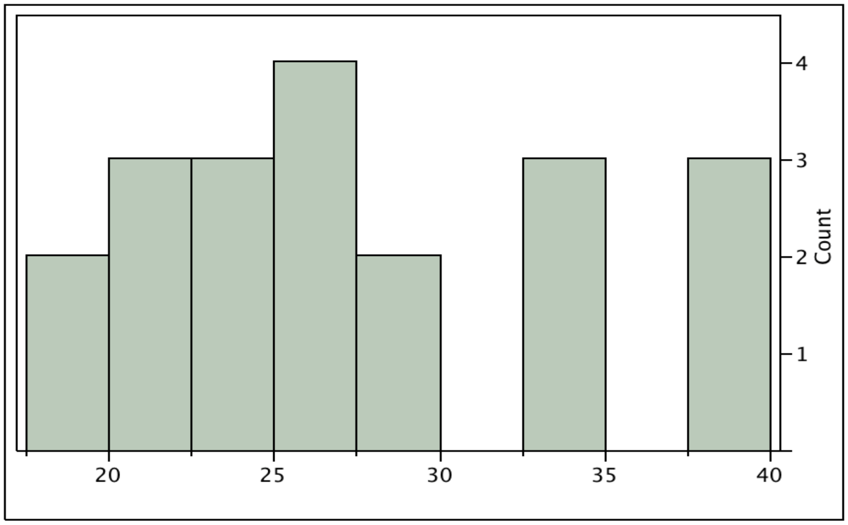
Figure 5. Histogram of the Heights of Participants



Height (cm)

Each participant’s BMI was calculated from their self reported weight and height using the formula kg/m^2. The range of BMI values was from 19.2 to 39.7. The mean BMI for the study sample was 27.8, with a standard deviation of 6.3.

Figure 6. Histogram of the Participants Body Mass Index



BMI

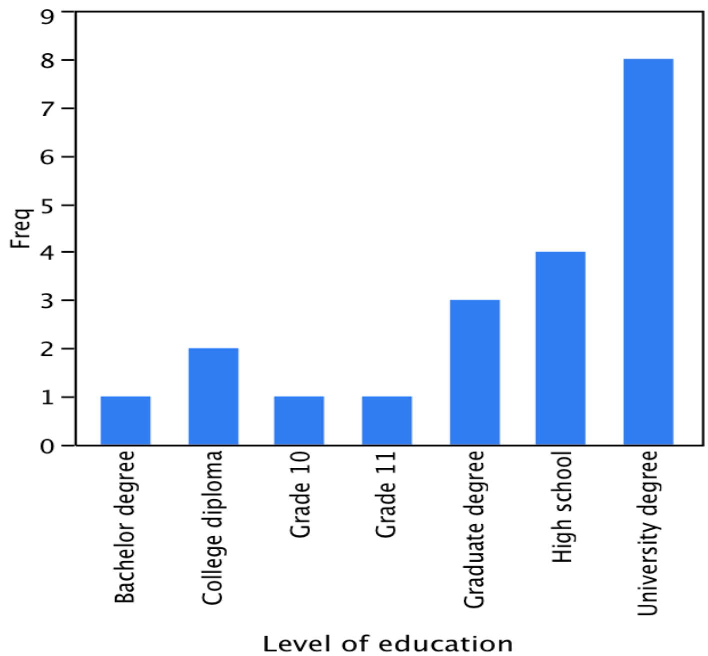
The number and percentage of participants in the various BMI classifications was also calculated and is highlighted in Table 6. Most participants were in the normal weight category (40%) followed by the overweight (30%) and obese (30%) categories. Therefore 60% of study participants were considered to be overweight or obese, placing them at a higher risk of developing chronic health conditions.

Table 6. Number of Participants in Each Body Mass Index Category

BMI Classification	< 18.5 (underweight)	18.5-24.9 (normal weight)	25-29.9 (overweight)	>30 (obese)
Number of participants	0	8	6	6
Percentage of total participants	0%	40%	30%	30%

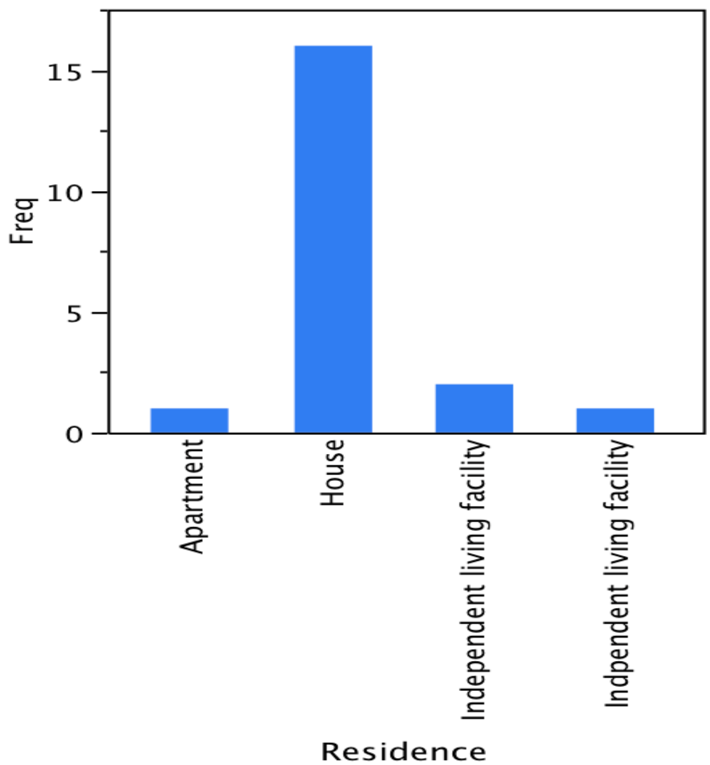
The study participants' level of education varied but most participants had achieved a high level of education. Specifically, two participants had completed a college diploma, nine had completed a University degree and three had completed a Graduate degree. All participants had completed some high school as one had achieved grade 10, one had achieved grade 11 and four had completed high school. Therefore, this population of older adults was highly educated.

Figure 7: Histogram of the Level of Education of Participants



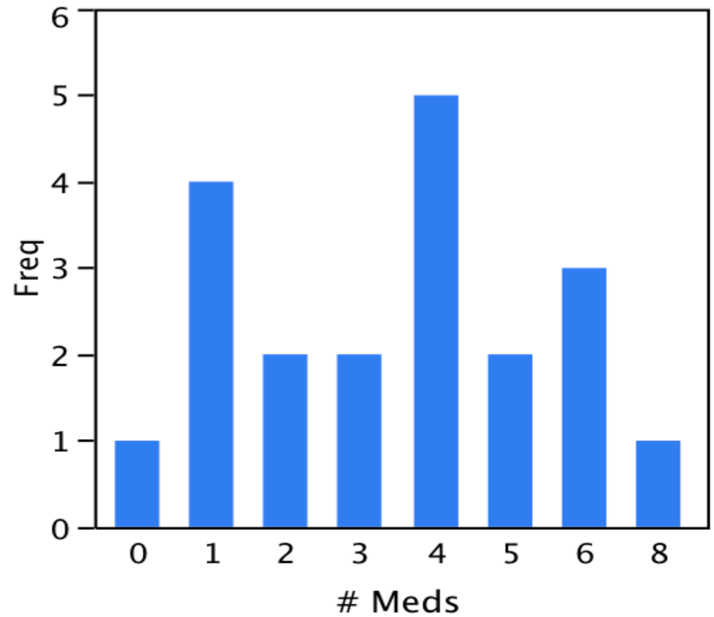
A requirement for participating in this study was that the subject must have the ability to prepare his or her own foods or must exhibit food choice. Therefore, older adults living in a personal care home or supportive housing were excluded from this analysis. Most participants (16) lived completely independently in a house and one lived in an apartment. The remaining three participants lived in an independent living facility, Bethel Place. At Bethel Place the residents are responsible for preparing their own breakfast and snacks but lunch and dinner are provided for them in a communal dining room. At both lunch and dinner the residents are able to choose between different options of foods for their meals.   As for the participants living arrangement, 8 lived alone, 6 lived with their husbands, 4 with their wives, and 2 lived with their sons.

Figure 8. Histogram of the Participants Residence



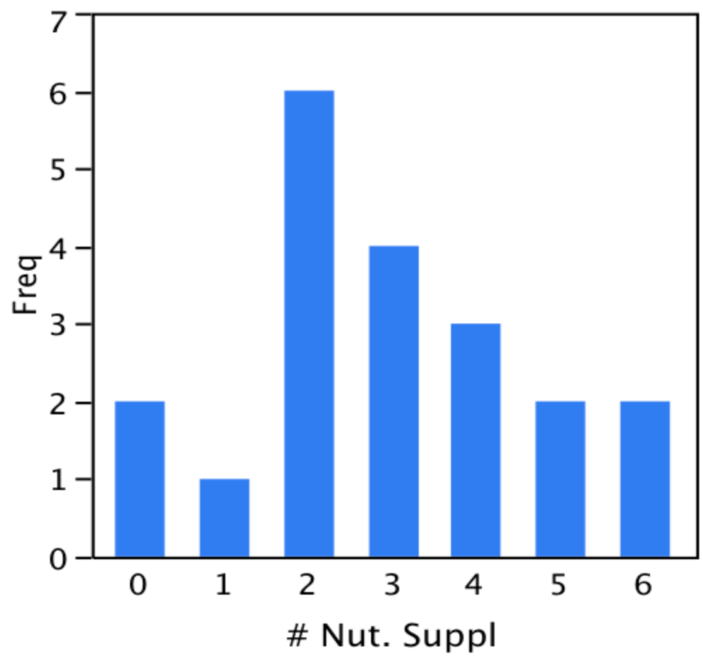
The number of daily medications that the participants were taking was recorded. Reports varied, as the range was 0-8 medications per day. The mean number of daily medications was 3.5, with a standard deviation of 2.1. The most common types of daily medications taken were: Aspirin, Lipitor, Metformin and Tylenol. These medications are commonly used for the prevention of cardiovascular disease, management of diabetes, management of high cholesterol and chronic pain management.

Figure 9. Histogram of the Number of Daily Medications



The number of daily nutritional supplements was also recorded. The range of daily supplements for this population was 0-5, the mean being 2.9 with a standard deviation of 1.7. The most common daily nutritional supplements taken were: Centrum select 50+ multivitamin, calcium with vitamin D, glucosamine, chondroitin, vitamin C, folate and omega 3 or fish oil supplements.

Figure 10. Histogram of the Number of Daily Nutritional Supplements



The demographic findings highlight that this group of respondents were highly educated and therefore most likely at a higher socioeconomic status than the average older adult living in Canada. They are interested in their health as many were consuming a daily nutritional supplement at the time of the assessment. Most participants resided in their own home and are responsible for obtaining and preparing all of their own food. The majority of participants (60%) were in the overweight and obese BMI categories, placing them at a greater risk of developing chronic diseases. Many were taking daily medications to manage such conditions as diabetes, heart disease, chronic pain and arthritis.

Differences in Recall Between the FCM and Average 24 HRs

Differences in recall between the two diet assessment methods were assessed looking at the following 3 parameters 1) the contribution of foods to diet structure, 2) level of processing of foods in the diet structure, and 3) differences in energy and nutrient intake.

I. Contribution of Foods to Diet Structure

The FCM analysis program yields the breakdown of the subjects' diet into individual food components based on categories from Health Canada. These components are displayed as the contribution of food groups as a percentage of the weight of foods in the group to the total food weight. These components include: dairy, herbs, fat/oils, poultry, soup, meat products, cereals, fruit/juice, pork, vegetables, nuts, beef, beverage, fish, pulses, meat, bakery, sweets, grains, fast food, mixed, and snacks. The key food components were isolated and grouped into meaningful categories based on major nutrient content. The following categories were used to look at differences in diet structure: dairy, fats and oils, fluids (beverages and soup), fruits and vegetables, grains (and cereal), meat (poultry, meat products, pork, beef, and fish), nuts and pulses, and other (bakery, sweets, and fast food).

Mean differences in recall between the methods with each dietary component expressed as a weight compared to the total food weight, were analyzed and tested for significance using matched pairs T tests. See the appendices for a detailed description of the differences in reports of dietary intakes of these 8 categories of foods between the methods. Table 7 outlines the mean values of each dietary component, along with variability in reports and mean differences between the methods. Reports of foods were generally higher with the FCM method and significant differences were found between the methods in reports of other foods. In this case, reports of other foods were higher with the multiple 24 HR compared to the FCM.

Table 7. Differences in Intakes of Dietary Components

Dietary Component	FCM mean	FCM standard deviation	FCM standard error	24 HR mean	24 HR standard deviation	24 HR standard error	Mean difference	p-value
Dairy	14.5	9.59	0.48	14.1	10.18	0.51	0.4	0.7994
Fats & Oils	0.5	0.38	0.02	0.5	0.27	0.01	0	0.5132
Grain & Cereal	2.9	2.43	0.12	3.4	3.26	0.16	-0.5	0.5125
Fluids	48.9	13.36	0.67	48.4	10.54	0.53	0.5	0.8019
Meats	3.1	1.14	0.06	2.9	1.35	0.07	0.2	0.4143
Nuts & Pulses	1.1	1.15	0.06	0.7	0.96	0.05	0.4	0.0719
Fruits & Vegetables	22.8	8.74	0.44	19.5	5.78	0.29	3.3	0.1002
"Other" foods	4.9	3.88	0.19	7.5	3.30	0.16	-2.6	*0.0018

II. Level of Processing

The FCM analysis program also provides a breakdown of the level of processing used to prepare the foods reported. These categories consist of raw (i.e. an apple), 1st stage (i.e. boiled potatoes), pre processed (i.e. instant oats), industrial processed (i.e. cheese spray), and manufactured (i.e. a hot dog) and the values are a percentage weight of the total weight of the diet. Categories were combined into two groups for data analysis. Group one consisted of raw foods, 1st stage, and pre processed. Group two consisted of industrial processed and manufactured. Matched pairs t-tests were conducted and no significant differences were found between the methods in terms of level of processing. However, participants on average had a higher weight of foods in group 1, compared to group 2. This indicates that this group of older adults consumes a very unprocessed diet.

Table 13 highlights the differences in reports of level of processing used to prepare the foods reported in the FCM and mean values of three 24 HRs.

Table 8. Level of Processing of the Diet

Participant	Group 1 (raw, 1st stage, pre processed) FCM	Group 1 (raw, 1st stage, pre processed) mean 24 HR	Mean difference	Group 2 (industrial processed, manufactured) FCM	Group 2 (industrial processed, manufactured) Mean 24 HR	Mean difference
1	92.9	86.8	6.1	7.0	13.2	-6.2
2	93.0	90.7	2.3	7.0	9.3	-2.3
3	91.1	87.7	3.4	8.9	12.3	-3.4
4	84.2	78.3	5.9	15.8	21.6	-5.8
5	93.4	61.6	31.8	6.6	38.4	-31.8
6	87.9	87.7	0.2	12.1	12.3	-0.2
7	88.4	94.3	-5.9	11.5	5.7	5.8
8	88.1	89.9	-1.8	11.9	10.1	1.8
9	83.1	86.9	-3.8	16.9	13.1	3.8
10	93.3	75.9	17.4	6.7	24.1	-17.4
11	79.8	71.8	8.0	20.2	28.2	-8.0
12	90.0	89.9	0.1	10.0	10.1	-0.1
13	93.8	77.5	16.3	6.2	22.4	-16.2
14	78.0	91.9	-13.9	22.0	8.1	13.9
15	95.8	87.9	7.9	4.2	12.1	-7.9
16	92.7	87.6	5.1	7.3	12.4	-5.1
17	89.7	80.3	9.4	10.3	19.7	-9.4
18	67.4	84.3	-16.9	32.6	15.7	16.9
19	97.4	90.1	7.3	2.6	9.8	-7.2
20	79.1	76.7	2.4	20.9	23.3	-2.4
Mean	**88.0**	**84.0**	**4.0**	**12.0**	**16.0**	**4.0**

No significant differences exist between the methods, p-value 0.1048 group 1 and p-value 0.1048 group 2.

III. Differences in Energy and Nutrient Intakes Between Methods

The FCM analysis program yields average daily energy intake and absolute nutrient intake values. Eight nutrients were selected for analysis due to their particular importance in the health of older adults. These nutrients are calcium, folic acid, dietary fiber, vitamin B_{12}, vitamin C, vitamin D, zinc, and sodium. Matched pairs t-tests were conducted to evaluate if differences exist between the methods in reports of these key nutrients. Table 9 highlights the differences in reports of these selected nutrients between the methods as well as mean intakes and variability. See appendices for a more detailed breakdown of differences in reports of each nutrient with each participant.

Table 9. Differences in Nutrient and Energy Intakes Between the Methods

Nutrient	FCM mean	FCM standard deviation	FCM standard error	24 HR mean	24 HR standard deviation	24 HR standard error	Mean difference	p-value
Calcium (mg)	1409.8	640.4	32.0	1019.9	391.5	19.6	389.9	*0.0106
Zinc (mg)	13.6	4.0	0.2	10.3	3.4	0.2	3.3	*0.0004
Vitamin B_{12} (mcg)	4.77	1.8	0.1	4.48	2.2	0.1	0.29	0.4967
Vitamin D (iu)	244.8	151.1	7.5	261.9	212.7	10.6	17.1	0.7519
Fiber (g)	31.6	11.1	0.6	27.4	8.8	0.4	4.2	0.0776
Folate (mcg)	470.3	181.9	9.1	407.6	90.0	4.5	62.7	0.1595
Vitamin C (mg)	180.9	119.5	6.0	129.5	78.2	3.9	51.4	0.0651
Sodium (mg)	2587.8	866.5	43.3	2673.4	824.9	41.2	-85.6	0.7561
Energy (kcal)	2022	444	22	1927	399	20	95	0.3076

Reports of energy intake in the FCM and mean values from 24 HRs were also analyzed to determine if significant differences exist. Although mean reports of energy intakes were on average higher with the FCM compared to the multiple 24HRs, no significant differences exist between the methods. Table 10 highlights the differences in energy intake between the two diet assessment methods.

Table 10. Reports of Energy Intakes

Participant	Energy intake FCM	Energy intake average 24 HR	Mean difference
1	2237	1946	291
2	1721	1403	318.0
3	2064	1704	360
4	1557	1674	-117
5	2089	1791	298
6	1139	2223	-1084
7	2148	2222	-74
8	2685	2364	321
9	1468	1658	-190
10	1793	2202	-409
11	1753	1584	169
12	2113	1473	640
13	1567	1629	-62
14	2206	1661	545
15	2070	1998	72
16	2340	2533	-193
17	1991	2004	-13
18	2723	1984	739
19	1844	1520	324
20	2939	2962	-23
Mean	**2022**	**1927**	**95**

No significant differences exist in reports of energy intake between the methods, p-value 0.3076.

Dietary Risk

The FCM analysis program yields results that compare the participants' dietary intakes to the RDA or if no RDA has been established, the AI for each nutrient. Therefore, the interviewer can assess the level of dietary risk at the time of assessment. Table 23 illustrates the number of participants who's reported intakes were above and below the recommended levels for the 8 selected nutrients. The positive sign indicates the number of participants who were over the RDA or AI for the selected nutrient and the negative sign indicates the number or participants who reported under the RDA or AI for the selected nutrient.

Table 11. Nutrient Intakes Compared to the Dietary Reference Intakes

	Calcium		Vit D		Zinc		Vit C		Vit B12		Folate		Fiber		Sodium	
	+	-	+	-	+	-	+	-	+	-	+	-	+	-	+	-
FCM	11	9	1	19	18	2	17	3	18	2	12	8	14	6	19	1
24 HR	6	14	1	19	13	7	13	7	17	3	9	11	12	8	19	1

Nutrients with the highest level of inadequacy from food were vitamin D (95% in both methods), calcium (45% FCM; 70% 24 HR), folate (40% FCM; 55% 24 HR), and dietary fiber (30% FCM; 40% 24 HR). Reports of daily sodium intake were high as 95% of participants reported intakes over the RDA in both the FCM and 24 HR. In addition, 50% and 70% of participants reported daily sodium intakes that were over the UL in the FCM and 24 HR respectively.

Incidence of Low Energy Reporting

The incidence of energy misreporting was analyzed in both the FCM and 24 HR by calculating the ratio between EI and TEE. The following calculations were used to determine TEE with all participants (Institute of Medicine, Food and Nutrition Board, 2002).

1. Men 19 years and Older (BMI 18.5-25)

TEE = 662 - 9.53 x age (yr) + PA x [15.91 x Wt (kg) + 539.6 x Ht (m)]

2. Overweight and Obese Men 19 years and Older (BMI 25 +)

TEE = 1086 – 10.1 x age (yr) + PA x [13.7 x Wt (kg) + 416 x Ht (m)]

3.Women 19 years and Older (BMI 18.5-25)

TEE = 354 – 6.91 x age (yr) + PA x [9.36 x Wt (kg) + 726 x Ht (m)]

4. Overweight and Obese Women 19 years and Older (BMI 25 +)

TEE = 448 – 7.95 x age (yr) + PA x [11.4 x Wt (kg) + 619 x Ht (m)]

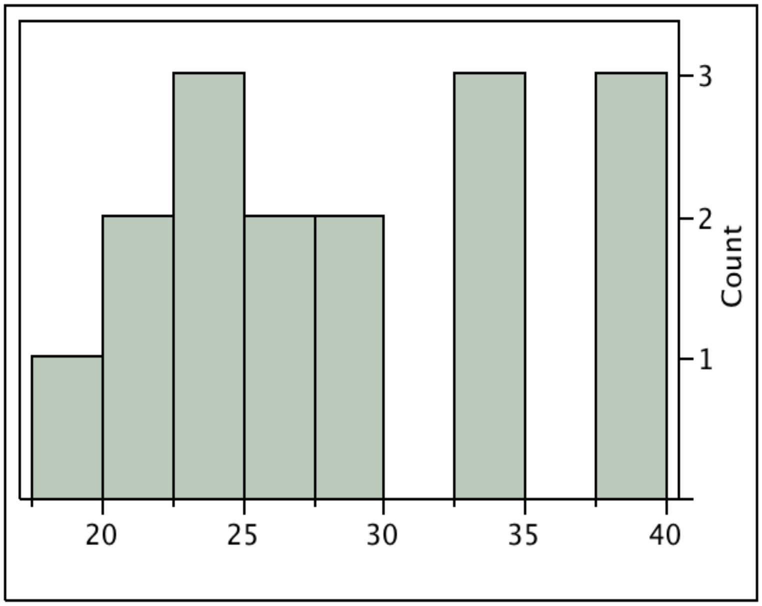
If the ratio between EI: TEE was calculated to be less than 0.79, the participant was considered to be a LER. If the ratio was over 1.21, the participant was considered to be a HER. Upon calculation, 16 participants were LERs and 2 HERs were detected in this population. The characteristics of the LERs are described in table 12.

Table 12. Characteristics of Low Energy Reporters

Participant	FCM ratio of EE: TEE	24 HR ratio of EE: TEE	Age	Gender	BMI
2	0.66	0.54	69	F	29.3
3	0.67	0.55	71	F	24.2
4	0.49	0.53	71	F	33.5
5	0.59	0.51	72	F	26.1
6	0.41		77	F	22.5
8		0.73	69	M	26.5
9	0.61	0.7	78	F	27.9
10	0.47	0.58	68	M	33.3
12	0.73	0.52	71	F	23.8
13	0.63	0.65	84	F	22
14		0.6	92	F	33.7
15	0.63	0.61	71	F	38.3
16	0.73		67	F	19.5
17	0.64	0.64	67	F	39.7
18		0.6	69	F	38.1
19		0.63	89	F	22.4

LER was evident in both diet assessment methods, 60% of participants in the FCM and 70% in the 24-hour recall reported low energy intakes. Most LERs reported low energy intakes in both diet assessment methods. The range of age of the LERs was 68-92 years and 14 out of 16 were women. The mean BMI of the LERs was 28.8 with a standard deviation of 6.5. Figure 12 highlights the distribution of BMIs of the LERs.

Figure 11. Body Mass Index of Low Energy Reporters



BMI

The characteristics of the HERs are described in table 13.

Table 13. Characteristics of High Energy Reporters

Participant	FCM ratio of EE: TEE	24 HR ratio of EE: TEE	Age	Gender	BMI
11	1.28		82	F	22.3
20	1.36	1.36	76	M	26.2

High energy reporting was detected in 10% of the respondents, specifically in one male and one female. Both HERs overreported energy intake on the FCM and one also reported high intakes on the 24 HRs.

II. Qualitative Results

Upon content analysis of the transcribed interviews and the identification of frequently occurring concepts, the following major themes were defined 1) memory, 2) abstract versus concrete thinking, and 3) perception of control. Under each of the major themes, various subthemes were derived from the transcripts that further explain the meaning of the major theme.

Memory

Memory in this context refers to the ability to accurately recall all consumed foods and beverages during the period of assessment. Many of the study participants expressed difficulty in completing the diet assessment methods due to issues in memory recall.

i. Use of Memory Aids

Memory aids refer to tools that aid in stimulating memory recall, such as keeping a food dairy or a journal during the time of assessment. Several participants mentioned using a memory aid to assist with their recall of consumed food and beverages. Some study participants specifically mentioned using a food journal as a memory aid to assist with recall.

"There are things I won't remember but if I was given a book or a sheet and you write down each meal, you may miss the odd one but it would be fairly accurate. This way is hard to remember though, I get dinner or breakfast ready and I don't even think about it, I just throw it in."

"*I would have liked to write down stuff beforehand, but that might not work for some reason. I think you said better to be spontaneous."*

Although they were asked not to, some participants even admitted to keeping a food journal while completing the 24 HRs, as they did not trust the accuracy of their memory.

"*Unless they wrote down exactly what they had to eat, I think the other way is probably better because you forget what you had to eat. That's why I thought, I know she's coming today, I'd better write this down, you know.*"

ii. <u>Confusion about Assessment Tools</u>

Prior to commencing the diet assessment interviews an initial meeting was held with each participant to explain the purpose of the study and the diet assessment tools. However, many participants remained confused about the purpose of the assessments.

"Well I think the first one, I found harder to do because I don't, you know, I was trying to think of all the possibilities that I might have. That was difficult to do. The second, the recall one, I found more interesting because I have been trying to lose weight and so for me, it's always, I know what to eat, it's always portion size."

Another participant commented in reference to the FCM interview:

"*Well this is harder. This is definitely harder. Oh because, you know, all the choices you have. I mean you could eat forever*."

In addition, all participants completed both diet assessments with a two-week break in between them to control for bias. When asked about the differences between the methods, some participants were unable to recall the first assessment method.

"This one was what I like to eat because I tried to get it, it was exactly what I had. I think this would be more true to what I eat. Now what did we do in the first one?"

iii. <u>Portion Size Estimation</u>

Difficulty in estimating portion size due to memory is a subtheme that arose with both assessment methods. In both methods the same tool, portion photos of popular foods, was used to estimate portion sizes.

"Gosh that's hard, isn't it? I think that one, don't you? (When the participant was asked to estimate the portion size of her morning coffee).

"Hope I'm not lying. I'm not trying to. It's very hard for me to know when I don't measure stuff. I think I'm gonna smarten up, though, after this interview."

"It could be any of them. I'd say this one. This size I guess."

Concrete versus Abstract Thinking

A difference in thinking patterns, particularly in concrete versus abstract thinking was illustrated by the participants when completing the different diet assessment methods. Concrete thinking is limited to only seeing what's directly in front of the face and in the here and now, with the absence of concepts and generalizations. Whereas, abstract thinking is characterized by the ability to use concepts and make and understand generalizations, such as the properties of pattern shared by a variety of specific items or events (American Heritage Medical Dictionary, 2010).

Many participants preferred the 24 HR method to the FCM as they found it to be easier to manage and complete. This method is concrete and very specific in asking precisely what the participant has consumed the day previous.

"I just think this is truer because I'm telling you exactly what I had to eat."

"Well I guess I felt that the second one (24 HR) *was more honest about what I was actually eating you know. The other one was more, okay what do I eat for breakfast, this or this or this. But this was more specific."*

Some participants struggled with the abstract thinking that is required to complete the FCM interview.

"I like how we worked with the actual amounts before. I think that was better."

"I think the first (24 HR) *was better because we went day to day and looked at my actual food, and this one I'm trying to remember what I eat."*

"*Say my mother, 25 or 20 years ago, my mother died 15 years ago, but if I had tried to do this with her, she would have been all mixed up, and she was not a confused person. She was, you know, lucid and everything but it's just that it was sort of too precise or something."*

This reliance on abstract thinking to complete the map created some frustration, particularly for one participant.

"*You know, we don't think like this. This doesn't make any sense to me now. Put it down 4 times I guess. Because everything is seasonal, and this thinking about how many times a week you have stuff, we just don't think like this. So now it's getting strange, you know."*

Due to the abstract thinking required to successfully complete the food choice map interview, some participants did not understand the concept of the map.

i. <u>Concept of the FCM</u>

The idea behind the FCM is to capture the participants' usual diet. However, some participants did not understand this concept and instead thought that they were providing the interviewer with that they had eaten in the past week.

"I'm just trying to remember. It's really, this is really hard, Jill, to think about what you've eaten in a week."

"The week recall, if we can actually manage the whole week, it gives a slightly different picture, doesn't it."

ii. <u>Portion Size Estimation</u>

Issues in portion size estimation arose from difficulty in memory recall and also from difficulty in abstract thinking. The participants were asked to estimate portion sizes using photos of popular foods as a reference.

"That's awful. Yeah there's another one that's hard to tell. It looks like my salad bowls. Is this supposed to be bigger than that? I can't tell."

"There's no figure ground. These pictures should not be taken in clear glass because you've got no figure ground between the bowl and the page so that is hard for older people to look at that, and when I, like I have a depth perception vision problem, so I can't tell from that."

"I don't know. They look identical to me, just different shapes."

iii. <u>Food Awareness</u>

Many participants experienced an increase in their food awareness as a result of completing the FCM interview. This method produces a visual display of one's usual diet.

"I rather like this weekly one. It sort of gives you a whole picture of what you're doing. I must say it kind of makes you perk up your ears and think, oh my goodness, what am I doing? Pay attention more, right?"

"Yes-cause it shows you-it's a lot when you put it on the paper, like the pictures make it look like a lot more than it does on the paper, and yet probably it would be the same amount if you tool all those little pieces out and put them on that piece of paper, but it gives you an idea of how much you're consuming in a day."

"Gosh, I don't even keep track of the wine that I drink. I better start keeping track of what I do, Jill. This is the broad purpose of this, isn't it."

<u>Perception of Control</u>

Upon analysis of the diet assessment interviews, perception of control is a theme that arose quite often in both methods, particularly with the FCM.

"That's, it's nice to see all those pictures, but really adults don't need those big pictures. If it was primary grades in school, yeah, but not, maybe that's the only way they can get the barcodes on, I don't know. But there's got to be a better way for this."

i. Use of a Food Diary

The act of keeping a food diary places the control in the hands of the participant instead of the interviewer. Some participants expressed that they would have preferred to write down their daily intakes instead of being asked to recall everything they had consumed.

"You should have warned us. We would have kept track of everything."

"I really do watch my amounts do if I could write down what I had everyday for 2 weeks I think it would be more accurate than this."

ii. Meeting Expectations

Previous research has shown that participants in diet assessment studies often alter reports of their dietary intake in order to "please" the interviewer (Gibson, 2005). In this study, many participants expressed some concern over being evaluated on their dietary intake.

"You know, I mean typically the male of the species isn't the guy in the kitchen preparing stuff, so like when you say how much oil? How the hell do I know? I don't sit here and watch her cook. Most people don't".

"24 hours is a whole lot easier to go back over. It's a little bit like the detective coming in and saying to you, on the evening of December 5th, what were you doing, and most of us would not have the foggiest idea, and the only way that we would be able to reconstruct it would be to go to a diary and see what, what was written down at that point and then trying to reconstruct it. And that's a little bit different from an instantaneous recall, so that's my impression of where you would get into trouble with the week one."

In addition, many participants expressed the need to do the right thing in regards to what they are eating.

"I think so. I think it would be equally as helpful to know what I shouldn't be doing and what I am doing, cause all this does is tell me what I'm doing. It doesn't tell me how to improve it or to modify it or anything else."

Chapter 5

Discussion

It is important to consider the demographic characteristics of the participants involved in this study when interpreting the results. This population was highly educated, as most (12) had attained a university degree or a graduate degree and 2 had completed a college diploma. As for the remaining participants, 4 had completed high school, 1 had completed grade 11 and 1 grade 12. Therefore, this group of older adults is most likely at a higher socioeconomic status than the average older adult living in Canada. This study also depended on volunteers from the community, so the participants included may have been more health motivated and aware of the importance of nutrition on health.

Another indicator of this population's interest in their health and their socioeconomic status is that most participants were taking a daily nutritional supplement. The range of supplement use was 0-5/day with an average of 2.9/day and a standard deviation of 1.7. Research has indicated that 30-70% of older adults take a daily nutritional supplement (Levy-Milne, 2004). This sample of older adults is taking more daily supplements than the average population. Therefore, when applying the results of this study to the general population it is important to consider non-response bias (Gibson, 2005), as this sample does not have the same characteristics as all Canadian older adults.

It is important to take into account the health status of the population under study. BMI and the number of medications taken on a daily basis are good indicators of disease risk, nutritional risk and disease management. All of the participants were in the normal weight to the obese weight category, as the range of BMI values were between 19.2-39.7.

The average BMI value in this sample was 27.8 and 60% of the participants were in the overweight and obese BMI categories. This indicates that many of the participants are at a higher risk of developing many chronic diseases and health conditions. However, it is important to consider that weight and height were self-reported.

The range of daily medication use was 0-8; the average number of medications taken per day was 3.5 with a standard deviation of 2.1. The most common daily medications taken included: Aspirin, Lipitor, Metformin, and Tylenol. This indicates that many of the respondents may be managing cardiovascular health conditions, high cholesterol, diabetes and chronic pain. Some participants were on many medications, indicating polypharmacy, placing the participant at a higher level of nutritional risk (Marion & Sacks, 2009).

The results of this study suggest that the FCM may have generated an inaccurate report of true dietary intakes with this population. Qualitative findings indicate that the design and method of the FCM interview requires participants to think about their diet in more abstract terms, which may be more difficult for older adults. This different way of thinking about the diet created confusion and even some frustration with the study participants. Consequently, this confusion may have resulted in a misrepresentation of dietary intakes.

Quantitative findings show that reports of energy intakes were higher with the FCM compared to the average of three 24 HRs but these differences were not statistically significant. This finding is consistent with results from a study conducted by Shuaibi and collegues, whereby reports of energy intakes were higher in the FCM compared to the 3 DFR (Shuaibi et al., 2008). The higher reports of energy intake seen in the FCM interview may be due to the fact that participants did not understand how to report their usual diet to the interviewer. Some participants may have included all the foods that they eat or like to eat, and did not limit it to the foods that make up their usual diet.

Portion size estimation is always a major challenge in diet assessment (Gibson, 2005) and this was apparent in the results of this study. Qualitative findings highlighted the difficulty that participants had in using the portion photo book to estimate portion sizes. Participants found it difficult to differentiate between the pictures in the portion photos book; this book was used to estimate portion sizes in both assessment methods. One participant explained that she had a depth perception vision problem and this could be a concern with many older adults as vision tends to decline with age (Marion & Sacks, 2009). Therefore, this error in portion size estimation may have skewed dietary intake data but this error was shared by both methods. Perhaps food portion models would be a more effective method to use when estimating portion sizes with this age group.

When testing for differences between the methods in capturing usual nutrient intakes, diet structure and level of processing of the diet, some differences were found to be significant between the FCM and 24 HR. A significant difference in reports of calcium intake was found between the methods at a p-value of 0.0106. Reports of zinc intake were also significantly different at a p-value 0.0004. Both calcium and zinc intakes were higher in the FCM compared to the 24-hour recall method. This difference may be due to the fact that participants may remember some foods over others. The difference in reports may also be attributed to the difference in structure between the two methods. The 24 HR measures intake during a fixed time period whereas the FCM captures an average dietary pattern. Therefore, a greater variety of foods are included in the FCM to represent the usual diet compared to the 24 HR.

When testing for differences in diet structure between the two methods, the only component that was found to be significantly different was reports of “other foods”. The “other foods” classification includes sweets, bakery items and fast food. The 24 HR method showed higher reports of these foods compared to the FCM at a p-value of 0.0018. This is an important finding as the reliance on the 24 HR for diet assessment may misrepresent true dietary intakes. This is due to the structure of this method, as it measures dietary intakes during a fixed-time period. For instance, if one was celebrating a birthday during the week of the assessment he or she would report a greater intake of cake than is actually consumed in their usual diet. Therefore, the amount of cake in the usual diet would be over-estimated as this is measured as the sum and average values of three 24 HRs taken place over a one week time period. However, because the FCM measures dietary pattern, this overestimation would not occur, as birthday cake would most likely not be included in one’s usual diet.

No significant differences were found in level of processing of the diet between the two assessment methods. Interestingly, the results indicated that all of the participants consume a very unprocessed diet. With the FCM, 67.39% to 95.77% of the participants diet was classified as being in group 1, which includes raw foods, 1st stage of cooking and pre processed foods. In the 24 HR method, 61.62% to 94.31% of the participants’ diet was classified as being in group one. When comparing these results to the demographics of this study population, most of the participants were women, highly educated, take nutritional supplements and all study participants were over 65 years of age and retired. Therefore, this group may have more time to grocery shop and to prepare meals. These participants are also quite educated and probably have more nutrition knowledge then the average older adult living in Canada.

Dietary risk was also assessed in this population of older adults, by assessing nutrient intakes from food alone. Looking at both assessment methods, average intakes from food of 8 selected important nutrients for older adults were compared to either the RDA or if no RDA was established, the AI. Results indicated low dietary intakes of calcium in both assessment methods; 45% of the population was below the RDA in the FCM and 70% was below the RDA in the 24 HR. This finding is consistent with research conducted by Vatanparast and colleagues (2009) whereby the majority of older adults assessed had dietary intakes of calcium that were below the RDA. Vitamin D intakes from food were very low in this study population, as 95% of participants were under the RDA for this nutrient in both methods. This finding is consistent with the literature as vitamin D is a very common nutrient deficiency seen in older adults (Cherniak et al., 2008; Marion & Sacks, 2009). However, it is important to consider that most of the respondents were taking a daily multivitamin supplement and many were also taking supplemental calcium and vitamin D at various doses.

Results indicated low reports of zinc intakes in the 24 HR method, as 35% of the population was below the RDA for this nutrient. However, the FCM did not reflect low dietary intakes of zinc and this might be due to the fact that a greater variety of foods are included in the FCM due to it's different structure. Low dietary intakes of zinc with older adults have been reported in other studies (Marion & Sacks, 2009) and may have an impact on taste acuity for salt (Stewart-Knox et al., 2008). Interestingly, 95% of the study participants were above the RDA for sodium intake and this was reflected in both methods. Furthermore, in the FCM 50% of participants reported intakes of sodium over the UL and 70% had reports over the UL for sodium in the 24 HR method.

Reports of vitamin C were lower in the 24 HR method compared to the FCM. In the 24 HR, 35% of participants reported intakes that were under the RDA for this vitamin. This finding of low vitamin C intakes with older adults is consistent with other studies in the literature (Sebastion et al., 2009). Reported intakes of dietary folate were below the RDA in both methods: 40% of participants with the FCM and 55% of participants with the 24 HR. Intakes of dietary fiber were also low with many of the participants; 30% were below the recommended level of intake in the FCM and 40% were below this recommendation in the 24 HR. This finding is consistent with the literature as in the National Health and Nutrition Survey less than 50% of older adults were consuming the recommended amount of dietary fiber (Dharmarajan et al., 2003).

When interpreting these values it is important to note that the FCM may underestimate the level of dietary risk, as more foods are included in this type of assessment. Also, because many participants did not grasp the concept of the FCM they may have over-reported foods that they sometimes consume but are not a part of their typical diet.

The incidence of energy misreporting was assessed, as this is a major problem in most diet assessment research (Cook et al., 2000; Mattisson et al., 2005; Gibson, 2005; Bazelmans et al., 2007, & Tooze et al., 2007). Qualitative findings highlighted the issue of low energy reporting. Some participants expressed the pressure of meeting expectations as to their diet as well as the need to do the right thing in regards to what they are eating. Upon calculation of results for the quantitative analysis, many participants were classified as LERs. In the FCM analysis 60% of the respondents were LERs and 70% reported low energy intakes in the 24HR method. High energy reporting was also detected with 2 participants, one reporting high intakes in both methods and the other with just the FCM method.

The high incidence of energy misreporting present in this study can be explained by looking at the themes that emerged from the qualitative data. Difficulty in memory recall may have biased reports of what makes up the usual diet, which may have lead to the energy misreporting seen in both methods. Issues with understanding the abstract nature of the FCM may have led to the significant differences seen in reports of calcium and zinc between the methods as well as energy misreporting. The perceived need to meet expectations may have impacted on reports of usual intakes, which resulted in LER in both assessment methods. It is important to consider that the LER may have lead to an overestimation of dietary risk. However, reports of sodium were high and may have been even higher with true reports. No pattern has been identified to explain these results. This may be due to the small sample size of this study as well as the reliance on self-reported height, weight, and physical activity levels. Generally, the LERs were mostly female and had a higher BMI, which is consistent with results found in other studies (Gibson, 2005; Bazelmans et al., 2007).

Qualitative findings suggest that the act of participating in a FCM interview results in greater food awareness. As this tool is visual, it shows people exactly what they are eating and how often these foods are included in their usual diet. Therefore, this tool has much potential for nutrition education, targeted nutrition intervention and the promotion of healthy eating with older adults.

Results of this study are significant to the fields of nutrition and gerontology. As nutritional status has a major impact on the quality of life of older adults and current methods have their limitations, exploring new methods of diet assessment is important to accurately capture nutritional intakes of this population. Although the FCM does not appear to be ideal in capturing true intakes, it has great potential as a nutrition education and dietary intervention tool.

Chapter 6

Conclusion

The results of this study indicated that the FCM might not be the most appropriate tool to use with older adults when assessing dietary intakes due to the reliance on memory recall and the abstract thinking involved for its successful completion. The qualitative results provided additional interpretation to the quantitative data and in some cases provided the answer to why certain quantitative results occurred. Qualitative results highlight the challenge that participants had in using the portion photo book for estimating portion sizes during the FCM interview and the multiple 24 HRs. This may have skewed nutrient intake data as participants may have over estimated or under estimated their usual intakes.

The participants in this analysis are at a moderate level of dietary risk when assessing intakes from food alone. Most participants were taking numerous medications and the average participant had a high BMI placing him or her in the overweight category. Reported intakes of calcium, folate, dietary fiber, zinc, and vitamin C were below recommended levels with many participants. Intakes of sodium were above the RDA for 95% of participants and even above the UL for many participants in both methods, placing them at a higher risk for developing hypertension.

I. Limitations

A few limitations did exist in this study and must be considered in the interpretation of the results. As it can be challenging to recruit older adults, the sample size of this study was small which limits the power of the results. This study depended on volunteers from the community; therefore, those who participated may have different characteristics and dietary intakes than those who did not. In addition, the study participants were most likely at a higher socioeconomic status than the typical older adult living in Canada. This is important to consider when applying the results of this study to the general population of Canadian older adults. Height, weight and physical activity levels were self-reported which may have impacted the accuracy of the BMI and TEE calculations.

II. Future Research

As significant differences existed between the methods in capturing average zinc and calcium intakes, additional study incorporating nutrient biomarkers would be useful to determine if true differences exist. Similar to the protocol of Shuabi and colleagues (2008), the method of triads could be used for analysis to validate the FCM in measuring zinc and calcium intakes with older adults. As Shuabi and colleagues (2008) validated the FCM for reflecting folate and vitamin B12 status in women of childbearing age, it would be useful to use nutrient biomarkers to validate the FCM in assessing these nutrients with older adults. To reduce bias associated with having a health motivated sample, it would be valuable to contact physicians and health clinics to aid in the recruiting process in order to attain a more representative sample of community living older adults.

As the FCM interview resulted in greater food awareness, it would be valuable to explore the effectiveness of the FCM as a nutrition education tool in this age group. All of the participants of this study received feedback about their diet. It would be interesting to revisit these participants for a follow-up study to measure the impact of participating in a diet assessment study on dietary intakes. As well, as the level of processing of the diet was quite low in this group, it would be interesting to see if this is true for other groups of older adults. These results could also be compared to the level of processing of the diet with younger adults to investigate changes in diet structure during the aging process as well as in advances in food technology.

Literature Cited

Adamson, A.J., Collerton, J., Davies, K., Foster, E., Jagger, C., Stamp, E., Mathers, J. C., Kirkwood, T. and The Newcastle 85+ Study Core Team. 2009. Nutrition in advanced age: dietary assessment in the Newcastle 85 + study. *European Journal of Clinical Nutrition,* 63, S6-S18.

American Dietetic Association. 2011. Practice Paper of the American Dietetic Association Diet Assessment: Using the Dietary Reference Intakes. *J Am Diet Assoc*. 111:762-770.

Bailey, K. D. 1978. Methods of Social Research. The Free Press, Collier MacMillan Publishers, London.

Bailey, L. 2004. Folate and vitamin B12 recommended intakes and status in the United States. *Nutr Rev.* 62: S14-20.

Barnard, J. A., Tapsell, L. C., Davies, P. S. W., *et al.* 2002. Relationship of high energy expenditure and variation in dietary intake with reporting accuracy on 7 day food records and diet histories in a group of healthy adult volunteers. *Eur J Clin Nutr.*, 56, 358-367.

Barr, S. I. 2010. Reducing dietary sodium intake: the Canadian context. *Appl. Physiol. Nutr. Metab.* 35: 1–8

Bazelmans, C., Matthys, C., De Henauw, S., Dramaix, M., Kornitzer, M., De Backer, G., & Leveque, A. 2007. Predictors of misreporting in an elderly population: the 'Quality of life after 65' study. *Public Health Nutrition,* 10 (2): 185-191.

Briefel, R. R., Sempos, C. T., McDowell, M. A., Chien, S., & Alaimo, K. 1997. Dietary method research in the third National Health and Nutrition Examination Survey: underreporting of energy intake. *American Journal of Clinical Nutrition,* 65: 1203S-1209S.

Bingham, S. A. 2002. Biomarkers in nutritional Epidemiology. *Public Health Nutrition*, 5 (6A): 821-827.

Bogden, J. D. 2004. Influence of zinc on the immunity of the elderly. *J. Nutr. Health Aging.* 8: 48-54.

Cherniack, E. P., Levis, S., & Troen, B. R. 2008. Hypovitaminiosis D: a widespread epidemic. *Geriatrics.* 63: 24-30.

Cook, A., Pryer, J., & Shetty, P. 2000. The problem of accuracy in dietary surveys. Analysis of the over 65 UK National Diet and Nutrition Survey. *J Epidemiol Community Health,* 54: 611-616.

Creswell, J. W. 2003. Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. Second Edition. Sage Publications, Inc.

Dharmarajan, T. S., Ravunniarath, J., & Pitchumani, C. S. 2003. Dietary Fiber: It's Role in Older Adults. *Practice Gastroenterology,* 43-58.

Dietitians of Canada. 2010. Fiber up! Available at: http://www.dietitians.ca/Nutrition-Resources-A-Z/Fact-Sheet-Pages%28HTML%29/Fibre/Fibre-Up.aspx. Accessed May 19, 2011.

Drewnowski, A. & Shultz, J. M. 2001. Impact of aging on eating behaviors, food choices, nutrition, and health status. *J. Nutr. Health Aging,* 5 (2); 75-9.

Durga, J., van Boxtel, M. P. J., Schouten, E. G., Kok, F. J., Jolles, J., Katan, M. B., & Verhoef, P. 2007. Effect of 3-year folic acid supplementation on cognitive function in older adults in the FACIT trial: a randomized, double blind, controlled trial. *Lancet,* 369: 208-16.

Evans J. R. 2006. Antioxidant vitamin and mineral supplements for slowing the progression of age-related macular degeneration. *Cochrane Database Syst Rev*. 2:CD000254.

Folstein, M. F., Folstein, S. E., McHugh, P. R. 1975. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research,* 12 (3): 189-98.

Foster, E., Mathews, J. N. S., Nelson, M., Harris, J. M., Mathers, J. C., & Adamson, A. J. 2006. Accuracy of estimates in food portion size using food photographs-the importance of using age-appropriate tools. *Public Health Nutrition,* 9 (4): 509-514.

Garriguet, D. 2007. Canadians' Eating Habits. *Statistics Canada Catalogue; Health Reports,* 18 (2): 1-17.

Gibson, R. S. 1990. *Principles of Nutritional Assessment.* Oxford: Oxford University Press.

Gibson, R. S. 2005. *Principles of Nutritional Assessment.* Oxford: Oxford Univeristy Press.

Gonzalez-Gross, M., Marcos, A., & Pietrzik, K. 2001. Nutrition and cognitive impairment in the elderly. *British Journal of Nutrition,* 86: 313-321.

Graham, I. M., Daly, L. E., & Refsum, H. M. 1997. Plasma homocysteine as a risk factor for vascular disease. The European Concerted Action Project. *JAMA*, 277: 1775-1781.

Guigoz, Y., Lauque, S., & Vellas, B. J. 2002. Identifying the elderly at risk for malnutrition The Mini Nutritional Assessment. *Clinical Geriatric Medicine*, 18: 737-757.

Hassard, T. H. 1991. Understanding Biostatistics. Mosby-Year Book, Inc. United States.

Health Canada. 2003. Canadian weight classification system. Accessed April 2011. Available from http://www.hc-sc.gc.sa.

Health Canada. 2008. It's Your Health- Sodium. Accessed May 2011. Available from http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/food-aliment/sodium-eng.php.

Health Canada Food program Canadian Nutrient File (CNF). 2001. Accessed May, 2008. Available from http://www.hc.sc.gc.cs/food-aliment/ns-sc/nr-rn/surveillance/cnf-fcen/e_cnf_download.html.

Health Canada. 2010. Vitamin D and Calcium: Updated Dietary Reference Intakes. Accessed May 2011. Available from http://www.hc-sc.gc.ca/fn-an/nutrition/vitamin/vita-d-eng.php

Hess, M. 1997. Portion Photos of Popular Foods. The United States of America: The American Dietetic Association, Centre for Nutrition Education, University of Wisconsin.

Institute of Medicine, Food and Nutrition Board. 1998. Dietary reference intakes for thiamin, riboflavin, niacin, vitamin B6, folate, vitamin B12, pantothenic acid, biotin, and choline. *The National Academy Press*, Washington, DC.

Institute of Medicine, Food and Nutrition Board. 2000. Dietary reference intakes for vitamin C, vitamin E, selenium, and caroteniods. *The National Academy Press*, Washington, DC.

Institute of Medicine, Food and Nutrition Board. 2002. Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. *The National Academy Press,* Washington, DC.

Janssen, H. C. J. P., Samson, M. M., & Verhaar, H. J. J. 2002. Vitamin D deficiency, muscle function, and falls in elderly people. *Am J Clin Nutr.* 75: 611-15.

Kamp, B. J., Wellman, N. S., Russell, C; American Dietetic Association, American Society for Nutrition, Society for Nutrition Education. 2010. Position of the

American Dietetic Association, American Society of Nutrition, and Society for Nutrition Education: Food and Nutrition programs for community-residing older adults. *J. Am Diet Assoc.*, Mar, 110(3): 463-72.

Kaufer, D. I., Williams, C. S., Braaten, A. J., Gill, K., Zimmermen, S., Sloane, P. D. 2008. *Journal of the American Medical Directors Association*, 9, 8, 586-593.

Keller, H.H., Ostbye, T., & Goy, R. 2004. Nutritional Risk predicts Quality of life in Elderly Community-living Canadians. *The Journals of Gerontology series A: Biological sciences and Medical sciences,* 59: M68- M74.

Krinke, J. 2002. The role of nutrition in healthy aging. *Minnesota Medicine,* 85, (9), 3409.

Kipnis, V., Midthune, D., Freedman, L., Bingham, S., Day, N. E., Riboli, E., Ferrari, P., & Carroll, R. J. 2002. Part E. New statistical approaches to dealing with bias associated with dietary data. Bias in dietary-report instruments and its implications for nutritional epidemiology. *Public Health Nutrition,* 5 (6A): 915-923.

Kim, J. M., Stewart, R., Kim, S. W., Yang, S. J., Shin, S., & Yoon, J. S. 2008. Predictive value of folate, vitamin B12 and homocysteine levels in late-life depression. *The British Journal of Psychiatry,* 192: 268-274.

Krebs-Smith, S. M., Graubard, B. I., Kahle, L. L., Subar, A. F., Cleveland, L. E., & Ballard-Barbash, R. 2000. Low energy reporters vs others: a comparison of reported food intakes. *European Journal of Clinical Nutrition,* 54: 281-287.

Kuczmarski, M. F., Weddle, D. O., & American Dietetic Association. 2005. Position paper of the American Dietetic Association: Nutrition across the spectrum of Aging. *The Journal of American Dietetic Association,* Apr; 105(4): 616-633.

Kurlowicz, L., & Wallace, W. 1975. “Mini Mental State”. A Practical Method for Grading the Cognitive State of Patients for the Clinician. *Journal of Psychiatric Research,* 12 (3): 189-198.

Levy-Milne, R. 2004. British Columbia Nutrition Survey: Report on Seniors’ Nutritional Health. B. C. Ministry of Health Services; 1-60.

Mahan, L. K. & Escott-Stump, S. 2004. Krause’s Food, Nutrition, & Diet Therapy. Elsevier (USA).

Malouf, R. & Sastre, A. A. 2009. Vitamin B12 for Cognition. *The Cochrane Collaboration*. Published by John Wiley & Sons, Ltd.

Marian, M., & Sacks, G. 2009. “Micronutrients and Older Adults. *Nutrition in Clinical Pracitce,* 24 (2), 179-195.

Martin, C.T., Kayser-Jones, J., Stotts, N. A., Porter, C., & Froelicher, E.S. 2007. Risk for Low Weight in Community-Dwelling, Older Adults. *Clinical Nurse Specialist*, 21(4): 203-211.

Mattisson, I., Wirfalt, E., Aronsson, C. A., Wallstrom, P., Sonestedt, E., Gullberg, B., & Berglund, G. 2005. Misreporting of energy: prevalence, characteristics of misreporters and influence on observed risk estimates in the Malmo Diet and Cancer cohort. *British Journal of Nutrition*, 94: 832-842.

Maylor, E. A. 2005. Age-Related Changes in Memory. The Cambridge Handbook of Age and Ageing. Cambridge University Press.

Maynard & Blane. 2009. Dietary assessment in early old age: experience from the Boyd Orr cohort. *European Journal of Clinical Nutrition*, 63, S58-S63.

McKeown, N. M., Yoshida, M., Shae, M. K., Jaques, P. F., Lichtenstein, A. H., Rogers, G., Booth, S. L., & Saltzman, E. 2009. Whole-Grain Intake and Cereal Fiber Are Associated with Lower Abdominal Adiposity in Older Adults. *J. Nutr.* 139: 1950–1955

National Advisory Council on Aging. Seniors of Canada 2006 Report Card. Accessed April 26, 2008 at: http:www.naca-ccnta.ca/rc2006/pdf/rc2006_e.pdf.

NCHS (National Center for Health Statistics). 1994. Plan and operation of the Third National Health and Nutrition Examination Survey, 1988-94. *Vital and Health Statistics*, 1 (32).

Ocke, M. C., & Kaaks, R. J. 1997. Biochemical markers as additional measurements in dietary validity studies: application of the method of triads with examples from the European Prospective Investigation into Cancer and Nutrition. *Am J Clin Nutr.* 65: 1240S-5S.

Poslusna, K., Ruprich, J., de Vries, J. H., Jakubikova, M., & Veer, P. V. 2009. Misreporting of energy and micronutrient intake estimated by food records and 24hour recalls, control and adjustment methods in practice. *British Journal of Nutrition*, 101, Suppl. 2, S73-S85.

Potvin, O., Forget, H., Grenier, S., Preville, M., & Hudson, C. 2011. Anxiety, Depression, and 1-Year Incident Cognitive Impairment in Community-Dwelling Older Adults. JAGS, 1-8.

Prasad, A. S., Beck, F. W. J., Bao, B., Fitzgerald, J. T., Snell, D. C., Steinberg, J. D., & Cardozo, L. J. 2007. Zinc supplementation decreases incidence of infections in the elderly: effect of zinc on generation of cytokines and oxidative stress. *Am J Clin Nutr.* 85: 837-44.

Public Health Agency of Canada. 2005. Table 1: Leading causes of death, Canada, 2005, males and females combined: counts (crude death rate per 100,000). Available at: http://origin.phac-aspc.gc.ca/publicat/lcd-pcd97/table1-eng.php, accessed on April 7, 2011.

Rawson, N. E. 2003. Age-Related Changes in Perception of Flavor and Aroma. *Generations*, 20-26.

Safman, R. M., & Sobal, J. 2004. Qualitative Sample Extensiveness in Health Education Research. 31; 9.

SAS institute. 2009. JMP. Version 8.0.1.

Staper, R.B., & Rash. R. 2009. Zinc: An Essential Micronutrient. *Am Fam Physician*, 79 (4): 768-772.

Statistics Canada. 2007. A Portrait of Seniors. The Daily. Available at: http://www.statcan.gc.ca/daily-quotidien/070227/dq070227b-eng.htm. Accessed on May 5, 2011.

Statistics Canada. 2010. Population projections: Canada, the provinces and territories. The Daily. Available at: http://www.statcan.gc.ca/daily-quotidien/100526/dq100526b-eng.htm. Accessed on March 8, 2011.

Sebastian, R. S., Cleaveland, L. E., Goldman, J. D., & Moshfegh, A. J. 2007. Older adults who use vitamin/mineral supplements differ from nonusers in nutrient intake adequacy and dietary attitudes. *J Am Diet Assoc.*, 107: 1322-1332.

Selhub, J., Morris, M. S., & Jacques, P. F. 2007. In vitamin B12 deficiency, higher serum folate is associated with increased total homocysteine and methylmalonic acid concentrations. *Medical Sciences*, 104, 50: 19995-20000.

Sevenhuysen, G. P., & Gross, U. 2003. Documenting the reasons people have for choosing their food. *Asia Pacific J Clin Nutr.* 12 (1): 30-37.

Shuaibi, A., Sevenhuysen, G., House, J. D. 2008. Validation of a food choice map with a three day food record and serum values to assess folate and B-12 intake in college-aged women. *J Am Diet Assoc* [submitted].

Skarupski, K. A., Tangney, C., Li, H., Ouyang, B., Evans, D. A., & Morris, M. C. 2010. Longitudinal association of vitamin B-6, folate, and vitamin B-12 with depressive symptoms among older adults over time. *Am J Clin Nutr.*, 92: 330-5.

Smith, A.D., Young-In, K., & Refsum, H. 2008. Is folic acid good for everyone? *Am J Clin Nutr.*, 87:517-533.

Smith, L. T., Johnson, D. B., Beaudoin, S., Monsen, E. R., & LoGerfo, J. P. 2004. Qualitative Assessment of Participant Utilization and Satisfaction with the Seattle Senior Farmers Market Nutrition Pilot Program. *Preventing Chronic Disease Public Health Research, Practice, and Policy.,* 1:1:1-11.

Statistics Canada. A portrait of seniors, The Daily. Downloaded on 02/06/2010, available at http://www.statcan.gc.ca/daily-quotidien/070227/dq070227b-eng.htm.

Stewart-Knox, B. J., Simpson, E. E. A., Parr, H., Rae, G., Polito, A., Intorre, F., Andriollo-Sanchez, M., Meunier, N., O'Conner, J. M., Maiani, G., Coudray, C., & Strain, J. J. 2008. Taste acuity in response to zinc supplementation in older Europeans. *British Journal of Nutrition,* 99: 129-136.

Staehelin, H. B. 2005. Promoting Health and Wellbeing in Later Life. *The Cambridge Handbook of Age and Ageing.* Cambridge University Press, Pp. 165-177.

The American Heritage Medical Dictionary. 2010. Houghton Mifflin Harcourt Publishing Company.

Toglia, J., Fitzgerald, K. A., O'Dell, M. W., Mastrogiovanni, A. R., Lin, C. D. 2011. The Mini Mental State Examination and Montreal Cognitive Assessment in persons with mild subacute stroke: relationship to functional outcome. *Arch Phys Med Rehabil,* May; 92 (5): 792-8.

Tooze, J. A., Vitolins, M. Z., Smith, S. L., Arcury, T. A., Davis, C. C., Bell, R. A., DeVellis, R. F., & Quandt, S. A. 2007. High Levels of Low Energy Reporting on 24-Hour Recalls and Three Questionnaires in an Elderly Low-Socioeconomic Status Population. *The Journal of Nutrition: Nutritional Epidemiology,* 137: 1286-1293.

USDA (U. S. Department of Agriculture, Agriculture research Service). 1998. Food and Nutrient Intakes by Individuals in the United States by Sex and Age, 1994-96. USDA Nationwide Food Surveys Report No. 96-2. Washington, D. C.

Vatanparast, H. Adolphe, J. L., & Whiting, S. J. 2010. Socio-economic status and vitamin/mineral supplement use in Canada. *Statistics Canada, Catalogue no. 82-003-XPE Health Reports*, 21, 4:1-7

Vatanparast, H., Dolega-Cieszkowski, J. H., & Whiting, S. J. 2009. Many adult Canadians are not meeting current calcium recommendations from food and supplement intake. *Appl. Physiol. Nutr. Metab*. 34: 191–196

Young, L. R., & Nestle, M. 1995. Portion sizes in dietary assessment: issues and policy implications. *Nutrition Reviews.* 53: 149-158.

Willet, W. C., & Hu, F. B. 2007. The Food Frequency Questionnaire. *Cancer Epidemiol Biomarkers Prev.*, 16; 182.

Appendices

Contribution of Foods to Dietary Structure

Reports of Dairy Intakes

Participant	Dairy FCM	Dairy average 24 HR	Mean difference
1	5.0	3.9	1.1
2	27.9	33.8	-5.9
3	18.1	28	-9.9
4	3.4	4.3	-0.9
5	5.9	8.1	-2.2
6	23.2	13.8	9.4
7	33	31.4	1.6
8	27.4	12.6	14.8
9	10	11	-1.0
10	6.3	7.5	-1.2
11	12.6	1.8	10.8
12	5.5	13.1	-7.6
13	13.4	15.7	-2.3
14	8.6	8.9	-0.3
15	7.2	6.1	1.1
16	4.4	8.0	-3.6
17	9.7	10.1	-0.4
18	26.0	10.1	15.9
19	27.4	35.8	-8.4
20	15.1	17.5	-2.4
Mean	**14.5**	**14.1**	**0.4**

No significant differences exist between the methods in reports of dairy, p-value 0.7994.

Reports of Intakes of Fats and Oils

Participant	Fats & Oils FCM	Fats & Oils average 24 HR	Mean difference
1	0.2	0.8	-0.6
2	0.6	0.5	0.1
3	0.5	0.2	0.3
4	0.3	0.4	-0.1
5	0.4	1.1	-0.7
6	0.3	0.5	-0.2
7	0.4	0.3	0.1
8	1.5	0.3	1.2
9	0.4	0.5	-0.1
10	1.1	1.0	0.1
11	0.3	0.1	0.2
12	1.3	0.7	0.6
13	0.5	0.1	0.4
14	0.3	0.4	-0.1
15	0.9	0.6	0.3
16	0.1	0.5	-0.4
17	0.3	0.2	0.1
18	0.6	0.6	0.0
19	0.2	0.3	-0.1
20	0.6	0.5	0.1
Mean	**0.5**	**0.5**	**0.0**

No significant differences exist between the methods in reports of fats and oils, p-value 0.5132.

Reports of Grain and Cereal Intakes

Participant	Grain & Cereal FCM	Grain & Cereal average 24 HR	Mean difference
1	3.8	4.3	-0.5
2	3.1	3.3	-0.2
3	6.1	4.6	1.5
4	3.1	4.0	-0.9
5	0.9	0	0.9
6	1.0	0.2	0.8
7	5.0	4.3	0.7
8	0	4.2	-4.2
9	3.1	1.2	1.9
10	1.5	1.3	0.2
11	0.9	1.3	-0.4
12	1.4	2.3	-0.9
13	8.5	5.6	2.9
14	1.3	2.4	-1.1
15	2.1	3.7	-1.6
16	0	0	0
17	1.9	1.4	0.5
18	3.0	15.1	-12.1
19	8.2	4.8	3.4
20	3.6	4.2	-0.6
Mean	**2.9**	**3.4**	**-0.5**

No significant differences exist between the methods in reports of grain and cereal intakes, p-value 0.5125.

Reports of Fluid Intakes

Participant	Fluids FCM	Fluids average 24 HR	Mean difference
1	32.4	49.6	-17.2
2	40.6	42.9	-2.3
3	32.9	36.1	-3.2
4	48.2	51.0	-2.8
5	57.5	52.1	5.4
6	47.9	51.1	-3.2
7	35.2	21.7	13.5
8	25.5	47.6	-22.1
9	62.6	46.0	16.6
10	73.2	65.5	7.7
11	41.9	54.2	-12.3
12	44.6	40.6	4.0
13	52.5	53.0	-0.5
14	70.1	62.4	7.7
15	66.0	52.9	13.1
16	59.3	54.0	5.3
17	55.4	58.0	-2.6
18	50.1	54.6	-4.5
19	33.7	28.7	5.0
20	49.3	45.7	3.6
Mean	**48.9**	**48.4**	**0.5**

No significant differences exist between the methods in reports of fluid intakes, p-value 0.8019.

Reports of Meat Intakes (poultry, fish, beef, pork, meat products)

Participant	Meat FCM	Meat average 24 HR	Mean difference
1	5.2	4.2	1.0
2	3.4	2.3	1.1
3	4.5	5.3	-0.8
4	3.1	3.0	0.1
5	2.1	1.6	0.5
6	3.4	3.0	0.4
7	1.2	0.4	0.8
8	3.9	3.0	0.9
9	1.6	3.6	-2.0
10	5.6	5.8	-0.2
11	2.4	1.5	0.9
12	2.7	4.2	-1.5
13	3.0	3.7	-0.7
14	3.7	2.0	1.7
15	2.8	3.2	-0.4
16	2.5	3.3	-0.8
17	3.5	2.8	0.7
18	1.9	1.4	0.5
19	3.7	1.4	2.3
20	2.2	2.8	-0.6
Mean	**3.1**	**2.9**	**0.2**

No significant differences exist between the methods in reports of meat intakes, p-value 0.4143.

Reports of Intakes of Nuts and Pulses

Participant	Nuts & Pulses FCM	Nuts & Pulses average 24 HR	Mean difference
1	1.2	0.4	0.7
2	0.1	0.5	-0.4
3	4.0	3.7	0.4
4	1.4	0	1.4
5	0.6	2.2	-1.6
6	0.1	0	0.1
7	0.4	1.3	-0.9
8	2.4	1.6	0.8
9	0	0	0
10	0.7	0.1	0.6
11	2.9	0.4	2.5
12	1.9	1.3	0.6
13	0.4	0	0.4
14	0.4	0	0.4
15	0.7	1.2	-0.5
16	1.9	1.2	0.7
17	0	0.1	-0.1
18	2.7	0.9	1.8
19	0	0	0
20	0.8	0	0.8
Mean	**1.1**	**0.7**	**0.4**

No significant differences exist between the methods in reports of nuts and pulses, p-value 0.0719.

Reports of Fruit and Vegetable Intakes

Participant	Fruit & Veg FCM	Fruit & Veg average 24-HR	Mean difference
1	45.3	21.2	24.1
2	22.0	13.5	8.5
3	29.5	18.3	11.2
4	33.2	27.3	5.9
5	26.6	13.6	13.0
6	20.0	24.1	-4.1
7	18.8	24.1	-5.3
8	27.7	25.7	2.0
9	14.11	31.4	-17.29
10	9.6	13.1	-3.5
11	31.4	20.9	10.5
12	31.1	28.2	2.9
13	19.2	17.4	1.8
14	10.5	11.6	-1.1
15	19.1	21.5	-2.4
16	24.7	17.2	7.5
17	20.1	17.2	2.9
18	14.0	13.1	0.9
19	25.1	17.8	7.3
20	14.7	13.7	1.0
Mean	**22.8**	**19.5**	**3.3**

No significant differences exist between the methods in reports of fruit and vegetables intakes, p-value 0.1002.

Reports of Intakes of "Other Foods" (bakery, sweets, fast food)

Participant	Other foods FCM	Other foods average 24 HR	Mean difference
1	6.8	11.2	-4.4
2	2.4	4.4	-2.0
3	4.4	5.3	-0.9
4	4.7	8.9	-4.2
5	3.7	2.2	1.5
6	3.6	6.2	-2.6
7	5.1	15.3	-10.2
8	7.1	4.3	2.8
9	7.5	6.6	0.9
10	1.5	1.7	-0.2
11	4.6	5.6	-1.0
12	7.1	8.0	0.9
13	2.5	7.1	-4.6
14	3.8	11.1	-7.3
15	1.1	8.9	-7.8
16	7.0	11.4	-4.4
17	8.6	10.1	-1.5
18	1.9	3.2	-1.3
19	1.8	4.6	-2.8
20	13.6	14.8	-1.2
Mean	**4.9**	**7.5**	**-2.6**

*Significant differences exist between the methods in reports of other foods, p-value 0.0018.

Differences in Reports of Nutrient Intakes Between the Methods

Reports of Calcium Intakes

Participant	Calcium (mg) intake FCM	Calcium (mg) Intake mean 24 HR	Mean difference
1	882.4	772.8	109.6
2	1634.4	1359.5	274.9
3	1883.7	1430.4	453.3
4	791.4	676.6	114.8
5	1399.1	730.3	668.8
6	1123.6	1596.7	-473.1
7	1265.4	933.6	331.8
8	1383.5	943.3	440.2
9	729.0	378.0	351.0
10	678.4	1191.0	-512.6
11	1217.0	572.2	644.8
12	844.8	879.3	-34.5
13	1083.8	659.2	424.6
14	1826.4	840.8	985.6
15	1576.3	758.6	817.7
16	1503.9	1062.0	441.9
17	966.1	1283.3	-317.2
18	3011.8	858.5	2153.2
19	1464.3	1697.2	-232.9
20	2931.5	1775.6	1155.9
Mean	**1409.8**	**1019.9**	**389.9**

*Significant differences exist between the methods in reports of calcium, p-value 0.0106.

Reports of Zinc intakes

Participant	Zinc (mg) intake FCM	Zinc (mg) intake average 24 HR	Mean difference
1	14.9	8.2	6.7
2	12.8	7.6	5.2
3	14.4	10.2	4.2
4	9.1	7.7	1.4
5	12.6	8.1	4.5
6	7.5	12.8	-5.3
7	14.3	13.8	0.5
8	13.4	10.3	3.1
9	8.9	8.0	0.9
10	11.0	5.6	5.4
11	10.1	6.3	3.8
12	9.2	6.5	2.7
13	11.6	10.9	0.7
14	18.5	9.1	9.4
15	18.1	17.0	1.1
16	14.1	11.5	2.4
17	12.2	11.2	1.0
18	23.5	13.9	9.6
19	16.3	9.1	7.2
20	19.4	17.7	1.7
Mean	**13.6**	**10.3**	**3.3**

*Significant differences exist between the methods in reports of zinc intake, p-value 0.0004.

Reports of Vitamin B_{12} Intakes

Participant	Vitamin B_{12} (mcg) FCM	Vitamin B_{12} (mcg) average 24 HR	Mean difference
1	4.14	2.38	1.76
2	7.65	5.41	2.24
3	4.63	4.54	0.09
4	2.29	3.3	-1.01
5	4.07	3.01	1.06
6	4.74	5.25	-0.51
7	3.85	7.34	-3.49
8	6.30	3.97	2.33
9	2.70	1.67	1.03
10	5.97	6.91	-0.94
11	3.37	0.78	2.59
12	2.05	3.13	-1.08
13	3.76	3.02	0.74
14	5.73	3.39	2.34
15	5.10	5.74	-0.64
16	3.16	5.70	-2.54
17	3.90	3.75	0.15
18	5.50	3.48	2.02
19	9.00	6.92	2.08
20	7.53	10.06	-2.53
Mean	**4.77**	**4.48**	**0.29**

No significant differences exist in reports of vitamin B12 between the methods, p-value 0.4967.

Reports of Vitamin D Intakes

Participant	Vitamin D (IU) intake FCM	Vitamin D (IU) intake average 24 HR	Mean difference
1	431.5	229.1	202.4
2	594.7	384.3	210.4
3	317.6	271.	46.3
4	199.3	308.5	-109.2
5	58.3	53.3	5.0
6	404.1	127.6	276.5
7	256.7	168.8	87.9
8	350.4	244.9	105.5
9	27.8	87.1	-59.3
10	372.8	256.6	116.2
11	269.9	22.9	246.0
12	104.6	265.2	-160.6
13	225.5	197.8	27.7
14	43.2	202.4	-159.2
15	163.1	93.7	69.4
16	163.9	987.1	-823.2
17	138.0	321.5	-183.5
18	137.6	97.8	39.8
19	432.8	539.7	-106.9
20	204.7	378.6	-173.9
Mean	**244.8**	**261.9**	**-17.1**

No significant differences exist in reports of vitamin D between the methods, p-value 0.7519.

Reports of Dietary Fiber Intakes

Participant	Dietary Fiber (g) FCM	Dietary Fiber (g) average 24 HR	Mean difference
1	44.8	23.1	21.7
2	36.7	14.2	22.5
3	30.2	27.6	2.6
4	33.6	23.7	9.9
5	19.6	27.8	-8.2
6	14.1	20.7	-6.6
7	34.8	25.2	9.6
8	27.1	28.7	-1.6
9	17.4	26.0	-8.6
10	15.0	26.5	-11.5
11	35.2	21.0	14.2
12	32.7	23.2	9.5
13	44.5	39.9	4.6
14	20.4	21.5	-1.1
15	51.2	42.6	8.6
16	33.8	25.8	8.0
17	26.7	33.4	-6.7
18	49.8	52.5	-2.7
19	24.4	20.6	3.8
20	39.9	24.7	15.2
Mean	**31.6**	**27.4**	**4.2**

No significant differences exist between the methods in reports of dietary fiber intake p-value 0.0776.

Reports of Folate Intakes

Participant	Folate, DFE (mcg) FCM	Folate, DFE (mcg) average 24 HR	Mean difference
1	1025.4	422.8	602.6
2	454.3	310.9	143.4
3	561.4	264.9	296.5
4	442.2	420.3	21.9
5	575.7	292.6	283.1
6	371.1	501.1	-130.0
7	612.0	612.6	-0.6
8	643.8	537.6	106.2
9	288.3	421.7	-133.4
10	322.5	397.1	-74.6
11	440.1	287.7	152.4
12	307.6	380.4	-72.8
13	402.6	400.7	1.9
14	447.1	373.3	73.8
15	520.5	512.4	8.1
16	704.0	396.2	307.8
17	334.2	464.6	-130.4
18	353.1	465.6	-112.5
19	249.9	360.4	-110.5
20	349.5	329.1	20.4
Mean	**470.3**	**407.6**	**62.7**

No significant differences exist in reports of folate intake between the methods, p-value 0.1595.

Reports of Vitamin C Intakes

Participant	Vitamin C (mg) intake FCM	Vitamin C (mg) intake average 24 HR	Mean difference
1	593.3	219.3	374.0
2	186.4	41.3	145.1
3	230.1	112.5	117.6
4	262.6	210.7	51.9
5	201.8	102.8	99.0
6	162.5	293.8	-131.3
7	116.7	218.2	-101.5
8	156.0	202.7	-46.7
9	111.3	247.8	-136.5
10	70.3	68.8	1.5
11	253.0	134.8	118.2
12	180.8	158.0	22.8
13	101.8	23.8	78.0
14	42.5	72.6	-30.1
15	251.1	122.5	128.6
16	220.3	105.1	115.2
17	200.5	94.3	106.2
18	35.9	67.0	-31.1
19	78.1	54.6	23.5
20	163.2	38.8	124.4
Mean	**180.9**	**129.5**	**51.4**

No significant differences exist in reports of vitamin C between the methods, p-value 0.0651.

Reports of Sodium Intakes

Participant	Sodium (mg) FCM	Sodium (mg) average 24 HR	Mean difference
1	2011.9	2321.3	-309.4
2	1866.1	2159.8	-293.7
3	3004.9	2253.4	751.5
4	1500.9	2182.6	-681.7
5	2654.1	3091.1	-437.0
6	1462.7	2855.0	-1392.3
7	2251.9	2372.4	-120.5
8	3383.8	3040.6	343.2
9	2791.9	2462.4	329.5
10	2010.8	4936.6	-2925.8
11	2186.1	3222.8	-1036.7
12	3092.4	1244.4	1848.0
13	2286.3	2734.0	-447.7
14	4562.3	2309.7	2252.6
15	2899.8	2952.9	-53.1
16	2237.6	1924.6	313.0
17	2780.0	4235.8	-1455.8
18	3123.4	2994.8	128.6
19	1307.1	1791.2	-484.1
20	4342.4	2383.8	1958.5
Mean	**2587.8**	**2673.4**	**-85.6**

No significant differences exist in reports of sodium intake between the methods, p-value 0.7561.

24 Hour Recall Form

Name ______________________________

Date_______________________________

Awake at: ________ To bed at: ________

Time food or beverage was consumed, where and with whom	Type of food or beverage	Amount consumed	Method of preparation (with inclusion of all ingredients)	Brand names, any additional information

Demographic Form

Name ______________________

Date _______________________

1. Age _____________ Sex _____________

2. Current weight ______________ Current height ______________

3. Marital status _____________________

4. Previous/current occupation _____________________

5. Level of education ___________________

6. Do you currently live in a house __________apartment _________retirement complex__________independent living facility _____________other____________
____

7. Who do you currently live with? ____

8. Do you currently smoke? Yes ______________________ No _________________

9. How many alcoholic beverages do you consume on average in a week?
____
____

10. Nutritional supplements in past month (name, brand, dose, frequency)
____
____
____

11. Vitamin 12 injection? Yes ________________ No ______________________

Date of last injection____

12. Medication in past month (name, brand, dose, frequency)

13. Have you been diagnosed with any type of malabsorption syndrome?

Food Choice Map Script

FOOD CHOICE MAP INTERVIEW GUIDE

Prompt, do not ask, for information, to avoid any thoughts about a "best" answer. Prompts are open and allow the respondent to talk about the choices that are 'normal' to him or her. As people think about experiences and choices, your data emerges.
If you do need to know about specific points, they must come from the Map that the person is creating (see explanation under 'Dynamic of Interactions').

1. Start with "**What food do you eat most often?**"
   Take time for the respondent to consider which food. Place a picture of the food on the extreme left outside the grid.
2. **When during a usual day do you eat this food?**
   Move the food picture vertically to the time period.
3. **How often during a usual week do you eat this food** at this time? For example: 'How many breakfasts in a usual week include this food?'. Move the food picture horizontally to the column with the right frequency in a usual week.

<u>To define a meal or snack</u>

4. **What other foods do you eat with this food?** Repeat until all possible foods have been mentioned. Some of the foods define the meal; others are substitute choices in this meal. For example, a sandwich can have an egg, tuna, or beef filling, in which case the sandwich is the meal and the different fillings are substitute foods in this meal. In this case, the grid shows a sandwich picture and a picture each for egg, tuna and beef.

<u>To define a meal pattern (substitute foods)</u>

5. **How often in a usual week do you eat the alternative foods?** There will be a separate frequency for each substitute food. For example, the sandwich is eaten 5 times per week at lunch, including 3 times with tuna and 1 time each with either egg or beef. The sandwich picture is in the 5 x/week column, the tuna picture in the 3 x/week column and both egg and beef pictures in the 1 x/week column.
6. **Do you drink anything with this meal?** Include a picture(s) and ask how often out of the 5 x/week this or these beverage(s) is (are) included.
7. Draw a white-board marker line around the foods and beverages that constitute the meal, including all the substitute foods eaten in a usual week (e.g. toast 5 times/week, with jam 3 times/week and the substitute eggs 2 times/week).

To define a dietary pattern (alternative meals)

8. **Do you eat anything at lunch time the other two days of the week?** (Complete lunch beyond the sandwich) For example, home-cooked pasta. Go through Question 4 to define the meal. Go through Question 5 to define its pattern.
9. Draw a different colour line around the foods that describe this second alternative meal at lunch time-period.
10. **Do you eat other foods at lunch in a usual week?** If not, then one line shows Meal 1 the sandwich and another line shows Meal 2 the pasta dish. Up to 7 alternative meals can be described in one meal period (e.g. lunch) with their substitute foods in any of the frequency columns.

Continue by defining the Dietary Pattern by asking about the meals and snacks in each of the other five meal periods, if any.

11. **When in a usual day do you eat or drink next?** Record the food, then the meal that includes substitute foods, then alternative meals. All foods have individual frequencies per week, even if many share the same frequency.
12. **Allow the respondent to correct frequencies or o add foods or drinks** as the patterns that being created prompts recall of details that were missed earlier in the interview.

13. **Check the frequencies on the map**. The frequencies of substitute foods or alternative meals may overlap so that there are too many meals or unusual combinations of staples or meal defining foods (e.g. fish or meat). If so, ask:

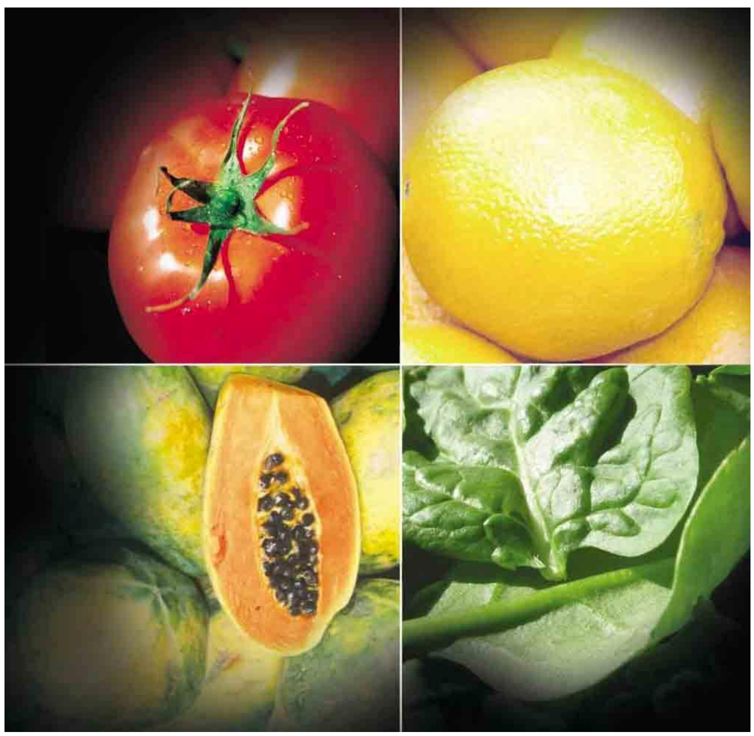
14. **Do you eat potatoes and rice at the same time?** Help the respondent to correct the frequencies of either food.

If a food is eaten less than once a week, but it is important to the respondent, place the picture on the extreme right hand margin outside the grid. Write a note on the grid about the frequency or seasonality with which that food is eaten.

<u>Poster</u>

Are you **65 years** of age or older? Do you live in the **community** or an **independent living facility**? Are you interested in receiving a **free** nutritional assessment?

You're in luck because we are looking for volunteers for a Nutrition Research Project!



This project is for a Master's thesis in Human Nutritional Sciences at the University of Manitoba

Participation will involve: 5 nutrition interviews over 2 months

Please contact **Jillian Einarson** at **999-2351** if you are interested in participating or for more project details.

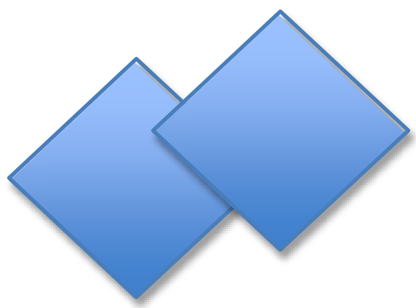
The Mini-Mental State Examination

Patient__________________Examiner ________________________Date ________

Maximum Score

Orientation

5	( )	What is the (year) (season) (date) (day) (month)?
5	( )	Where are we (state) (country) (town) (hospital) (floor)?
		Registration
3	( )	Name 3 objects: 1 second to say each. Then ask the patient all 3 after you have said them. Give 1 point for each correct answer. Then repeat them until he/she learns all 3. Count trials and record. Trials ____________
		Attention and Calculation
5	( )	Serial 7's. 1 point for each correct answer. Stop after 5 answers. Alternatively spell "world" backward.
		Recall
3	( )	Ask for the 3 objects repeated above. Give 1 point for each correct answer.
		Language
2	( )	Name a pencil and watch.
1	( )	Repeat the following "No ifs, ands, or buts"
3	( )	Follow a 3-stage command: "Take a paper in your hand, fold it in hand, and put it on the floor."
1	( )	Read and obey the following: CLOSE YOUR EYES
1	( )	Write a sentence.
1	( )	Copy the design shown.



______ Total Score

ASSESS level of consciousness along a continuum __________

Alert Drowsy Stupor Coma

(adapted from Folstein et al., 1975)