Assessment of Nutritional Benefits of Home-Delivered Meals to Elderly Persons.

by

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A thesis
presented to the University of Manitoba
in partial fulfillment of the
requirements for the degree of
Masters of Science
in
Department of Foods and Nutrition

Winnipeg, Manitoba

ISBN 0-315-34029-0

ASSESSMENT OF NUTRITIONAL BENEFITS OF HOME-DELIVERED MEALS TO ELDERLY PERSONS

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MASTER OF SCIENCE

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ACKNOWLEDGEMENTS

The author would like to acknowledge the advice and assistance of the thesis committee: Dr. G. P. Sevenhuysen, Foods and Nutrition; Professor M. Campbell, Foods and Nutrition; and Dr. J. Bond, Family Studies.

Thank you Dr. G. Flowerdew, Statistics, for your guidance and assistance and Effie Henry, Foods and Nutrition, for helping to collect the data.

Many thanks are extended to my family, professional colleagues and friends, for their continuous encouragement and support, as well as advice and assistance.

ABSTRACT

A volunteer group of 10 potential Meals on Wheels (MOW) program participants (control group) and 10 MOW program participants (treatment group) were interviewed at three stages - prior to meal delivery, shortly after meal delivery and two weeks after meal delivery, to determine the nutritional benefits of home-delivered meals. All study participants were self-referrals to the program. Two-day food records per stage, anthropometric and demographic data, and questionnaire data on health status, social activity, income and food preparation were obtained from all study participants.

Group mean nutrient intakes of the two groups at stage I indicated the control group consumed significantly more calcium ($p<.01$) and riboflavin ($p<.05$) than the treatment group. Hospital menu analysis indicated one of the three hospitals servicing the treatment group contributed significantly more ($p=.005$) calcium in MOW for a three-week cycle of food record days. There were no other significant differences in the nutrient content of MOW. After nutritional intervention, group mean nutrient intake and paired-difference analyses did not reveal an increase in daily nutrient intake among MOW recipients at both stages II and III. Mean nutrient intake densities did not significantly improve after nutritional intervention. In the treatment group, however, nutrient densities of MOW-supplied and consumed foods were higher than home-supplied foods for protein ($p<.001$), iron ($p<.001$), vitamin A

($p<.001$) and niacin ($p<.001$) at stages II and III. The hypothesis "The MOW meal will decrease the number of MOW recipients consuming less than the RNI for daily nutrient intakes" could not be statistically tested because of the small sample size and small changes. Anthropometric data indicated more treatment than control women were 81% or less of their recommended weight. The mean age of the treatment group was significantly ($p<.05$) higher at 82.5 ± 4.9 years, than the control group at 76.6 ± 6.2 years. The total annual income of the treatment group was significantly ($p<.05$) less than the control group. There was no significant difference in the male:female composition of the two groups. The correlation between initial nutrient intake and health comparison with one year ago was positively correlated with energy ($p<.002$), iron ($p<.008$) and riboflavin ($p<.01$) intakes for the treatment group.

MOW recipients should be encouraged to continue to consume nutritious home-supplied meals despite receiving MOW, and to not substitute the MOW meal for two meals.

Chapter I

INTRODUCTION

The proportion of elderly in the Canadian population has been increasing. Census data from 1976 and 1981 indicate an increase in the proportion of Canadians 65 years of age and older from 8.7% to 9.7% respectively (Statistics Canada, 1981; Statistics Canada, 1982). In Manitoba, the proportion of elderly in the population has risen from 10.4% in the 1976 census, to 11.9% in the 1981 census (Statistics Canada, 1981; Statistics Canada, 1982).

About 75% of the population over 65 years of age is reported to have at least one chronic illness (Auerbach and Gerber, 1976). Clark and Collishaw (1975) reported that in 1971 the elderly, who constituted 8.1% of the Canadian population, accounted for 35% of all patient days in Canadian hospitals. Specifically, aging is associated with an increased prevalence of chronic diseases or degenerative conditions such as atherosclerosis, hypertension, cancer, diabetes mellitus, obesity and osteoporosis (Posner, 1979; Anon, 1983). Nutrition is involved as an etiological factor and regarded as an important element in the treatment of some of these age-related disorders. The maintenance of health in old age by improving nutritional status, is beneficial both from a humanitarian and economic point of view. Nutritional intervention programs such as a home-delivered meal service, may delay or prevent expensive hospitalization and institutionalization. In view of the increasing proportion of elderly in the Canadian population and the extent of

chronic illnesses where nutrition is involved, the effectiveness of a home-delivered meal service should be examined to determine the impact upon nutrient intakes of the recipients.

Chapter II

STATEMENT OF THE PROBLEM

A paucity of information exists on the effectiveness of a home-delivered meal service to the elderly in order to delay or prevent hospitalization and institutionalization. As well, the response of the elderly to a home-delivered meal service has not been well documented. It is assumed that the nutritional status of the elderly is poor and that nutrient intakes may be improved by a home-delivered meal service. It is also assumed that the elderly with poor nutritional status can be reached by a home-delivered meal service. An evaluation of a Meals on Wheels (MOW) program would appear warranted to address these issues.

The purpose of this research is to investigate the effect of delivery of food upon the nutrient intakes of elderly recipients of MOW in Winnipeg by: i) determining nutrient intakes before and during service participation; ii) determining the health status, extent of social activity, income, age, sex, and anthropometric measurements of the sample studied; and iii) relating nutrient intakes to the characteristics of the sample studied. Knowledge of these variables may be used to develop and improve a MOW program with nutritional benefits.

Chapter III

REVIEW OF THE LITERATURE

Posner (1979) reported that the nutritional status of the elderly is influenced by the adequacy of nutrient intake; personal factors such as age, sex, mental and physical health status; and, environmental factors including housing, social isolation, income and cultural food habits. The extent of the influence of these factors is the subject of much interest and research.

Insufficient evidence is available on the effects of aging on nutrient requirements, other than energy and protein needs. It is likely that the chronic and acute diseases prevalent in old age may affect nutrient requirements of the elderly. Estimates of nutrient requirements are used in calculating the Recommended Nutrient Intakes for Canadians (RNI) and the Recommended Dietary Allowances for Americans (RDA), which may be used in group diet evaluation. However, the RNI and RDA may be of limited use in evaluating the diets of the elderly if their nutrient requirements are not accurately known (Posner, 1979).

Nutritional intervention programs have an effect on the nutrient intake of the aged. Nutrient intakes of the elderly with and without nutritional intervention, as well as factors affecting nutrient intake, will be examined in the following review of the literature.

3.1 NUTRIENT INTAKES OF THE ELDERLY WITHOUT NUTRITIONAL INTERVENTION

Reported nutrient intakes of the elderly, without nutritional intervention, are presented in this section.

Davidson et al. (1962) studied the nutrient intakes of 104 healthy elders in Boston, Massachusetts. The nutrient content of food supplies was compared to the 1963 RDA in a study of food brought into the homes of 283 elderly, low income persons in Rochester, New York, by Le Bovit (1965). Food practices and nutrient intakes of 74 elderly, home-bound Winnipeg, Manitoba, individuals were investigated by Johnson and Feniak (1965). Guthrie et al. (1972) investigated the adequacy of nutrient intakes of 55 elders on a food assistance program (FAP) and 54 elders not on FAP in rural Pennsylvania. The Nutrition Canada (1973) study surveyed the nutrient intakes of 1785 Canadian elders and classified nutrient intakes according to nutrient requirements. The nutrient intakes of 50 elders in Guelph, Ontario were determined by Reid and Miles (1977) while Yearick et al. (1980) studied the nutritional status of 100 seniors in Corvallis, Oregon.

In the studies cited, various methods were used to estimate individual nutrient intakes. Davidson et al. (1962) combined a 1-week food record with 1-week recall method while Le Bovit (1965) used a 1-week recall method. The accuracy of a 1-week dietary recall is strongly dependent upon memory, which itself is variable. The 24-hour recall method, with food models, was used by Guthrie et al. (1972) and the Nutrition Canada study (1973). Food frequency of specific foods was also determined in the Nutrition Canada study (1973). The 24-hour recall method has limitations due to reliance on memory, (Campbell and

Dodds, 1967), habitual intake is not necessarily reflected on the recalled day and specific nutrient dense foods may not be ingested on the day in question. Foods may vary in vitamin A or iron content to a greater extent than other nutrients, which may skew the nutrient intakes to either high or low. An average of several days may more closely approximate usual nutrient intake.

Johnson and Feniak (1965) were the only group reviewed employing the diet history and 1-day meal pattern method. Usual food consumption and nutrient intakes can be determined with this method provided extensive probing is carried out. A 4-day food record was used by Reid and Miles (1977) while Yearick et al. (1980) used a 1-day food record at three different times and then averaged them. The food record method has the advantage of being less dependent upon memory; but accurate and immediate recording of food ingestion is essential in order to not rely upon memory. As well, physical infirmities and language skills limit the usage of the food record to the more healthy and literate segment of the elderly.

Less than recommended energy intakes in the elderly were found by Johnson and Feniak (1965), Guthrie et al. (1972), Nutrition Canada (1973), Reid and Miles (1977) and Yearick et al. (1980).

Protein intakes less than 67% of the RDA were reported only by Guthrie et al. (1972) in the studies reviewed. Iron, however, which is often found in high protein foods, was reported to be consumed in less than recommended amounts by Davidson et al. (1962), Johnson and Feniak (1965), Guthrie et al. (1972), and Nutrition Canada (1973). None of

these studies reported less than recommended amounts of protein intake. It may therefore be possible that low iron containing protein foods are being consumed by the elderly.

Calcium intakes of the elderly were found to be less than the RDA (Davidson et al., 1962), or less than 67% of the RDA (LeBovit, 1965; Guthrie et al., 1972; Yearick et al., 1980). The Nutrition Canada study (1973) also reported low calcium intakes where "less-than-adequate" and "inadequate" intakes of calcium were found for the national survey.

Less than recommended vitamin A intakes in the elderly were reported by Johnson and Feniak (1965), Guthrie et al. (1972), Nutrition Canada (1973), Reid and Miles (1977) and Yearick et al. (1980). Vitamin C intakes, however, of the elderly were found to be less than recommended amounts by Davidson et al. (1962), LeBovit (1965), Johnson and Feniak (1965), Guthrie et al. (1972) and Reid and Miles (1977).

For the B vitamins, less than recommended thiamin intakes in the elderly were found by Davidson et al. (1962), Guthrie et al. (1972) and Nutrition Canada (1973), and less than recommended riboflavin intakes were reported by Guthrie et al. (1972) and Nutrition Canada (1973).

Despite the various methods employed in the studies reviewed, common nutrient inadequacies are reported. Nutrient intakes less than the RDA and the CDS for energy, iron, vitamin A, calcium, vitamin C, thiamin and riboflavin are reported in the elderly.

Nutritional intervention programs for the elderly have been developed out of a concern for the nutritional needs and health status of the elderly.

3.2 NUTRIENT INTAKES OF THE ELDERLY WITH NUTRITIONAL INTERVENTION

There are many nutritional intervention programs available, such as the Congregate Meal Program in the United States where the elderly go to a centre for meals; Wheels for Meals, where the elderly are driven to a centre for meals; senior citizen clubs where nutritious meals are served; and Meals on Wheels (MOW), where meals are delivered to the elderly and others in need.

The effectiveness of nutritional intervention programs is examined to determine whether the nutritional needs of the elderly are being met. Several studies are discussed focusing on nutrient intakes of the elderly, with nutritional intervention.

Henry (1959) sampled menus and calculated the nutrient contribution of MOW to daily nutrient intake in 36 subjects aged 45 to 96 years in Rochester, New York. The mean age was 76.8 years and the mode 80 years. MOW provided a hot noon meal and a cold sandwich supper. The nutrient content of MOW meals was calculated to provide 75% of the daily RDA for a 65 year old man. The MOW menus met the RDA for all nutrients except vitamin C. Using menus for nutrient calculations without a record of food intake may lead to incorrect conclusions, as the recipients of MOW may not consume the meals received entirely.

A preliminary assessment of MOW was conducted by Moore (1966) in Winnipeg, Manitoba. A one day meal pattern and dietary history were obtained from 16 homebound seniors prior to MOW and from 12 of the seniors after ten weeks of MOW. Their nutrient intake was compared to 53 seniors who were not associated with MOW. After 10 weeks of nutri-

tional intervention, the percentage of seniors receiving MOW consuming less than the CDS for vitamin C dropped from 44% to 0% and for iron from 38% to 0%. The mean intakes of vitamin C and iron were significantly ($p<.05$) higher than immediately before MOW. The percentage of senior recipients with nutrient intakes less than the CDS for energy, protein, vitamin A and vitamin C decreased. However, the percentage of recipients with nutrient intakes less than the CDS for calcium increased. In both groups, vitamin A and vitamin C were consumed less than the CDS. The comparison group was reported to consume a better diet in quantity and quality than the MOW recipients. It is pointed out that the MOW recipients were homebound and the comparison group was not. Health status could be a confounding variable in the observed differences between the two groups. A comparison group of subjects, with characteristics more similar to the MOW group would appear indicated for more accurate interpretations of the effects of MOW.

The Congregate Meals Program in the United States has been studied in several investigations. Grandjean et al. (1981) examined the nutrient intakes of elderly participants in a Congregate Meals Program in Nebraska. Twenty-four hour recalls were obtained from five different days for 19 women and 11 men. The majority, 70%, were 64 to 83 years of age and the remainder, 58 to 63 years of age. At least 70% of the RDA was met by 93% of the sample for energy, protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin, vitamin C, pantothenic acid, vitamin B_6, vitamin B_{12} and phosphorus intakes. The remaining 7% of the sample consumed at least 54% of the RDA.

Kohrs et al. (1978) determined the contribution of the Congregate Meals Program to one day's dietary intake. The total sample consisted of 154 seniors who consumed the program meal, 213 who did not consume the program meal on the day studied and, 99 non-participants in the meals program. The total sample was 59 to 96 years of age with equal distribution of ages among the three categories. Other differences among the three groups were not identified or controlled. Home interviews were conducted to recall what had already been consumed on that day, and a food record left to complete for the remainder of the day. It was reported that energy, protein and calcium intakes were significantly ($p<.05$) greater for program participants who consumed the program meal. Riboflavin and niacin intakes were significantly ($p<.05$) less for the non-participants than for the other two groups. Iron intake, however, was significantly ($p<.05$) less in the participants who consumed the program meal than in the other two groups. The combining of two methods for nutrient intake determinations is suspect because different problems are associated with each method. Small intakes tend to be over-reported and large intakes under-reported in 24-hour recalls; with food records, there is a tendency to underestimate actual intake (Gersovitz et al., 1978). The differences in nutrient intakes among the three groups, however, would be evident.

The association of nutritional status with participation in a Congregate Meals Program was investigated by Kohrs et al. (1980). The total random sample consisted of 250 people, 59 to 99 years of age. They were regular participants, irregular participants, and non-participants of the Congregate Meals Program. Dietary intakes were

determined by a 1-day food record, 24-hour recall, and a dietary history using food frequencies. Results were not reported by method of dietary intake determination. A larger proportion of regular participants consumed "excellent" (100% of the RDA for all nutrients) or "fair" (at least 67% of the RDA for all nutrients) diets than irregular or non-participants. "Poor" diets, any nutrient less than 67% of the RDA, were consumed by 25% of the irregular participants and 33% of the non-participants. As well, larger proportions of non-participants consumed less than 67% of the RDA for thiamin and riboflavin. There was a significant positive relationship between the quality of the diet and participation in the program.

It is evident that nutritional intervention programs in the reported studies have had a positive effect on the nutrient intakes of the elderly program participants. The MOW menus were found to meet the RDA for all nutrients except vitamin C (Henry, 1959). After 10 weeks of receiving MOW, the percentage of senior recipients with nutrient intakes less than the CDS for energy, protein, vitamins A and C decreased (Moore, 1966). Similar positive results were found for Congregate Meals Program participants. A larger proportion of regular participants in a Congregate Meals Program consumed at least 67% of the RDA for all nutrients, than irregular or non-participants (Kohrs et al., 1980). The majority of a sample participating in a Congregate Meals Program met at least 70% of the RDA for the nutrient intakes studied (Grandjean et al., 1981). Energy, protein and calcium intakes were found to be greater for Congregate Meals Program participants than for irregular or non-participants (Kohrs et al., 1978). Further and more current research on

the MOW program is needed to ascertain whether the reported improvement in nutrient intakes of elderly MOW recipients persists. Conducting an investigation with a control group similar to the treatment group is necessary to explain and strengthen the results and conclusions made.

Nutrient intakes of the elderly may also be influenced by nutrient supplementation. It is therefore necessary to examine ingestion of nutrient supplements by the sample.

3.2.1 Vitamin and Mineral Supplements

Besides nutritional intervention programs, vitamin and mineral supplements may be used to improve the nutritional adequacy of one's diet. Two studies are presented that considered the use of nutrient supplements by elderly subjects.

In the Guthrie et al. (1972) study, 40% of the sample reported using dietary supplements. Only 63.6% of the users indicated taking a dietary supplement on the dietary recall day. A dietary supplement was taken which provided all of the nutrients in which the diet was deficient in only 7% of the cases. Some of the needed nutrients were provided by supplements in 67.9% of the cases. The dietary supplement provided none of the needed nutrients in 17.9% of the cases and was not needed at all in 7% of the cases.

The Reid and Miles (1977) sample reported a lower dietary supplement usage of 24%. A dietary supplement was taken which provided all of the nutrients in which the diet was deficient in 33% of the cases. This is considerably higher than in the Guthrie et al. (1972) study. Some of

the needed nutrients were provided by dietary supplements in 8% of the cases which is much lower than in the Guthrie et al. (1972) study. No needed nutrients were supplied by dietary supplements in 33% of the users rather than 17.9% in the Guthrie et al. (1972) sample. Dietary supplements were not needed by 25% of the users as opposed to the 7% in the Guthrie et al. (1972) study.

From both of the studies presented, it is apparent that few individuals took dietary supplements which elevated their nutrient intakes to recommended levels for all needed nutrients.

Combining the categories "providing all of the nutrients in which diets were deficient" and "providing some of the needed nutrients", :75% of the individuals taking supplements studied by Guthrie and co-workers (1972), and 42% of the individuals taking supplements, studied by Reid and Miles (1977), would appear to be benefitting from nutrient supplementation. However, 18% of the individuals taking supplements, studied by Guthrie and co-workers (1972) and 33% of the individuals taking supplements, studied by Reid and Miles (1977), were taking nutrient supplements which provided no needed nutrient.

A determination of nutrient supplementation usage is warranted when examining the nutrient intakes of the elderly. The correlations between nutrient adequacy and economic, psychological, social and physical factors should be considered as well.

3.3 FACTORS AFFECTING NUTRIENT INTAKE IN THE ELDERLY

Many social, psychological, physical and economic factors can influence nutritional needs, alter dietary intake, and alter the utilization of nutrients, consequently affecting the nutritional status of the elderly (Anon, 1983). As the elderly vary in age, living situations, ethnic and cultural backgrounds, education, marital status, work experience, health and dietary habits (Anon, 1983), it is difficult to make generalizations. In the following section, several factors affecting nutrient intakes in the elderly are presented. Specifically examined are age, sex, income, health status, social activity and the nutritional intervention program, MOW.

3.3.1 Age

The largest number of nutrient inadequacies were reported in older subjects by Johnson (1964), Le Bovit (1965), and Guthrie et al. (1972). Johnson (1964) found the percentage of subjects consuming less than the CDS for energy, protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin and vitamin C doubled from the 60 to 69-year old group to the 80-year old and over group. Seventy-four homebound individuals were studied, ranging from 60 to over 90 years of age. The samples consisted of 34 men and 40 women with 15 people in the 60- to 69-year old group and 18 in the over 80-year old group. Nutrient intakes were estimated from diet histories and 1-day meal patterns. Rough estimates of nutrient intakes may be determined if foods usually eaten and usual patterns are known. An actual nutrient intake requires accurate recording and measuring or weighing of foods consumed. Le Bovit (1965) reported 52% of the diets in households where the homemaker was under 75

years of age met the RDA in all nutrients whereas 34% of the diets in households where the homemaker was 75 years of age and older met the RDA in all nutrients. Estimates of usual nutrient intakes were reported based on weekly food brought into the homes of 283 elderly people. It is not reported whether food supplies already in the household were analyzed and whether variation in weekly food procurement was considered. There may also have been differences in shopping habits between the older and younger homemakers. Guthrie and co-workers (1972) found energy was consumed less than the RDA by a significantly ($p<.05$) greater percentage of seniors, 80 years of age and over, compared to those 60- to 69-years old. There were a total of 109 subjects in the sample studied. The 24-hour recall method was used which has limitations due to reliance on memory (Campbell and Dodds, 1967). Differences in nutrient intakes between the younger and older subjects may reflect a difference in memory, and not age.

In contrast, no significant correlations between age and any of the dietary nutrients studied, were found by Yearick and co-workers (1980) and Stiedemann and co-workers (1978). In the Yearick study, 100 seniors aged 63 to 96 years had their food intake determined from three randomly selected days in a month. Twenty of the sample lived in a retirement community where one major meal daily was supplied. It is possible that this factor influenced the results. The Stiedemann study sample consisted of 46 people from 62 to 98 years of age living in a nursing home. Dietary intakes were determined by weighing foods served to and returned from the subjects for three consecutive days. Snacks, however, were estimated by the subject or a nurse. No indication of the proportion of daily intake supplied by snacks was given. As well, dietary

intakes of people in a nursing home with food prepared for them, may differ from people at home who prepare their own.

When food patterns of a representative sample of individuals living in an urban community were examined by Slesinger and co-workers (1980), a relationship with age was found. Food intake was determined by 24-hour recall where each food item mentioned was assumed to be a standard serving. Five hundred interviews were conducted and weighted to be age representative for a total of 672. The age of the respondents was from 18 to over 65 years. Age was significantly and negatively related to the intake of milk and dairy products. The 18 to 34 year olds consumed significantly more milk and dairy products than the over 65 year olds. As well, age was significantly and positively related to the intake of breads and cereals. The over 65-year old group consumed more breads and cereals than any other group. Despite the questionable accuracy of intake, where serving sizes were standardized, a pattern of food consumption is seen. The elderly are more frequently reported to consume less than adequate amounts of calcium (Le Bovit, 1965; Davidson et al., 1962; Guthrie et al., 1972; Nutrition Canada, 1973; Yearick et al., 1980) than of the vitamin-B complex (Davidson et al., 1962; Guthrie et al., 1972; Nutrition Canada, 1973).

Despite the various methods used, and differences in sample composition, age generally appears to be related to a decreasing nutrient intake among the elderly.

3.3.2 Sex

Sex has been considered as a factor affecting nutrient intakes of the elderly. In the Nutrition Canada (1973) sample, there were 926 men and 859 women 65 years of age and older. The mean nutrient intakes of the men were higher than those of the women, except for thiamin and vitamin C. Stiedemann et al. (1978) on the other hand, reported energy and all nutrient intakes except for vitamin A and vitamin C, were consumed significantly more ($p<.05$) by men than women. There were 23 men and 23 women, aged 62 to 98 years in the sample studied. As previously noted, the seniors were nursing home residents.

Brown et al. (1977) studied the nutrient intakes of 14 women and 9 men with a mean age of 77 years. They were all independent living elderly who completed a 10-day food record. Though statistical significance was not determined, the mean intake for energy and all nutrients was found to be higher for men than women. Calcium intake was the lowest of all of the nutrients with women consuming a mean of 71% of the RDA and men 83% of the RDA. It has been reported by Gersovitz et al. (1978) that the accuracy of a food record declines beyond a two day collection period. The accuracy of a 10-day food record therefore, would be questionable.

Reid and Miles (1977) examined the nutrient intakes of 39 women and 11 men from 65 to over 85 years of age. Mean nutrient intakes indicated the men consumed significantly ($p<.05$) more protein and iron than the women. Women were also found to consume significantly ($p<.05$) less adequate intakes of iron than men in the study by Guthrie et al. (1972).

There were a total of 69 elderly women and 40 elderly men in the sample, with no age range given. Reid and Miles (1977) employed the 4-day food record method and Guthrie et al. (1972) the 24-hour recall method.

Caliendo and Smith (1981) studied 169 elderly Congregate Meal Program participants. Complete three-day food records were collected from 142 persons for an assessment of nutrient intake. There were 119 women and 23 men who completed the food record. For the men, mean nutrient intakes met the RDA, but mean calcium and thiamin intakes for the women were less than the RDA. At least 67% of the RDA for calcium intakes was consumed by 87% of the men but only 60% of the women did. Since the sample consisted of few men, a larger representation with greater variability in nutrient intake might affect the mean nutrient intakes.

The nutrient intakes of 466 people at least 59 years of age were investigated by Kohrs et al. (1979). Male participants in the Congregate Meal Program were found to consume significantly ($p<.05$) more energy, protein and thiamin than women. Among the program participants not consuming the program meal, men consumed significantly ($p<.05$) more energy, protein, iron, thiamin and niacin than women.

Grandjean et al. (1981) in a study of 19 women and 11 men, at least 64 years of age, and participating in a Congregate Meals Program, report a sex difference in diet evaluation. Diets were scored based upon the mean of the percentages of the RDA supplied for protein, calcium, iron, vitamin A, thiamin, riboflavin, niacin and vitamin C. Forty-two percent of the women had diets rated "good" compared with 73% for men. On the other hand, 47% of the diets for women and 27% for men were rated "fair".

As can be seen from the studies reviewed, despite the various nutrient intake assessment methods and differing sample characteristics, men were consistently found to have generally larger nutrient intakes.

3.3.3 Income

Income has been found to affect nutrient intakes in the elderly. High income was reported to be more often associated with adequate nutrient intake by Le Bovit (1965) and Cohen (1974). The sample of 283 seniors studied by Le Bovit (1965) all had low-incomes subdivided into high, middle and low. Fifty-four percent of the "high" income group met the RDA in all nutrients whereas only 38% of the "low" income group reached this level. Cohen (1974), in a British study of 879 seniors at least 65 years old, reported higher mean intakes of nutrients for subjects with higher incomes. The study of nutrient intakes of 60 women from 69 to 94 years of age, by Harrill et al. (1976), reported the energy intake of women in the lower economic level was significantly ($p<.01$) less than women in the higher economic level. Dietary intake was determined by weighing the food consumed for 3 consecutive weekdays. Seventy-five percent, 45, of the women lived in a nursing home whereas the remainder lived in private homes. A breakdown of income by place of residence would enable one to determine whether income distribution was similar for the two groups.

Yearick et al. (1980) reported a significant ($p<.005$) and positive correlation between income and vitamin C intake. When considering foods consumed, Slesinger et al. (1980) reported a significant and positive relation between income and fruit and vegetable consumption, but signif-

icance levels were not stated. This would appear to support Yearick's finding because fruits and vegetables are prime sources of vitamin C. Slesinger et al. (1980) further reported a significant (level not given) and positive relation between income and milk consumption. As previously mentioned, portion sizes consumed were not measured by Slesinger et al. (1980), so nutrient intakes should be cautiously inferred.

The nutrient intakes of 55 seniors whose income qualified them for food assistance and 54 seniors who were not qualified, were compared by Guthrie et al. (1972). The average income of the group not eligible for food assistance was twice that of the other. The higher income group was found to consume significantly more protein ($p<.01$), iron and riboflavin ($p<.05$) than the lower income group.

Higher income subjects were found by Reid and Miles (1977) to consume diets with more variety ($p<.05$) and to consume more nutritional diets ($p<.05$). The authors noted the reluctance and inability of many of the 50 subjects to state their exact income. All subjects received Old Age Security and all but one received additional income in the form of other pensions, savings, investments and the Guaranteed Income Supplement. The conclusions drawn should therefore be interpreted cautiously.

The report on the relationship between income and nutrition (Canada, 1975), based on Nutrition Canada (Nutrition Canada, 1973) data, found that the nutritional status of men 65 years of age and older was more often adversely affected by low income.

From these studies, it is seen that the nutrient intakes of the elderly may be positively influenced by increased income. Furthermore,

differences in nutrient intakes are found whether comparisons are made between incomes within the low income bracket, or between high and low incomes.

3.3.4 Health Status

Guthrie et al. (1972) examined self-rated health as a factor influencing the adequacy of the diet of two groups of seniors. The seniors were divided by income for eligibility in the food assistance program. The two groups differed significantly ($p<.01$) in self-rated health assessment. The group with sufficient income to disqualify them from food assistance, more often rated their health as "good" or "very good", than the group eligible for food assistance. Self-rated health was not found to change diet adequacy significantly. This may be due to the confounding effect of receiving food assistance. Food assistance participants, who rated their health as poorer than non-participants, were found to consume significantly ($p<.10$) more adequate amounts of energy, protein and iron.

With aging comes a common loss of dentition which can affect the type of food consumed. Johnson (1964) reported that many of the 74 homebound seniors visited were without teeth or dentures. It was found that their diets were monotonous and unappetizing. Unfortunately the nutrient adequacy of the diets was not reported according to dentition status. The positive effect of consuming a greater variety of foods on diet rating has been reported by Reid and Miles (1977).

Few studies have reported the relationship between health and nutrient intake. Positive health is seen to be associated with adequate nutrient intakes. As well, health plays a role in the physical and psychological perception of one's self and life satisfaction.

3.3.4.1 Self-rated Health and Life Satisfaction

Self-rated health rather than physician-rated health assessment, can be a valuable tool in assessing health status in terms of personnel, time, and money requirements. Factors which seem most closely associated with a general self-assessment of health in the elderly were investigated by Tissue (1972). The same interview with questions on physical or objective health, subjective response to health, medical care, response to aging and morale, was conducted twice on the same group of pension recipients. Of the original 256 persons, 235 were re-interviewed after one year. The first year ratings were significantly ($p<.001$) associated with the second year ratings in areas of perceived health. It was determined that in the general ratings of health, the subjective perception of health was more important for rating, than objective information.

A comparison of self and physicians' rating of health was conducted by Friedsam and Martin (1963). The sample consisted of 87 low-income seniors with 41.3% having both assessments. Physician's and self-rated health assessments were significantly ($p<.05$) and positively related. Significant relationships were reported between self-health ratings and worry about health ($p<.02$), happiness ($p<.02$) and dejection ($p<.01$). No significant relationships were found between physician ratings and any attitudinal items. This is in agreement with the Tissue (1972) study.

The study by Palmore and Luikhart (1972) further supports these findings. Self-rated health was found to be more important to life satisfaction than the physician's health assessment ($p<.05$). Self-rated health was found to be significantly ($p<.05$) and positively correlated to life satisfaction. The authors conclude that if self perception of health is good, there is more positive life satisfaction even if the physician rating of health is poor. The sample of 502 persons from 45 to 69 years, was part of an interdisciplinary longitudinal study in North Carolina. The subjects were contacted every second year. A strong component of self-rated health is life satisfaction (Palmore and Luikart, 1972). Social activity was a factor found to influence life satisfaction.

3.3.5 Social Activity

There is an association between isolation and nutrition (Pelcovitz, 1972). Food is a medium of socialization whereby one eats for social significance (Weinberg, 1972). In the elderly, it is not so much what they eat but with whom they eat, that is important for socialization (Weinberg, 1972). The relations between nutrient intakes and social activity are examined in the following studies.

In the study by Harrill et al. (1976), a life satisfaction rating (LSR) was obtained from a questionnaire scale for 60 women aged 69 to 94 years. Dietary intakes were determined by weighing and recording foods and beverages consumed for 3 consecutive days. In general, nutrient intakes of subjects with lower LSR scores were less than for subjects with higher LSR scores. Mean daily caloric and protein intakes were

significantly ($p<.05$) less for the subjects with lower LSR scores than for the subjects with higher LSR scores.

Preliminary observations on the food habits of seniors as related to media use and social participation were reported by Clancy (1975). Nutrient intakes of 41 women and 6 men living in upstate New York were determined by 24-hour recall, food frequencies and subject-reported meal patterns. The mean age was 72 years with a range from 60 to 93. Media use was determined by the number of hours spent watching television and reading. A social participation score was based on the frequency of meeting with friends and relatives outside the home and at home. Results indicated one-third of the sample had diets that contained less than 67% of the RDA for at least three nutrients. The nutrients most frequently low in the diet were vitamins A and C, and calcium. No significant correlation was found between social participation and television viewing. The dietary score was significantly ($p<.01$) related to the social participation score. The social participation score was significantly and positively related to energy, iron, thiamin and riboflavin intakes as well as generally higher dietary scores. Television watching and nutrient adequacy of the diet were reported to be positively related. As television watching increased, nutrient adequacy of the diet increased. Nutrient intakes in excess of the recommended amounts were not given, which would elucidate this relationship.

Reid and Miles (1977) found that of the 50 seniors studied, the 31 who lived with another person had significantly ($p<.01$) higher diet variety scores than the 19 subjects who lived alone. The authors also found a significant ($p<.01$) positive correlation between diet variety score and diet rating.

From the studies reviewed, it would appear that life satisfaction, social participation and television viewing, are related to nutrient adequacy of the elderly. An examination of life satisfaction, social participation and media use is warranted to better understand the relationship with nutrient adequacy of the elderly.

The effects of aging on activities and attitudes were studied by Palmore (1968). One hundred twenty-seven volunteers from a longitudinal study of aging were interviewed four times at 3 year intervals. At the fourth interview, the sample age range was 70 to 93 years with a mean of 78 years. The sample was determined to be an elite group among the elderly, socially, psychologically and physically. The Chicago Inventory of Activity and Attitudes test was used as the tool of measurement. The activity questions consisted of four questions in five areas - health, contacts with family and friends, leisure activites, economic restrictions on activity, religious activity by attendance and media participation. The attitude questions dealt with satisfaction in eight areas - health, friends, work, economic security, religion, usefulness, family, general happiness. There were seven questions per area. The test was reported to have a high degree of reliability based upon the moderately high correlations of initial scores with later scores for both total activities and attitudes. Statistically significant ($p<.01$) changes were found in activity scores for men between interviews one and two for health and leisure activities, between interviews one and three for leisure activities, and between interviews one and four for leisure activities. As men aged, their leisure scores decreased which would indicate decreased attendance at meetings. The

health score increased between time one and two, possibly because of reduced employment stress. For the women, statistically significant ($p<.01$) changes were found in activity scores between interviews one and three for leisure activities, between interviews one and four for contacts with family and friends, leisure activities, and economic restrictions on activity. As for the men, there was a decrease in leisure activites over time, but also, a decrease in the contacts with family and friends. The economic score actually increased which would signify few economic restrictions on activity, over time. No significant overall decrease in total activity score was found for the 51 men and only small ones for the 76 women. In other words, aging did not significantly change the activities of the men, in the five areas studied. However, women decreased their activities slightly over the ten year period.

Statistically significant ($p<.01$) changes were found in attitude scores for the men between interviews one and three for economic security and general happiness and between interviews one and four for religion. Most of the men voluntarily went back to work or increased the amount of time spent at work, during the study. This would increase the economic score. The religion score increased, possibly as the men approached death and had an increased concern with an afterlife. For the women, statistically significant ($p<.01$) changes were reported in attitude scores between interviews one and three for economic security, religion and general happiness and between interviews one and four for health, work, economic security, usefulness and general happiness. The women felt few economic restrictions, had an increased interest in

religion, possibly because of approaching death and concern with an afterlife. A decrease in health and work scores may explain the decrease in usefulness and general happiness scores. However, no significant overall decrease in attitude scores was found for the men and only small ones for the women in the sample. As in the activity scores, men were not found to have changed their attitudes, in the eight areas studied. The women, as in the activity scores, changed slightly, towards a more negative attitude. Changes in total activites were significantly and positively correlated with changes in total attitudes at $p<.01$ for both men and women. The subjects who reduced activities as they aged, tended to a decrease in overall satisfaction, while those who increased activities as they aged, tended to an increase in overall satisfaction. These findings support the activity theory of aging which states keeping active as one ages, is important for happiness.

A common leisure activity of the elderly is using the mass media (Graney and Graney, 1974). The attention to the mass media may be a substitute activity for more active forms of activity (Graney and Marshall, 1974). Media use as a substitute activity in old age was investigated in a sample of 60 women aged 62 to 89 years (Graney and Marshall, 1974). Questions were asked about media use - television viewing, reading, listening to the radio; community participation - non-neighbour friends and relatives; and neighbourhood participation. Results indicated age was not associated with the amount of neighbourhood participation activity, though 49% of the sample had less than daily contact with neighbours. The most elderly women visited less ($p<.0004$) in the community than the youngest women. All of the sample were considered to be in good mental and physical health. There may,

however, be a difference in mental and physical health, between the oldest and youngest members of the sample. This information was not given by the authors. There was no statistically significant relationship between media use and community participation.

The effects of health and income upon leisure satisfaction and psychological well-being in the elderly, were investigated by Mancini (1978). The sample consisted of 74 seniors with a mean age of 70 and a modal yearly income of $2,000-$3,000 U.S. Psychological well-being and self-rated health were measured by Cantril's Self-Anchoring Striving Scale, leisure satisfaction was measured by a two-item ordinal-level scale, and annual income information was sought. Psychological well being was found to be significantly correlated with both leisure satisfaction ($p<.001$) and self-rated health ($p<.01$). Leisure satisfaction was significantly correlated ($p<.01$) with self-rated health as well.

The area of social activity and component parts should be considered when determining factors which influence seniors' dietary intakes. Nutritional intervention programs have been found to positively affect the nutrient intake of the elderly. In the MOW program, there is social contact between the person delivering the meal and the recipient.

3.4 MEALS ON WHEELS PROGRAMS

The MOW program is international with services offerred in Australia, New Zealand, Sweden, India, Israel, Barbados, the United Kingdom, the United States and Canada (Best et al., 1970). A summary of various home-delivered meal services is shown in Table 1. It is meant to serve

as background information to the MOW programs and point out the similarities and differences among programs. "Sponsor" refers to the source of program funding, "personnel" to those who are involved in conducting the program, "purpose" to the purpose of the program, while who is eligible is listed under "eligibility", who the recepients are, is found under "recipients", restrictions to service participation are under "restrictions", location of meal prepatation is under "food preparation", the food/meals served is listed under "food/meals served", the cost to the recipients under "cost", frequency of meal delivery is under "meal delivery" and availability of special diets is under "special diets".

The Ontario and Winnipeg programs receive funding from provincial sources, charitable organizations and private donations. Two of the four American programs presented are federally funded, the sponsor is unknown in one program, and the fourth program is a research study. Various personnel are involved in the delivery of meals. Excluding the study by Rhodes (1977), all other MOW programs listed are to some extent dependent upon volunteers. Volunteer drivers and meal deliverers are needed in all of the reported Canadian programs, in Kalamazoo, Michigan, and in Rochester, New York. The driver is paid in the Columbus, Ohio program but the deliverers are volunteers. The Visiting Nurse Service is involved in the Rochester, New York program.

The purposes of the reviewed programs (Table 1) are to deliver a hot meal: to the elderly in Peterborough, Ontario, Texas, Kalamazoo, Michigan, and Rochester, New York; to the elderly and handicapped in Kingston, Ontario and Columbus, Ohio; to anyone unable to prepare a hot meal in Kitchener-Waterloo, and London, Ontario and Winnipeg, Manitoba.

TABLE I. DESCRIPTION OF HOME DELIVERED MEAL SERVICES

REFERENCE AND LOCATION	SPONSOR	PERSONNEL	PURPOSE	ELIGIBILITY	RECIPIENTS
Ontario Meals on Wheels Conference, Sir Wilfred Laurier University, Waterloo, Ontario. June 13-16, 1982. Peterborough, Ontario	Partial funding from the Ministry of Community and Social Services Home Support Program.	Full-time Co-ordinator Route Convenors Volunteer drivers and deliverers.	To maintain or improve the health status of the elderly who are unable to prepare a hot meal. To increase the social contact of the elderly.	Referrals from Home Care and Medical and Health Personnel, Families, Friends, Recipients themselves.	Average age is 86.
Ontario Meals on Wheels Conference, Sir Wilfred Laurier University, Waterloo, Ontario. June 13-16, 1982. Kingston, Ontario	Victoria Order of Nurses. Funding from the Ministry of Community and Social Services Home Support Program.	Part-time Co-ordinator and Assistant. Volunteer drivers and deliverers.	To maintain or improve the health status of the elderly and handicapped who are unable to prepare a hot meal.	Referrals from Medical and Health Personnel, Families, Friends, Recipients themselves.	Elderly and handicapped.
Ontario Meals on Wheels Conference, Sir Wilfred Laurier University, Waterloo, Ontario. June 13-16, 1982. Kitchener-Waterloo, Ontario	Kiwanis Club and donations.	Full-time Co-ordinator Volunteer drivers and deliverers.	To maintain or improve the health status of people who are unable to prepare a hot meal.	Referrals from Medical and Health Personnel, Families, Recipients themselves.	Mostly Senior Citizens.
Ontario Meals on Wheels Conference, Sir Wilfred Laurier University, Waterloo, Ontario. June 13-16, 1982. London, Ontario	United Way	Full-time Co-ordinator Volunteer drivers and deliverers.	To maintain or improve the health status of people who are unable to prepare a hot meal.	Referrals from Medical and Health Personnel, Families, Recipients themselves.	No age restriction 69% women 31% men.
Rhodes, L. NASA Food Technology. A method for meeting the nutritional need of the elderly. Gerontol. 17(4):333, 1977. Texas, U.S.A.	Research Study	Research team.	To develop and test a palatable, easily transportable, shelf-stable meal system which required minimum preparation and which could be used in the congregate meal and M-O-W programs. To reach the eligible elderly who are not being reached at the present.	Low Income - $392.12/mo. for one person. $512.87/mo for two people.	168 elderly volunteers over a 3-month period.
Rankine, D.C., Taylor, B. Are community nutrition programs meeting the needs of the elderly? J. Home Econ. 67:37, November, 1975. Kalamazoo, Mich. U.S.A.		Volunteer drivers and deliverers.	To provide meals for the homebound aged in order to improve their nutritional status and consequently their general health.		Homebound Aged.
Williams, I.F., Smith, C.E. Home-delivered meals for the aged and handicapped. J. Amer. Diet. Assoc. 35:146, 1959. Columbus, Ohio U.S.A.	Federally funded	Paid driver Volunteers.	To deliver hot meals to the home of the aged and handicapped who would not otherwise receive balanced meals.	Any person who is unable to prepare meals because of physical or mental disability, absence of cooking facilities, inability to shop or carry on normal activities. Referrals from a Social Welfare or health agency or investigated to determine need.	Aged and handicapped.
Henry, C.E. Feeding elderly people in their homes. J. Amer. Diet. Assoc. 35:149, 1959. Rochester, N.Y. U.S.A.	Visiting Nurse Service.	Visiting Nurse Service Volunteers	To supplement the food by providing 2 meals a day, 5 days a week to elderly people in their own homes.	Must be in need of service.	45-96 years Median - 79 Mean - 76.8 Mode - 80
HOW Office Winnipeg, Manitoba 1984 Winnipeg, Manitoba	Government of Manitoba, United Way, Winnipeg Foundation.	Full-time Co-ordinator. Volunteer drivers and deliverers.	To maintain or improve the health status of people who are unable to prepare a hot meal.	Referrals from Medical and Health Personnel, Families, Recipients themselves.	No age restriction. Mostly elderly and handicapped.

RESTRICTIONS	FOOD PREPARATION	FOOD/MEALS SERVED	COST	MEAL DELIVERY	SPECIAL DIETS
Elderly (age not given). Initially visited by the Chairman of the Assessment Committee.	2 hospitals 1 home for senior citizens.	Hot noon meal, roll, soup, dessert.	$2.00/ meal	Tuesday, Wednesday, Thursday only because of restrictions at source. Some receive two meals on Thursday. 70 meals daily	Available Diabetics notified about the caloric content of meals so they can adjust their intake.
None given. Initially visited with some re-assessment later.	4 Institutions for the elderly and infirm. 20 meals, twice a week, from a high school where students are participating in a "Bridging the Gap" Program for seniors.	Hot noon meal.	$1.75/ meal	5 days/week 70 meals daily.	Diabetic dessert, low fat, mixed, salt free
Must be in need. Assessed by telephone or upon visitation. On-going evaluation.	1 hospital	Hot noon meal. Supper may be served when the need increases.	$1.55/ meal	5 days/week Average of 157 meals daily.	Therapeutic diets and individual requests.
Must be in need. Initially assessed by the Co-ordinator.	4 hospitals 3 institutions for the elderly 2 psychiatric institutions 1 children's institution	Hot noon meal, soup, bread and butter, dessert. Milk supplied by several sources.	$2.00/ meal	5 days/week 190 meals daily.	Diabetic desserts.
Recipients have sufficient mobility and dexterity to unpack, open and prepare the meals.	Specially prepared for research purposes.	Thermostabilized (can), freeze-dried, dehydrated, foil-polyethylene layered pouches. All single meal units included an entree, 2 side dishes, dessert, bev.	Competitive	1 week supply of 7 meals packaged in a box weighing under 10 pounds. Box was mailed.	None
	Central Kitchen with a public health nutritionist. Hot noon meal, salad, dessert, roll and butter, Milk supplied for lunch and dinner, if desired.	Breakfast (Can of juice, Individual Cereal Box, Milk) Cold Lunch-(Soup & Fruit or Sandwich & fruit) if requested.	$2.00/ dinner $2.24/ dinner & lunch $3.50/all 3 meals	6 days/week with an extra frozen meal sent along for seventh day.	Salt free, Diabetic, low residue.
	Local Restaurant	Hot and cold meals late afternoon and early evening delivery.	Public assistance recipients- $.80/day max. non-indigent elderly or handicapped $2.00/day temporary service- $2.00/day	5 days/week	None
Public Health Nurse, Supervisor assesses eligibility initially & each month thereafter.	Centrally prepared under the supervision of a nutritionist.	Hot meal, salad, bread, dessert, choice of beverage protein sandwich, fruit, milk Cold supper-	$1.25/ day but adjusted to $.50/ day if assistance needed.	5 days/week 36 clients	Diabetic, moderately restricted sodium.
Assessed by telephone.	6 hospitals 3 institutions for the elderly	Hot noon meal, soup, roll & butter, dessert salad occasionally Cold supper - protein sandwich, fruit, cookies	$2.60/ meal with adjustments	7 days/week 600+ meals daily approx. 200 on weekends	Diabetic, Sodium, Fat, Energy Restricted, Mechanical Soft Not all diets offered by all suppliers.

In all of the programs, except for the research study in Texas, the maintenance or improvement of health status is the goal for meal recipients. The purpose of the Rhodes study in Texas was to develop and test a palatable, easily transportable, shelf-stable meal system which required minimum preparation to be used in Congregate Meal and MOW programs.

Eligibility for MOW is based upon referrals from medical and health personnel, families, friends and the recipients themselves in all of the Canadian programs (Table 1). Eligibility for MOW is based on income in the Texas study, not given in the Kalamazoo, Michigan program, based upon need (which was not described) in the Rochester, New York program and upon referrals from a social welfare or health agency, or investigated to determine need, in the Columbus, Ohio program (Table 1).

The recipients of MOW in the programs outlined tend to be elderly (Table 1). Restrictions to the service are determined by various assessments of need for meal delivery in the programs reviewed (Table 1). Food preparation for the programs is in hospitals, homes for senior citizens, institutions for the elderly, psychiatric institutions, centrally prepared in a restaurant and in a high school (Table 1). The food for the research study in Texas was specially prepared for research purposes.

A hot noon meal and a cold supper are served in the Winnipeg, Manitoba, Columbus, Ohio and Rochester, New York programs (Table 1). Only a hot noon meal is provided in the listed Ontario programs. Breakfast, a cold lunch and a hot noon meal with milk for lunch and

dinner are provided by the Kalamzaoo, Michigan program. A one week supply of seven meals was provided in the research study (Rhodes, 1977).

The cost of the meals delivered is minimal and adjusted to recipient income (Table 1). The listed costs per meal are given for interest and should not be compared because they have not been adjusted to equal dollar value.

Five-day meal delivery is provided by all of the listed Ontario programs except for Peterborough where three-day meal delivery is provided (Table 1). Five-day meal delivery is provided in the Columbus, Ohio and Rochester, New York programs. Seven-day meal delivery is provided by the Winnipeg, Manitoba program and the Texas study. A six-day meal delivery, with a frozen meal sent for the seventh day, is provided by the Kalamzaoo, Michigan program. The number of meals delivered daily varies from 36 in the Rochester, New York program to over 600 in the Winnipeg, Manitoba program (Table 1). No figures are given for the Kalamazoo, Michigan and Columbus, Ohio programs.

Special diet modifications are offered to varying degrees in all of the Canadian programs listed (Table 1). No diet modification was available in the Texas study and Columbus, Ohio program.

3.4.1 Social Component of the MOW Program

The social component of MOW, as well as the nutrient content of the meals, must be considered when examining the effect of meal delivery upon nutrient intake of the elderly.

The social components of a MOW service in Mansfield, Ohio were determined by analyzing case histories of MOW recipients (Kaplan and Williams, 1961). It was concluded that MOW offerred social interaction through volunteer contact. As well, program participants were discharged earlier from the hospital and avoided temporary institutionalization if it was known MOW would be available during convalescence. MOW encouraged independence by making it possible to remain in the home, and maintained health status by offerring nutritious meals. This study was based upon anecdotal evidence and subjective evaluation of three cases considered to be representative of MOW recipients in Mansfield, Ohio.

The general characteristics of persons receiving MOW in five programs sampled in Connecticut, Michigan, Pennsylvania, Maryland and New York State were summarized by the National Council on Aging (1965). Data were collected by visiting the clients and writing case histories. Males constituted 30% of 142 current clients whose median age was 76 years. General health status of 165 clients was reported to be poor with only 11 well. The majority, 138 of 165 clients were under some type of medical care, 15 under no care, 4 questionable, and 8 unknown. Out of 65 clients, 74% had few social and recreational activites and only 11% had many social and recreational activities. Once again subjective judgements were made which influence the data collected. Each surveyor purposefully influenced the choice of clients visited by personal area of interest. There was variability in the method of data collection due to personal interest and some clients were visited by one surveyor, by two surveyors jointly, and by different surveyors for each visit.

It is evident that the MOW recipients interviewed had few social contacts but the MOW program offers some social interaction through volunteer contact.

3.4.2 Nutrient Content of MOW Meals

A sampling of Rochester, New York MOW menus for a hot noon meal and a cold sandwich supper was conducted by Henry (1959) to determine the contribution of MOW to daily nutrient intake in MOW elderly recipients. The MOW menus provided 75% of the daily RDA of all nutrients studied for a 65 year old man but were lower than 75% of the RDA for vitamin C.

The MOW program in Wellington, New Zealand was reported to supply almost half of the daily protein recommendation and nearly one-third of the energy recommendation for 37 elderly MOW recipients (Davidson and Butler, 1971). Vitamin C content of the meals was reported to be low.

The nutrient content of MOW meals was determined by Turner and Glew (1982) in Leeds, England. The mean energy, protein, calcium, iron and vitamin C contents of a total of 59 meals provided by five sources were 658 Kcal, 28.1 g, 279.2 mg, 3.9 mg and 13.5 mg, respectively. The energy, protein, calcium and iron contents of meals was determined by calculations based upon portion weights and food tables. The vitamin C content of meals was determined by chemical analysis.

The mean nutrient content of 10 meals supplied by the Winnipeg MOW program was presented by Moore (1966). The mean nutrient contents were 885 Kcal, 35 g protein, 190.0 mg calcium, 6 mg iron, 1509.4 RE vitamin A, 0.6 mg thiamin, 0.6 mg riboflavin, 7.7 mg niacin and 66 mg ascorbic acid. The percentage of the daily CDS (1963) supplied by MOW for a

75-year old man, was calculated to be 48% energy, 73% protein, 38% calcium, 100% iron, 135% vitamin A, 120% thiamin, 66% riboflavin, 154% niacin and 220% ascorbic acid (Moore, 1966).

The variation in nutrient content of MOW meals is evident. The American (Henry, 1959) and Canadian (Moore, 1966) meals, supplied the greatest proportion of the daily recommended nutrient allowances. The English (Turner and Glew, 1982) program, however, supplied substantially more calcium - 279.2 mg than the Canadian (Moore, 1966) program with 190.0 mg of calcium.

3.5 SUMMARY

The preceding review of the literature has indicated that nutrient intakes by the elderly of energy, calcium, vitamin A, vitamin C, iron, thiamin, riboflavin and protein, are often inadequate. However, nutritional intervention programs are reported to have a positive effect upon the nutrient intakes of the elderly. Other factors affecting nutrient intakes of the elderly include age, sex, income, health status and social activity. There is a need to assess the nutritional benefits to the elderly of nutritional intervention programs such as MOW and the role of the factors listed. With the proportion of elderly in the Canadian population increasing, serious consideration must be given to a program such as MOW which aims to maintain the health status of recipients and decrease expensive hospitalization and institutionalization.

Chapter IV

RESEARCH DESIGN

4.1 OBJECTIVES

Four objectives are formulated for this study. They are as follows:

1. To measure the nutrient intake of a segment of the elderly population and compare it to the Recommended Nutrient Intakes (RNI) for Canadians.
2. To measure the nutrient intake of a segment of the elderly population receiving Meals on Wheels (MOW), and compare it to the nutrient intake of a segment of the elderly population not yet receiving MOW.
3. To determine the nutrient contribution of MOW to daily nutrient intake among elderly MOW recipients.
4. To determine the relationships among specific nutrient intakes and age, sex, health status, social activity, income, and MOW in a segment of the elderly population.

4.2 HYPOTHESES

"Nutrient intake" is operationzalized to include daily energy (Kcal), protein (g), vitamin C (mg), calcium (mg), iron (mg), vitamin A (RE), thiamin (mg), riboflavin (mg) and niacin (NE) intakes. "Nutrient density" is operationalized for the same nutrients and expressed as amount of nutrients/1,000 Kcal. The hypotheses are:

1. The MOW meal will increase daily nutrient intake among MOW recipients.
2. The MOW meal will increase the nutrient density of diets eaten by MOW recipients.
3. The MOW meal will decrease the number of MOW recipients consuming less than the RNI for daily nutrient intakes.

The response to the independent variable, MOW meal, may be affected by the associated variables age, sex, health status, social activity and income. The dependent variables are the listed daily nutrient intakes, the listed nutrient densities, and the number of MOW recipients consuming less than the RNI for the stated nutrients.

4.3 EXPERIMENTAL DESIGN

This study design is quasi-experimental, termed a nonequivalent control group design. Potential study subjects were identified by the MOW agency from program waiting lists and asked to participate in the study. Individuals who were not at the time receiving MOW made up the control group and individuals who were expected to receive MOW shortly, made up the experimental/treatment group. The pretest of the experimental design was conducted for both groups prior to receipt of MOW and the posttest after the receipt of MOW, for the experimental group, or one week after the initial interview for the control group. A further posttest was added, two weeks after the second observation, in order to determine if there had been a change in nutrient intakes over time. It was assumed that a change in nutrient intake may not be as evident after three days of meal delivery as after several weeks because of an adjust-

ment period to the MOW meals. The experimental design is depicted in Figure 1.

"Stage I interviews" in Figure 1 refer to the individual pretest interviews for both the experimental and control groups before any meal delivery. At this time, a two-day food record, and weight of the individual were obtained. "Stage II interviews" are the individual interviews one week after the Stage I interviews. For the experimental group, MOW service would have been received for at least three days. The control group would not have received MOW service. Once again, a two-day food record was obtained and the weight of the individual recorded. Stage III interviews were conducted at least two weeks after the Stage II interviews. As in stages I and II, a two-day food record was obtained for both the treatment and control groups. Height, weight, and triceps skinfold thicknesses were obtained and a questionnaire on health status, social activity, income and food preparation was administered to all of the subjects at Stage III. Several further questions about the MOW service were asked of the treatment group only.

Comparisons of results between the control and experimental groups were made to determine if the MOW program had an effect. This design guards against internal invalidation (Babbie, 1983) because both the experimental and control groups are treated similarly. Sources of internal invalidity listed by Babbie (1983) are minimized as:

1. History - which should affect both groups similarly because the interviews were conducted individually with no ordering of experimental or control participants to particular times of the year;

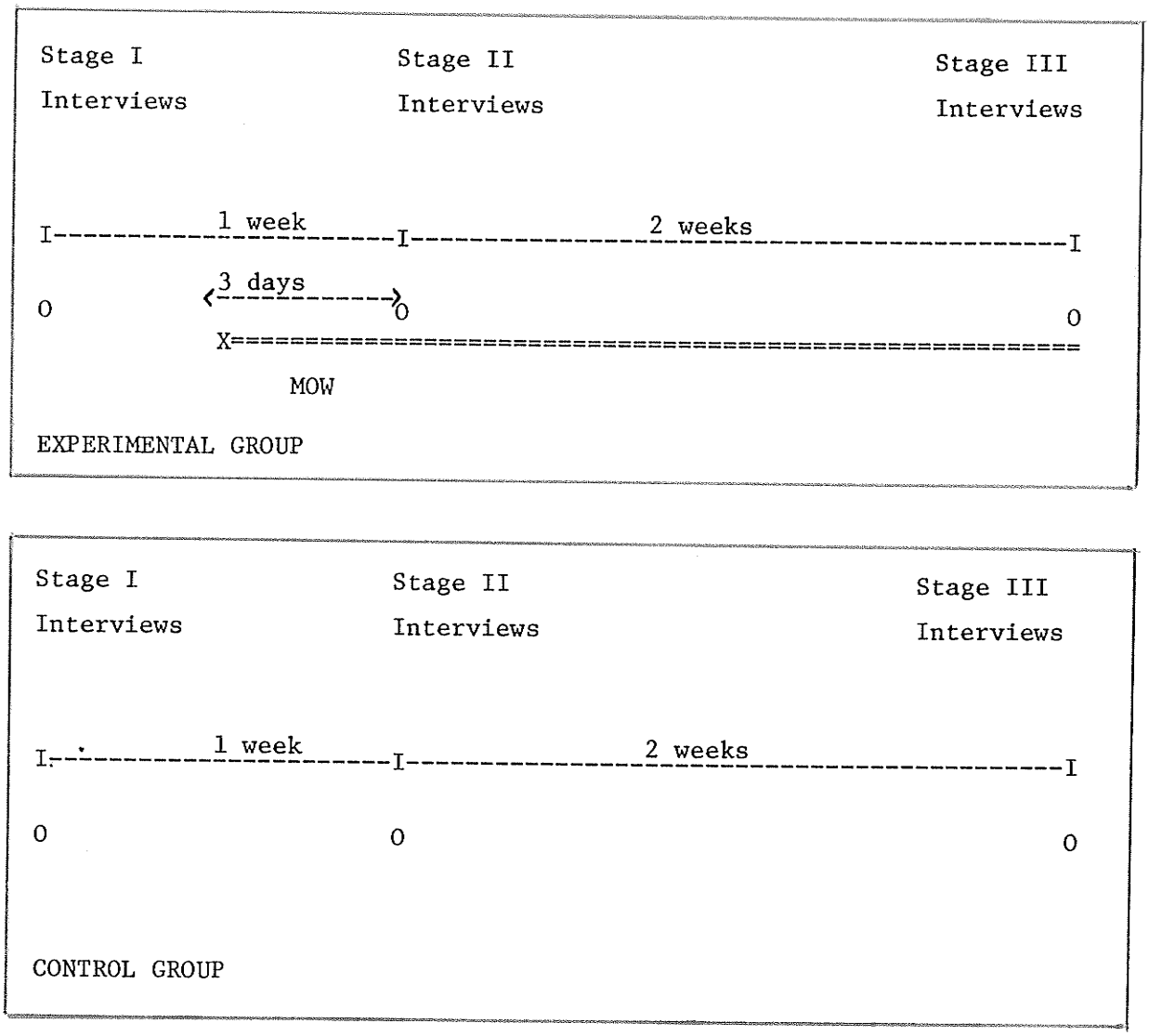

Figure 1: Experimental Design. Dietary intake is shown by "O", the start of meal delivery is "X", and the period of meal delivery is "=".

2. Maturation - both groups should be affected similarly because the interview time period was the same;
3. Testing - both groups are being tested the same number of times, at equal time intervals, and by the same interviewer;
4. Instrumentation - both groups are given the same tests;
5. Statistical regression - is expected to be minimal since both groups are potential MOW recipients;
6. Selection biases - are possible with individuals more in need receiving MOW sooner and because random allocation to experimental and control groups was not possible;
7. Experimental mortality - all individuals who agreed to participate in the study finished their full schedule of interviews though some no longer received MOW and were dropped from the treatment group. A bias for subjects pleased with MOW is possible in the treatment group. This could accentuate the apparent positive effects of MOW service recipients.
8. Selection - maturation and other interactions - is possible to have a change in nutrient intakes occur in the experimental group not due to receiving the MOW service;
9. Causal time-order - the experiment was carefully controlled to the number and time of interviews and was the same for both groups;
10. Diffusion or imitation of treatments - do not believe the treatment or control subjects were in touch since they were not informed that some participants were receiving meals and others not;

11. Compensation - none was given to either group;
12. Compensatory rivalry - the control subjects did not know they were controls at the time of the study. They were waiting to start the MOW service;
13. Demoralization - all subjects finished their scheduled interviews, possibly with less effort and enthusiasm.

The problem of external invalidity relates to the generalizability of results (Babbie, 1983) to all MOW recipients. Interaction of testing with the stimulus is not controlled for in this experimental design. It is possible that this interaction will have a greater effect upon results than the two components individually. It is further possible that the recording of food intake plus receiving MOW would lead to either more accuracy or exaggeration of the food record. Any apparent nutrient increase would not be due to the stimulus, MOW, but to better recording. For this reason, a second posttest was obtained three weeks after the receipt of MOW. It would be difficult to maintain an apparent increase in nutrient intakes over the timespan of two weeks. Other sources of external invalidity are listed by Campbell and Stanley (1963) and are as follows:

1. Interaction of selection with the stimulus - this is more likely when difficulty in obtaining subjects is experienced. There was difficulty in obtaining subjects for this study.
2. Other interactions with the stimulus - the possibility exists in an experiment that more than one treatment be administered. Subjects were asked at each interview whether their food intake represented their usual diet. The cited reasons for a change were illness and receiving MOW.

3. Reactive arrangements - the knowledge of participating in an experiment can lead to an artificial response. The subjects knew they had to record what they consumed in a day and may have changed their dietary intake. To minimize this error, food records were obtained for two consecutive days at each data collection stage and subjects were encouraged by the interviewer to not change their regular eating habits and food consumption.

Chapter V

METHODOLOGY

5.1 RESEARCH INSTRUMENTS

5.1.1 Two-day Food Record

Two-day food records were obtained on three different occasions to determine the effect of MOW service upon the nutrient intakes of the elderly. Instructions for completing the food record and the food record forms are in Appendix B.

Study participants were instructed not to change their regular eating habits and to list on the food record form all the foods they ate and drank from the time of the interview to the same time the next day. This was repeated the next day to obtain a food record for two consecutive days. The food record consists of three columns with column one containing the food item and a brief description, column two the amount consumed, and column three any addition or sauces to the food item. The days for the food record, Wednesday-Thursday and Thursday-Friday, were chosen for two reasons. First, MOW were delivered on week days only, so those days were sampled to determine the effect on nutrient intakes. Secondly, dietary intake on other than weekdays may not be typical of daily intake and food record days were chosen so as to not include any food from weekends and weekend visiting.

The use of a two-day food record is supported by evidence from Gersovitz et al. (1978). In their sample of 65 seniors with a mean age of 71.7 years, the number of usable food records declined from 85% for two days to 60% for seven days.

5.1.2 Hospital Menus

Meals on Wheels in Winnipeg are supplied by hospitals, senior citizen homes and psychiatric institutions. The treatment group in this study received meals from three general hospitals. Two of the hospitals, Health Sciences Centre and St. Boniface General, are situated in the downtown area and Victoria General is situated in the suburbs. Meals on Wheels three-week cycle menus were obtained from the three hospitals to assess and verify that the nutrient contribution of the independent variable, MOW, was similar in all cases.

5.1.3 Social Activity, Health Status, Income, Food Preparation, Meals on Wheels

An interviewer administered questionnaire was used to measure social activity, health status and income of the sample. Questions on food preparation and MOW for the treatment group were asked. All of the indices were previously validated and chosen from the published literature. The questionnaire is found in Appendix B. Similar questions have been used in other studies of the elderly. Social activity was measured by using individual items of the Graney and Graney (1974) social participation scale, and individual items of the leisure satisfaction scale (Mancini, 1978; Mancini and Orthner, 1980). Health status determination

was made using individual items of the Jaslow (1976) and Warren (1980) indices. Income was measured by categories used in the 1981 Canadian Census (Statistics Canada, 1981) and by the Manitoba Department of Health and Social Development (1973). The wording of the questionnaire was based upon the questionnaire used by Browning (1984) to examine the adjustment to retirement of senior citizens in Winnipeg. Questions about food preparation and MOW were added to this study questionnaire, for descriptive data about food habits of the sample.

5.1.3.1 Social Activity

Social activity was measured to determine the relationship with nutrient intakes of the elderly (Appendix B). Social activity was measured by eight items of social participation (Q 4, 5, 6, 7, 8, 9, 10, 11) and two items of leisure satisfaction (Q 12, 13). Responses to the social participation questions have been categorized by Graney and Graney (1974) into low, moderate and high activity. The same categories were used in this study. The questions and the categorizations of responses are outlined in Table 2. The Graney and Graney (1974) sample was 60 American women with a median age of 75.3 years who were considered to be representative of elderly persons. They were interviewed initially and 46 women were reinterviewed 4 years later. Responses were pooled and divided into three roughly equal categories with a fourth for non-respondents. The distribution of activity reports at the two different interviews was used as a normative criterion for the establishment of the categories.

TABLE 2

Categorization of responses to social participation questions.

Question	Activity		
	Low	Moderate	High
How many hours would you say you watch television in a day?	≤2 hr/d	2-5 hr/d	≥5 hr/d
How many hours would you say you listen to the radio in a day?	<1 hr/d	1-2 hr/d	≥2 hr/d
How many hours would you say you read in a day?	≤1 hr/d	1-3 hr/d	>3 hr/d
How often do you get together with you neighbours.	< daily	daily	>daily
Aside from your neighbours, how often do you see any of your friends and relatives in Winnipeg- I mean people you know pretty well?	≤monthly	>monthly<weekly	>weekly
About how many phone calls do you make and receive in a day?	≤2/d	3-4/d	≥5/d
How often do you attend church or participate in church-related activities?	never	sometimes	≥weekly
How often do you attend meetings of any clubs, civic groups, or other organizations?	never	irregular	regularly

Source: Graney and Graney (1974).

Leisure satisfaction was measured by two items scored 1 to 5 where 1 is indicative of dissatisfaction and 5 indicative of satisfaction (Mancini, 1978; Mancini and Orthner, 1980). The study sample was 74 seniors who lived in two senior public housing complexes in a south-east American city, with a mean age of 70 years. Seventy-five percent of the sample were women.

Browning (1984) determined the reliability of the scales on an elderly Winnipeg sample of 62 men with a mean age of 70.4 years, and 78 women with a mean age of 67.8 years. A reliability coefficient of .60 was considered to be moderately reliable and scale items which did not meet the minimum criteria for reliability were considered separately. Browning (1984) reported Cronbach alpha coefficients of .197 for solitary social activity (Q4,5,6), .119 for informal social activity (Q7,8), .371 for formal social activity (Q10,11), and .790 for subjective social activity (Q12,13). Palmore (1968) also reported the reliability of the questions was acceptable because of high correlations of earlier scores with later scores in the sample of 67 elderly subjects, with a mean age of 78 years in the fourth interview. Subjects were interviewed at 3 year intervals four times.

5.1.3.2 Health Status

The relationship between health status and nutrient intakes of the elderly was examined. Health status (Appendix B) was measured by three items (Q1, 2, 3) which assessed self-rated current and past health (Jaslow, 1976) as well as the functional aspects of perceived health (Warren, 1980). The items had fixed responses and were scored 1 to 5

for self-rated health and 1 to 6 for functional health where 1 is indicative of poor health and 5 or 6 is indicative of good health.

Jaslow (1976) examined employment, retirement and morale among an American national probability sample of 2398 women at least 65 years of age. Their mean age was 72.9 years and their median age was 71.7 years. An assessment of self-rated current and past health was determined. A measure of functional health was reported by Warren (1980), in a longitudinal study on the effects of health changes upon life satisfaction.

The results of reliability analysis by Browning (1984) in the sample of 67 elderly persons, indicated the subjective health questions (Q1,2) had a reliability coefficient of .621, which indicates moderate reliability. Functional health (Q3) was analyzed by Browning (1984) using the Guttman Scalogram Analysis. Items in the functional health scale were considered scalable when the coefficient of reproducibility was greater than or equal to .90 and the coefficient of scalability was greater than or equal to .65. The reported coefficients of reproducible and scalability obtained in the functiononal health items were .96 and .76 respectively (Browning, 1984) which indicate an acceptable Guttman scale.

5.1.3.3 Income

The relationship between income and nutrient intakes of the elderly was measured (Appendix B). Income was measured by three items dealing with total annual income, Q 14, and satisfaction with income, Q 15 and 16. The total annual income question was used in the 1981 Canadian

Census (Statistics Canada, 1981). The subjective income questions (Q15, 16) were used in a Manitoba longitudinal study on aging in 1971 (Manitoba, 1973). The sample consisted of 3558 seniors at least 65 years of age.

5.1.3.4 Food Preparation

Questions (Q 17, 18, 19) were asked of the total sample to obtain descriptive data about who prepares the food consumed and the extent of convenience product usage. There is a paucity of descriptive data about MOW recipients. This information is necessary when considering changes to the type of service offered by MOW.

5.1.3.5 Meals on Wheels

Two questions, Q 20 and 21, were asked of MOW recipients to determine perceived adequacy of meal portions and the extent of meal substitution with MOWs.

5.1.4 Anthropometric Measurements

Height, weight and triceps skinfold thicknesses were obtained from all subjects. The same bathroom scale was used for all three stage weighings of each person. The scale was checked and adjusted to zero prior to weighing the subjects. Weights were recorded in kilograms and to the nearest decimal. Subjects were asked to remove shoes before weighing for a more accurate determination of body weight (Nutrition Canada, 1980). No allowance was made for clothing.

A portable stadiometer was used with a leveling headboard, for height measurements (Nutrition Canada, 1980). The measurement tape was pulled from the level platform to the level headboard. Heights were recorded in centimeters and to the nearest decimal. Subjects were measured in stocking feet using techniques described by Nutrition Canada (1980).

The Lange caliper with a pressure of 10 gm/mm^2 was used for the right arm triceps skinfold thickness determination (Yearick, 1980). The midarm point was located between the olecranon and acromial processes by holding the right arm perpendicular, across the stomach. The arm was then dropped to the side and a vertical skinfold of subcutaneous adipose tissue grasped by the fingers of the left hand, just above the midpoint. The calipers were applied to the midpoint and pressure applied for three seconds. The reading was recorded and then the whole procedure repeated for another reading. The average of two was taken. In advance the subjects were asked to wear short sleeves on the day of the measurement to facilitate triceps skinfold thickness determination.

5.2 DATA COLLECTION

5.2.1 Sample

The nonprobability sample of subjects consisted of residents of Winnipeg, 65 years of age and over, who were eligible for MOW program participation. Eligible persons for MOW program participation are considered to be incapable of preparing adequate meals because of age, health problems including infirmity which often results in decreased mobility, and/or lack of cooking facilities. Individuals are referred to Meals on Wheels of Winnipeg Inc. by home care, hospitals, the province, physicians, by themselves, relatives and friends (Anon, 1982a).

Acceptance into the program is based on information collected over the phone by MOW personnel. The MOW staff determine the health problems of the individual in this interview, and determine whether the individual has previously received the service. Priority of service is dependent upon the MOW agency perception of need which is influenced by i) the health status of the individual; ii) if they were on the program previously; iii) service load of the geographical route of meal delivery designated for that individual; iv) reminders for inclusion into the program. An individual in poor health, who is considered in need because of receiving MOW previously, who lives on a geographical route of meal delivery with an opening, and who calls to remind the agency of the desire to receive MOW, is likely to start the program before an individual in slightly better health, who has never been on the program, who lives where the meal delivery route is filled and who fails to remind the agency of the need for the service.

The MOW agency administrative offices telephoned persons prior to starting the MOW program and asked, using the statement in Appendix A, if they would be willing to participate in the study. If the person agreed, they were told they would be contacted by the researcher. MOW then telephoned the researcher with information including the name, address, phone number, age, sex, health problem, diet, number of meals per week, and source of MOW meals for each potential subject. The researcher in turn made contact by telephone, explaining the study using the statement in Appendix B. If the person was interested in participating, a time for the first interview was established. Participants were assured data collected would remain confidential.

Subjects about to start the MOW program were classified as the treatment group. The treatment group received 5 noon meals/week from one of five specific meal preparation sources. Meals for the MOW service are prepared in nine institutions but the majority of meals are prepared at five of them. Subjects who were on waiting lists were classified as the control group. Waiting lists of people waiiting several weeks for service develop because of the MOW program dependency on volunteers. There are 38 meal delivery routes on week days in the city. Volunteers deliver the meals and are given a set number of meals per route which varies depending on the route and source of meal preparation. When the quota is full, a waiting list is started. The backlog on routes can not be predicted by the MOW administration. Meal delivery may also be delayed if the new recipient lives too distant from a route or if the route must be drastically changed to accomodate the recipient.

The names of 67 individuals were given to the researcher over a one year time period from May 1983 to May 1984. Twenty-seven of the 67 individuals, 40.3%, agreed to participate in the study. All 27 were self-referrals to the MOW program. Statistics listing number of referrals by source, from May 1983 to May 1984, were not available from the MOW agency. The 1982 statistics of service were used for this description. There were 971 new persons starting the MOW program in 1982 of whom 183 or 18.8% were self-referrals (Anon, 1982a). The majority of referrals, 37.7% came from home care and hospitals (Anon, 1982a). It is evident that this study sample is not representative of Winnipeg persons waiting to receive MOW. Of the non-participants, 35% (14) thought participating involved too much work, 22.5% (9) were physically unable to participate, 17.5% (7) did not want MOW, 12.5% (5) had difficulties

comprehending, 10% (4) were younger than 65 years of age, 2.5% (1) was hospitalized, 2.5% (1) received less than 5 meals/week and 2.5% (1) was illiterate. Using 1982 MOW figures the 67 individuals would represent approximately 6.9% of the 971 new persons starting the program in 1982. However, not all new persons were solicited for study participation. Persons thought by MOW to be most likely to participate in the study, were contacted by the agency. The decision was based upon ability to communicate, language, mental status, and health status. Control group subjects were obtained from the waiting list for MOW. All potential subjects had to be serviced by one of the five meal sources in order to avoid increasing variability in the nutrient content of meals delivered.

Probability sampling was not possible because of inaccessability to MOW files. As well, it was considered unethical to withhold service to a potential MOW recipient, in order to be in the control group. The study protocol was approved by the Ethical Review Committee of the Faculty of Human Ecology at the University of Manitoba.

5.2.2 Interviewer Training

The researcher and a research assistant in Foods and Nutrition conducted all of the interviews. To ensure standardization in data collection, several half-day training sessions were conducted by the researcher. The research protocol was reviewed and both interviewers practised techniques to be used in the interviews. Probing techniques were emphasized and standard interviewer responses to anticipated subject questions were developed. Anthropometric measurements were practised to minimize interperson variation.

Each interviewer was provided with a standard folder containing extra forms, an interviewer check list and a calendar. Individual subject folders with the forms and a consent form were taken to interviews (Appendix B). To verify food record amounts, the interviewers were provided with three sets of household measuring cups, which they were encouraged to leave at the subject's home if none were available. Food models similar to the ones used in the Nutrition Canada (1973) study were used to check portion size. They included meat shapes, a thickness determination model and varying portion size mounds. The Lange calipers, stadiometer, and bathroom scale were used for anthropometric measurements.

5.2.3 Pretest

A pretest was conducted to test the research format, the questionnaire and interview techniques. The sample consisted of four women who met the subject selection criterion and of whom two were treatments and two were controls. The categories of the functional health question (Q 3) in the questionnaire were changed to better reflect the capabilities of the sample. Categories of "sit or stand", "walk slowly", "light domestic work", "walk 1 city block", "walk at least 4 city blocks" were used, plus the original heavy work question. The wording of question 7 was clarified from "see your neighbours" to "get together with your neighbours". No changes were made to the interview techniques. The research format was changed to the questionnaire being administered once, in stage III. Food record forms were simplified with only the duration of the food record to be kept, written across the top of the

form. Rulers, for measuring food portions, especially meat, were discontinued because manipulation of the ruler as well as seeing the scale were problems. During the study, meat shape and thickness determination models were used to verify the size of meat portions (Nutrition Canada, 1973).

5.2.4 Interview Procedure

The study participants were visited Wednesday, Thursday and Friday at three different times or stages, for a total of nine visits per person. On day one, the study was explained verbally, an interview schedule established and the consent form (Appendix B) signed. The subjects were instructed on how to keep the two-day food record, given an example and left the food record to complete. A set of household measures was left, if none were present. On day two, the one-day food record was reviewed with the subject to check accuracy and detail. On day three, the second food record was reviewed with the subject to check accuracy and detail. Food models similar to the Nutrition Canada models, were used to ensure accuracy of portion sizes. As well, probing questions of the "this or this" format were used. For example, "Did you use butter or margarine on your toast?"; "Was that white bread or brown bread?". Weight of the person was taken on day three. The same procedure was followed one week later to obtain two-day food records, and weight data. Two weeks later, the same procedure was followed with the addition of the triceps skinfold thickness and height measurements and questionnaire administration. The subjects were always asked if each day of the food record was a typical day's intake, reasons for why not, and if vitamin and mineral

supplements were taken. The type, dose and frequency of dietary supplement usage was obtained. At the end of each home interview, the interviewer would remind the subject of the next interview and inform them of the procedure to be followed. This enabled the subject to be cognizant of the study procedure and to be ready for the anthropometric measurements and questionnaire administration.

5.3 DATA ANALYSIS

5.3.1 Two-day Food Record

Two-day food record data were coded, entered into the computer and analyzed for nutrient content using the Nutrient Analysis Program 1983 at the Univerisity of Manitoba (Department of Foods and Nutrition, 1983). The nutrient database was the 1983 Canadian Nutrient File of Health and Welfare Canada, which was based on U. S. D. A. Handbook No. 8 with revisions for Canadian foods because of supplementation, fortification, and manufacturing differences. Food items not listed in the nutrient database were coded by the researcher as foods with similar nutrient content.

Daily energy (kcal), protein (g), vitamin A (RE), vitamin C (mg), calcium (mg), iron (mg), thiamin (mg), riboflavin (mg) and niacin (NE) intakes were obtained and averaged for stage nutrient intake per person and per treatment or control group. The nutrient contributions of lunch and dinner were determined for both treatment and control groups. The contribution of MOW supplied food to the nutrient intakes at lunch and dinner was determined for the treatment group. The nutrient contents of meals served by MOW to each individual were calculated. Energy and

nutrient data were compared to the 1982 RNI (Canada, 1982b) to determine adequacy of nutrient intake for both groups, based upon age, sex and activity data. Nutrient densities of home-supplied and MOW-supplied food were determined for an assessment of diet quality.

5.3.2 Hospital Menus

MOW contributing hospital menus from three sources were coded, entered into the computer and analyzed for nutrient content using the Nutrient Analysis Program (Department of Foods and Nutrition, 1983) containing the 1983 Canadian Nutrient File, at the University of Manitoba.

The mean difference and range between subject reported MOW-supplied nutrient intakes and actual MOW-supplied nutrient intakes were determined. Actual MOW-supplied nutrient intakes were determined from the hospital menu nutrient calculations.

5.3.3 Questionnaire

The subject responses to the questionnaire were analyzed for mean response, standard deviation and range per question using the SAS package MEANS (Helwig and Council, 1979). Significance of differences in responses between the treatment and control groups was determined using the t-test at the 5% level of significance.

5.3.4 Anthropometric Measurements

Height, weight and triceps skinfold thickness measurements were obtained for each person. The change in weight among stages was determined. Recommended weight for height was calculated based upon the height and weight data presented in the RNI (Canada, 1982b) for determining average energy requirements.

5.3.5 Demographics

Age and sex data were obtained for each individual in order to determine the adequacy of nutrient intake which varies depending on the age and sex of the individual.

5.3.6 Statistical Analysis of Data

The differences in group mean nutrient intakes between the treatment and control groups at each of stages I, II and III were determined using the SAS package TTEST (Helwig and Council, 1979). Statistical significance was set at the 5% level.

Before and after MOW intervention nutrient intake data were available for each subject. Because of the pairing which is inherent in the experimental design, the paired-difference test (paired-t test) was used to eliminate subject-to-subject variability and yield mean differences in nutrient intakes at the various stages. Stage I and II, II and III, and I and III comparisons were made for the treatment and control groups at the 5% level of significance. The SAS package TTEST (Helwig and Council, 1979) was used for statistical analyses.

Mean nutrient intakes and analysis of variance among the actual three MOW contributing sources were determined for food-record days of the three-week cycle menu using the SAS packages MEANS and ANOVA (Helwig and Council, 1979).

Correlations between questionnaire responses and stage I nutrient intakes were determined. Kendall's coefficient of correlation was used to determine the correlation between nutrient intakes and the ordinal variables of the questionnaire: Q 1, 2, 3, 7, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19. The SAS package CORR KENDALL was used (Helwig and Council, 1979). The level of significance was set at alpha = .05.

Spearman's coefficient of correlation was used to determine the correlation between nutrient intakes and the nominal variables of sex and treatment or control group. The SAS package CORR SPEARMAN with a 5% level of significance was used (Helwig and Council, 1979).

The Pearson product-moment coefficient of correlation was used to determine the correlation between nutrient intakes and the interval or ratio variables of the questionnaire: Q 4, 5, 6, 9, 14. The SAS package CORR with a 5% level of significance was used (Helwig and Council, 1979).

Chapter VI

RESULTS AND DISCUSSION

6.1 DEMOGRAPHIC CHARACTERISTICS OF THE SAMPLE

Of the 27 persons who participated in the study, 20 met the study criteria and protocol (Table 3). There were 10 persons in each of the control and treatment groups. Four of the 27 persons dropped out of the MOW program after stage II. They were interviewed in stage III but were dropped from the treatment group and study analysis because they no longer met the study criterium of receiving MOW. MOW reported a 49.8% dropout rate from the program after two weeks of the service (Anon, 1982a). Despite the small number of study participants, a dropout rate from the MOW program of 4 out of 14, or 28.6% was observed. Three of the four persons dropped out because of dissatisfaction with the meals, and the fourth person dropped out because of family reasons which were not divulged.

Three of the 27 participants were dropped from the study because they were interviewed at four rather than three stages. All three recieved MOW at stage III and were thus disqualified from being in the control group. At the fourth stage, two persons were still receiving MOW and one person was not. Dissatisfaction with the meals was the reason given for stopping the MOW service.

TABLE 3

Number of subjects at each stage of interview

Group	Stage				Total
	I	II	III	(IV) [1]	
Experimental	14	14	10 4-no longer receiving MOW -dropped from analysis		10
Control	13	13	10 3-received MOW -dropped from analysis	2-still receiving MOW 1-no longer receiving MOW	10

[1]Not used in the analysis.

Demographic characteristics of the sample are listed in Table 4. The mean age for the treatment group was 82.5 years with a range from 75 to 90 years. The mean age for the control group was 76.6 years with a range from 65 to 89 years. The four treatment group persons dropped from the analysis had a mean age of 81.8 years, ranging from 75 to 90 years. The three control group persons interviewed at four stages had a mean age of 77 years with a range from 65 to 85 years. The mean age of the treatment group was significantly ($p<.05$) older than the control group. The four treatment group persons dropped from the analysis were found to be older than the control group as well. Statistical significance was not determined. The control persons who received MOW at stage III and were thus dropped from the control group, had a mean age less than the treatment group. Differences in age between the treatment and control groups diminish if bias in sampling was removed. The difference in age may be a reflection of health status, with the older persons being perceived by the MOW agency to have poorer health and thus receive meal service faster. Age, per se, was not a criterium for meal service, by the MOW agency.

There were 3 men in the control group and only 1 man in the treatment group. The sex difference of the treatment and control groups was not statistically significant. Of the four treatment group persons dropped from the analysis, one was a man who lived with his spouse; of the three four stage interviewees, one was a man also. He and two of the men in the control group, lived alone. The remaining control-group man and the treatment-group man lived with their spouses. Two of the control group women lived with their spouse, two were sisters living together and all

TABLE 4

Demographic characteristics of the sample, n=20.

Subject Number	Group	Age (years)	Sex	Living Arrangement	Previous Occupation
3	C[1]	80	F	Spouse	Farm/Maid
16	C	65	M	Spouse	Soldier
34	C	79	F	Alone	Teacher
39	C	80	F	Sister	Secretary/Clerk
40	C	89	F	Sister	Teacher
56	C	73	F	Alone	Business
58	C	76	F	Alone	Secretary/Clerk
61	C	76	F	Spouse	Secretary/Clerk
65	C	75	M	Alone	Police Superintendent
67	C	73	M	Alone	Foreman
7	T[2]	90	F	Alone	?
13	T	88	F	Alone	Housewife
18	T	75	F	Alone	?
19	T	77	F	Alone	Nurse's Aide
24	T	84	F	Alone	Apartment Manager
41	T	88	F	Alone	Business
42	T	82	F	Alone	Secretary/Clerk
43	T	81	F	Spouse	?
44	T	80	M	Spouse	Railroad Foreman
59	T	80	F	Alone	Nurse

[1] C = Control; [2] T = Treatment

others lived alone. In the treatment group, only one woman lived with her spouse and all others lived alone. More of the treatment than control group subjects lived alone. Living alone may have influenced the MOW agency for priority service. There is the possibility if one has a companion, the companion may prepare meals. However, living arrangement was not an official criterium for meal service, by the MOW agency.

Though not asked, the previous occupation of 17 of the 20 subjects was given during the interview sessions. Classification of occupation according to a collapsed Blishen scale, as used in a study of 400 seniors by Strain and Chappell (1982) is as follows: 23.5% (4) professional or high management (teacher, nurse, police superintendent); 23.5% (4) low-level management (foreman, business); 41.2% (7) semi-skilled (apartment manager, secretary/clerk, nurse's aide, soldier); 5.8% (1) farm labourer; and 5.8% (1) housewife. In the Winnipeg random sample interviewed by Strain and Chappell (1982), 22% were categorized as professional or high management, 28% low level management, 23% semi-skilled, 5% farm labourer and 23% housewife. In this study sample, most of the women had been employed outside of the home, which is reflected in the higher percentage of the sample in the semi-skilled category and small percentage in the housewife category. Comparison with the Strain and Chappell (1982) study results would seem to indicate an over representation of previously employed senior women in the present sample. As previously pointed out, the study sample were all self-referrals. Possibly seniors who have been employed outside the home are more aware of the social programs available and take advantage of them.

6.2 HOSPITAL MENU ANALYSIS

The mean hospital menu nutrient contents for Wednesdays, of a three week cycle menu of a three week cycle menu Thursdays and Fridays, for the three hospitals which serviced the treatment group, are presented in Table 5. Analysis of variance indicated no significant differences in energy, protein, iron, vitamin A, vitamin C, thiamin, riboflavin or niacin menu contents among the three hospitals for food record days. The mean calcium contribution from Victoria General Hospital was significantly greater (p=.005) than from St. Boniface General Hospital or the Health Sciences Centre.

TABLE 5

Three MOW contributing hospital menu mean nutrient contents for a three week cycle of food record days.

Nutrient	Mean			F-value
	St. Boniface	Health Sciences Centre	Victoria	
Energy, Kcal	672.4	697.6	748.7	0.64
Protein, g	30.2	28.9	30.0	0.10
Iron, mg	4.6	5.2	4.5	0.79
Vit. A, RE	348.5	1519.4	560.1	1.04
Calcium, mg	169.3	121.5	233.5	6.10*
Vit. C, mg	14.09	25.0	18.2	2.63
Thiamin, mg	.43	.40	.44	0.08
Riboflavin, mg	.42	.66	.57	0.55
Niacin, N.E.	11.2	11.7	10.7	0.19

*p=.005

Thus, the nutrient contribution of the independent variable, MOW meal, was taken to be constant for all nutrients except calcium.

Based upon Table 5 figures, the mean nutrient content of MOW meals regardless of hospital, are 706.2 Kcal energy, 29.7 g protein, 4.8 mg iron, 809.3 RE vitamin A, 174.8 mg calcium, 19.1 mg vitamin C, 0.42 mg thiamin, 0.55 mg riboflavin, and 11.2 NE niacin. These values are higher than the 658 Kcal energy, 28.1 g protein, 3.9 mg iron and 1.35 mg vitamin C, for MOW meals, reported by Turner and Glew (1982). The calcium content of the MOW meals reported by Turner and Glew (1982) was higher, 279.2 mg, than in this study. Similarly, the calcium content of the MOW meals reported by Moore (1966) was higher, 190.0 mg, than in this study. The other nutrients listed by Moore (1966) included 885 Kcal energy, 35 g protein, 6 mg iron, 1509.4 RE vitamin A, 66 mg vitamin C, 0.6 mg thiamin, 0.6 mg riboflavin, 7.7 mg niacin. Only niacin content was less than in the present study which may be because the contribution of the conversion of tryptophan to niacin was not calculated.

6.3 NUTRIENT INTAKES OF SUBJECTS

Nutrient intakes of subjects per stage, were determined by averaging two-day nutrient intakes. Mean nutrient intakes per stage for treatment and control groups are listed in Table 6. The response to the MOW meal was assumed to be the same for men and women. A bias may be present because there is one man in the treatment group and three men in the control group. In stage I, prior to nutritional intervention, the treatment group reported consuming significantly less ($p=.01$) calcium, 676.2 mg$\pm$192.5, than the control group with 1077.9 mg$\pm$408.3 (Table 6).

As well, the mean riboflavin intake for the treatment group, 1.7 mg±.63, was significantly (p=.05) less than for the control group with 2.6 mg±1.2 of riboflavin intake. For all other nutrients, the data do not indicate significant differences in group mean nutrient intakes between the treatment and control groups.

TABLE 6

Treatment and control mean nutrient intakes and significance of differences per stage.

Nutrient	Group	Mean		
		Stage I	Stage II	Stage III
Energy, Kcal	Treatment[1]	1495.8±272.3[2]	1502.1±338.6	1334.6±260.6
	Control[1]	1841.2±531.7	1642.3±574.9	1680.3±573.0
Protein, g	Treatment	57.6±18.5	60.1±15.2	54.4±12.5
	Control	72.2±25.4	63.9±21.1	63.6±20.6
Iron, mg	Treatment	12.1±2.6	13.1±4.4	10.8±3.0
	Control	16.2±7.0	14.5±7.2	14.0±7.6
Vitamin A, RE	Treatment	1625.8±2649.3	4459.1±3394.5[3]	2067.1±2575.6
	Control	2004.8±2450.5	923.2±445.9	1670.6±1518.4
Calcium, mg	Treatment	676.2±192.5[4]	579.6±199.2[5]	504.7±183.1[4]
	Control	1077.9±408.3	892.2±378.1	906.4±373.2
Vitamin C, mg	Treatment	100.0±106.0	78.6±47.4	63.8±39.9
	Control	122.8±78.1	93.8±63.1	79.6±86.0
Thiamin, mg	Treatment	1.1±.33	.99±.25	.83±.18
	Control	1.4±.43	1.25±.54	1.17±.51
Riboflavin, mg	Treatment	1.7±.63[6]	2.2±1.1	1.5±.58
	Control	2.6±1.2	2.3±1.1	2.2±1.0
Niacin, NE	Treatment	24.4±6.3	28.4±6.5	23.6±5.6
	Control	28.8±10.3	26.6±11.6	25.3±7.5

[1] n = 10; [2]standard deviation; [3]p=.009; [4]p=.01; [5] =.03; [6]p=.05

A comparison of stage I mean nutrient intake for this sample and the sample of Moore (1966), prior to meal delivery, indicates greater daily nutrient consumption for this sample. The Moore (1966) sample was reported to consume 1427 Kcal, 50.5 g protein, 6.8 mg iron, 1266 RE

vitamin A, 830 mg calcium, 38 mg vitamin C, 0.73 mg thiamin, 1.39 mg riboflavin and 7.0 mg niacin. As previously mentioned, the contribution of tryptophan to niacin intake was not considered by Moore (1966), which would otherwise raise the figure. In the Yearick et al. (1980) study, the mean nutrient intake for the sample was reported to be 1734 Kcal, 75.8 g protein, 11.8 mg iron, 2151.4 RE vitamin A, 773.1 mg calcium, 103.4 mg vitamin C. The group of elders consumed more energy, protein and vitamin A, but less iron, calcium and vitamin C than the present study sample. However, the elderly sample studied by Guthrie et al. (1972) was reported to have mean nutrient intakes of 1514 Kcal, 61.5 g protein, 10.6 mg iron, 900.6 RE vitamin A, 530.5 mg calcium, 57.2 mg vitamin C, 0.95 mg thiamin, and 1.25 mg riboflavin. All of these mean nutrient intakes are less than what is reported to have been consumed in the present study. The mean nutrient intakes of seniors, reported by Reid and Miles (1977) are also less than in the present study. The mean nutrient intakes reported were 1593 Kcal, 58 g protein, 9.4 mg iron, 1502.1 RE vitamin A, 644 mg calcium, 72 mg vitamin C, 0.91 mg thiamin, 1.45 mg riboflavin, and 12.9 mg niacin. As in the Moore (1966) study, the contribution of tryptophan to niacin intake was not considered. Comparisons of the present study mean nutrient intakes, with those of the four studies cited, would indicate the present study sample generally had a larger mean nutrient intake, except in one case (Yearick et al., 1980), for energy, protein and vitamin A.

At stage II, after nutritional intervention, the reported mean vitamin A intake in the treatment group, 4459.1 RE±3394.5, was significantly ($p=.009$) higher than in the control group with a 923.2 RE ± 445.9

reported mean intake (Table 6). However, the MOW menu of liver would explain the significantly higher reported mean vitamin A intake in the treatment group. Though not a habitual day's menu, it nevertheless points out the positive contribution of MOW meals. Mean calcium intake, as in stage I, was signficantly ($p=.03$) less in the treatment group at 579.6 mg ± 199.2, than in the control group, at 892.2 mg ± 378.1. This may be due to the low calcium content of MOW meals. The percent nutrient contribution of MOW to daily intake is discussed later (Table 12). No significant difference between the treatment and control groups was found in reported mean riboflavin intakes. It is possible that nutritional intervention to the treatment group eliminated the previously determined difference. No other significant differences in mean nutrient intakes were found.

In stage III, two weeks after nutritional intervention, only the reported mean calcium intake for the treatment group, 504.7 mg ± 183.1, was significantly ($p=.01$) less than for the control group with a reported mean calcium intake of 906.4 mg ± 363.2 (Table 6). MOW meals continued to lack a good source of calcium which would have elevated the mean calcium intake for the treatment group. Reported mean vitamin A intake of 2067.1 RE ± 2575.6, for the treatment group was not significantly higher than for the control group with a 1670.6 RE ± 1518.4 reported mean intake. Reported mean riboflavin intake continued to remain similar for both groups.

In the Moore (1966) study, significantly ($p<.05$) less iron, niacin and ascorbic acid were consumed by the study group prior to MOW than 10 weeks after the service. This was not the case in the present study. Mean nutrient intakes after 10 weeks of meal delivery (Moore, 1966) were

reported to be 1611 Kcal, 58.7 g protein, 9.4 mg iron, 1421 RE vitamin A, 740 mg calcium, 81 mg vitamin C, 0.90 mg thiamin, 1.37 mg riboflavin and 11.0 mg niacin. More energy, calcium, vitamin C, less iron, vitamin A, niacin and similar amounts of protein and thiamin were reported to be consumed by the Moore (1966) sample after MOW than by the present study treatment group. The Moore (1966) sample consisted of 5 men and 7 women while the present study treatment group consisted of 1 man and 9 women. It is possible the group mean intakes were higher for energy, calcium, and vitamin C because of the intakes of the men in the Moore (1966) sample. As well, the MOW meals reported to be supplied in the Moore (1966) study were higher in nutrient content than the present study MOW and would thus have a greater impact on the Moore (1966) sample whose initial nutrient intake was found to be less than in the present study. Less iron and vitamin A would be consumed in the Moore (1966) sample because a liver meal was consumed by the present study sample on the food record days.

The study by Kohrs et al. (1978) found that Congregate Meals Program participants who ate the program meal, consumed significantly ($p<.05$) more energy, protein and calcium, than non-program participants and program participants who did not eat the program meal. Riboflavin and niacin intakes were significantly ($p<.05$) less for the non-participants than for both the program participants who consumed and did not consume the meal. Moore (1966) similarly reported a significant ($p<.05$) increase in mean niacin intake with MOW intervention. Conversely to the Moore (1966) study, the Kohrs et al. (1978) group reported significantly ($p<.05$) less iron intake by the Congregate Meals Program participants

who consumed the program meal than for both the program participants who did not consume the program meal and non-program participants.

The significant ($p<.02$) increase in vitamin A intake for the treatment group after MOW was not found by Moore (1966) or Kohrs et al. (1978). The present study change in vitamin A intake is due to the MOW meal of liver. The significant ($p=.05$) increase in riboflavin intake for the treatment group, after MOW, was similarly found by Kohrs et al. (1978). The significantly less ($p=.03$) calcium ingested by the treatment group than the control group, after MOW, was not reported by Moore (1966) or Kohrs et al. (1978). The MOW meal in this study did not contain good sources of calcium (Table 12).

Statistical analyses of group mean nutrient intake data support the hypothesis "the MOW meal will increase daily nutrient intake among MOW recipients" for only vitamin A at Stage II, and for no nutrients at stage III.

The patterns over time, of mean energy, protein and vitamin A intakes for the treatment and control groups are depicted in Figures 2, 3, and 4, respectively. The control group pattern of intake for these nutrients, always decreased at week 2 (stage II) and increased at week 4 (stage III) but not to the level of week 1 (stage I). It is not possible to explain why these changes occurred. Explanations can include changes in the interest of the subject to participate in the study, changes in compliance and due to an increase in social interaction.

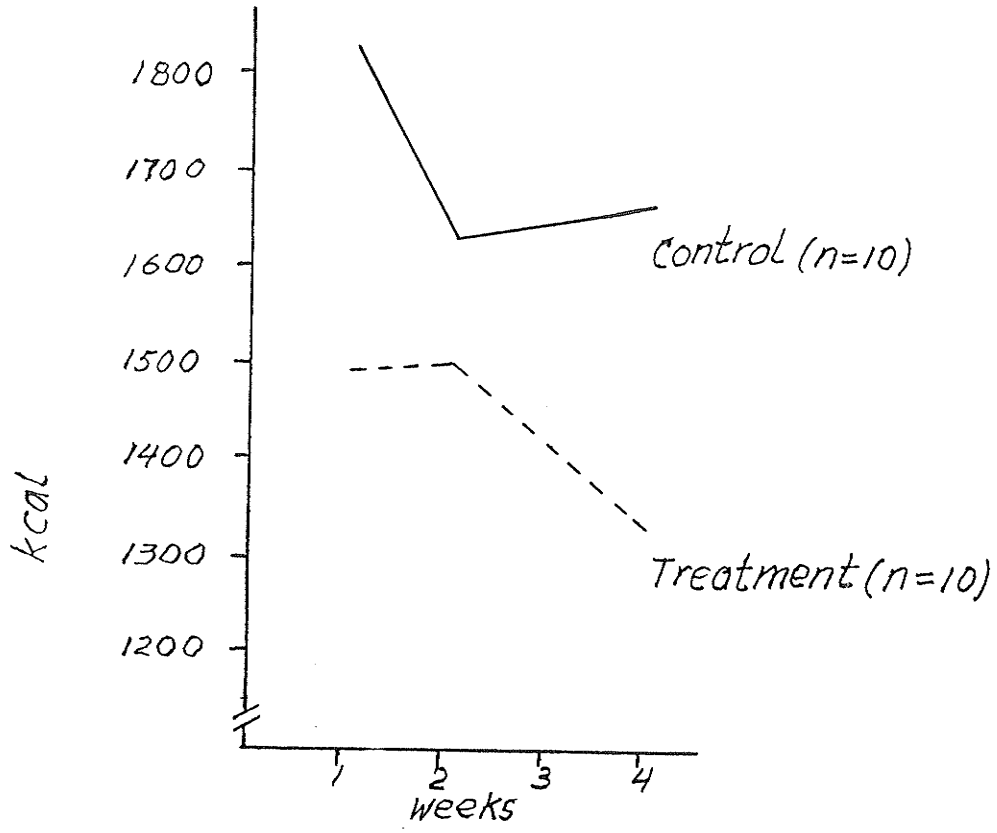

Figure2: Mean energy intake vs time

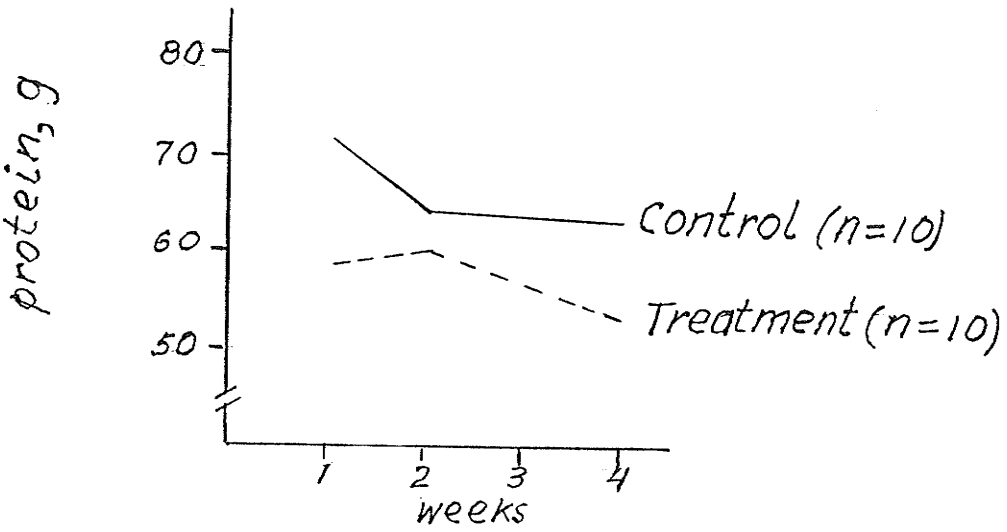

Figure3: Mean protein intake vs time

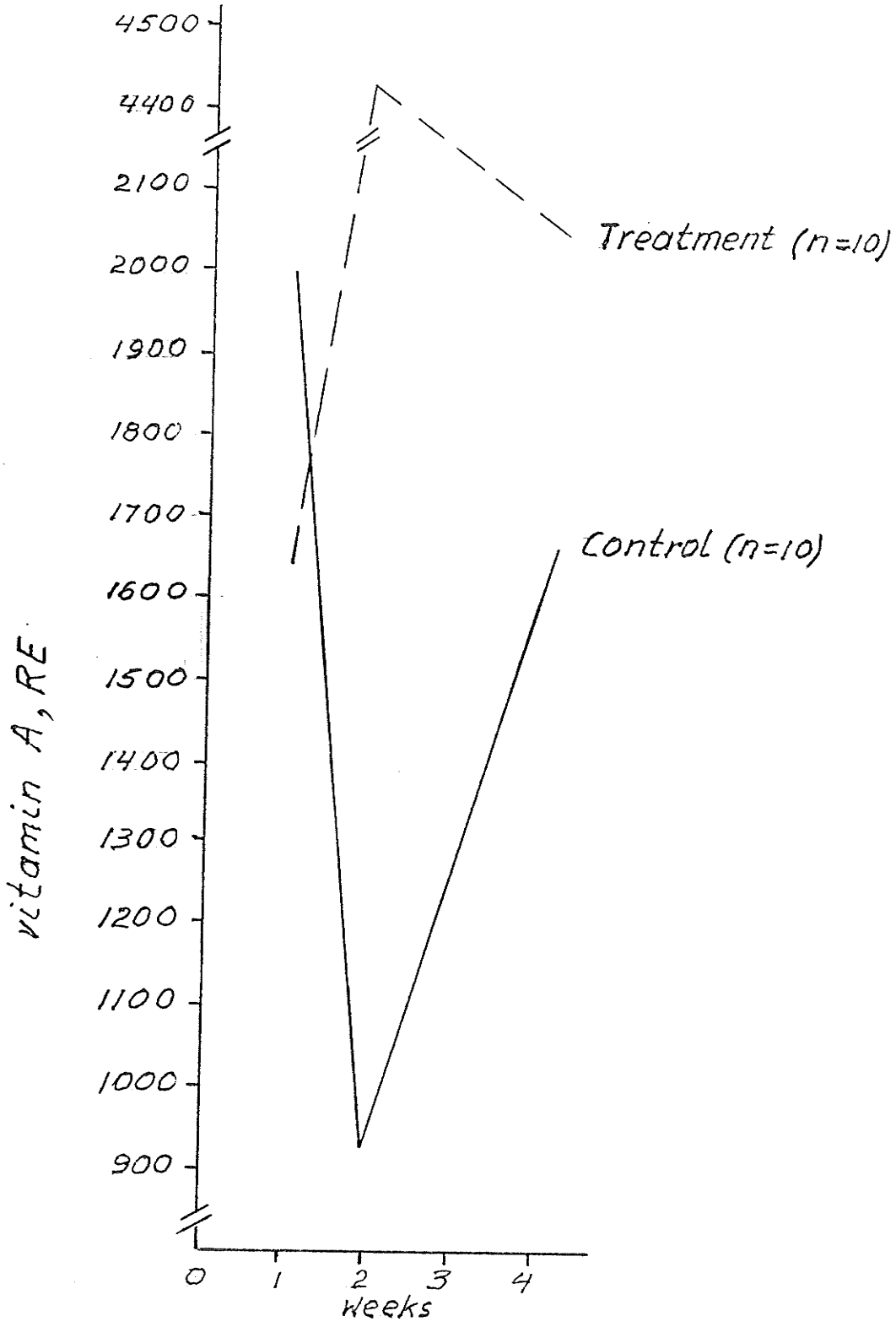

Figure 4: Mean vitamin A intake vs time

The treatment group nutrient intakes appeared to show the effects of the delivery of MOW at stage II. The mean nutrient intakes for energy, protein and vitamin A all increased at week 2 (stage II) and decreased at week 4 (stage III) to a level less than week 1 (stage I) for both energy and protein. At week 2 (stage II), the effect of the delivery of MOW is significantly ($p=.009$) seen for only vitamin A. At week 4 (stage III), the treatment group may be relying more on MOW as a major source of daily nutrients.

The patterns of mean iron, vitamin C, thiamin, riboflavin and niacin, for the control group, were all similar with a decrease over time (Table 6). The mean intakes of calcium, energy, protein and vitamin A decreased from week 1 (stage I) to week 2 (stage II) but increased at week 4 (stage III). Possible reasons for the observed pattern of intake have been presented.

In the treatment group, the patterns of mean iron, riboflavin and niacin intakes were similar to those of mean energy, and protein. The patterns of mean calcium, vitamin C and thiamin intakes indicated a decrease over time. Reasons for the observed pattern have been previously postulated.

The data were analyzed using the paired-difference test to eliminate subject-to-subject variability, potential bias due to the male: female composition of the treatment and control group and to yield more information on the mean difference in nutrient intake for the various stages (Table 7). Significantly less ($p=.02$) calcium was consumed in stage II than in stage I by the control group and yet there was no difference

between stages I and II. No significant difference was found for the stage I-II comparison of vitamin A intake, for the treatment group. About half of the group consumed liver in stage I and then again in stage II. Differences in vitamin A intake would therefore have been small and no significant differences would occur, after the start of MOW service. The increase in mean vitamin A intake in Stage II in the treatment group, is not supported by this analysis that controls for differences between individuals.

TABLE 7

Significance of individually paired differences between stages in nutrient intakes.

Nutrient	Group	Stage I and II Comparison	Stage II and III Comparison	Stage I and III Comparison
		Significance (I-II)	Significance (II-III)	Significance (I-III)
Energy, Kcal	Treatment	p=.90	p=.09	p=.12
	Control	p=.11	p=.76	p=.22
Protein, g	Treatment	p=.59	p=.10	p=.33
	Control	p=.15	p=.97	p=.19
Iron, mg	Treatment	p=.51	p=.07	p=.20
	Control	p=.19	p=.81	p=.07
Vitamin A, RE	Treatment	p=.06	p=.19	p=.71
	Control	p=.44	p=.19	p=.66
Calcium, mg	Treatment	p=.11	p=.06	p=.004*
	Control	p=.02*	p=.81	p=.07
Vitamin C, mg	Treatment	p=.52	p=.25	p=.34
	Control	p=.10	p=.41	p=.07
Thiamin, mg	Treatment	p=.34	p=.06	p=.01*
	Control	p=.24	p=.52	p=.06
Riboflavin, mg	Treatment	p=.24	p=.11	p=.34
	Control	p=.28	p=.69	p=.01*
Niacin, mg	Treatment	p=.08	p=.06	p=.62
	Control	p=.42	p=.72	p=.28

* Significant difference

Stage I and III comparisons of paired differences in nutrient intakes indicate significantly less (p=.004) calcium was consumed in stage III than in stage I, by the treatment group. In stage I, there was no nutritional intervention but in stage III home-delivered meals were ongoing. MOW contributed a mean of 31.3% daily calcium (Table 12) and a mean of 46.5% of the daily energy (Table 12) for the treatment group. The significantly lower calcium intake in stage III may be due, therefore to a lower calcium content of the home-delivered meals, compared to the regular diet.

Significantly (p=.01) less thiamin was reported to be consumed in stage III than in stage I, by the treatment group. In stage III, a mean of 44.9% of the daily thiamin intake was supplied by MOW (Table 12). Food choices in stage I, before nutritional intervention, would appear to have been rich in thiamin. As well, other foods consumed while receiving MOW may not be good sources of thiamin.

Significantly (p=.01) more riboflavin was reported to be consumed in stage I than in stage III, by the control group. This may be due to the variety of personal food choices made and different food choices of less riboflavin containing foods may have been made in stage III.

No significant differences in nutrient intakes were found between stages II and III for either the treatment or control groups using the paired difference analysis (Table 7). This would imply the level of nutrient intake is maintained for the time-span examined. Comparisons of the paired difference analysis results can not be made with the literature because they were not reported in the literature reviewed.

The paired difference analysis of the data does not support the hypothesis "the MOW meal will increase daily nutrient intake among MOW recipients". The treatment group was shown to be eating significantly less calcium (p=.004) and thiamin (p=.01) after more than 2 weeks of receiving MOW.

6.3.1 Nutrient Intake Densities

The mean nutrient intake densities were determined and compared for treatment and control groups at the three stages (Table 8). Nutrient density data give an indication of diet quality. The nutrient intake is expressed per a common base of 1000 Kcal of energy and thus comparisons for nutrient concentrations of dietary intake may be made. If a nutrient concentration is low but energy intake high, daily nutrient intake may still meet the RNI. Conversely, if a nutrient concentration is high but energy intake low, daily nutrient intake might not meet the RNI. Assuming people eat a diet with the same energy content, nutrient densities give information whether MOW contributes more to nutrient intake than an equivalent amount from a regular diet.

Mean nutrient intake densities indicated the control group in stage I had higher iron (p=.05), calcium (p=.001) and riboflavin (p=.001) densities (Table 8) than the treatment group. The mean niacin density for the treatment group was higher (p=.02) than for the control group. The comparison of group mean nutrient intakes, supported the higher calcium (p=.01) and riboflavin (p=.05) consumption by the control group.

TABLE 8

Mean nutrient intake densities per stage with significance of differences between treatment and control groups.

Nutrient	Stage I		Stage II		Stage III	
	Treatment	Control	Treatment	Control	Treatment	Control
Protein, g	38.60±10.19+	39.04±7.04	40.00±5.51	39.82±5.82	40.80±5.35	39.01±9.50
Iron, mg	8.11±1.15	8.57±2.28[1]	8.78±2.11	8.57±1.71	8.05±1.48	8.26±3.20
Vitamin A, RE	1123.77±1891.54	1022.25±1016.33	3296.98±2649.54[2]	566.68±204.74	1505.53±1821.94	1134.98±1408.19
Calcium, mg	455.85±118.23	580.28±116.50[2]	385.89±105.65	546.90±169.08[2]	379.77±111.54	539.22±141.24[2]
Vitamin C, mg	63.25±56.39	73.00±61.30	53.02±31.22	59.23±36.96	46.39±21.66	43.31±33.92
Thiamin,mg	0.74±0.18	0.74±0.14	0.67±0.13	0.74±0.12[2]	0.63±0.15	0.68±0.15[3]
Riboflavin, mg	1.15±0.43	1.38±0.38[2]	1.59±0.85[1]	1.40±0.49	1.10±0.40	1.31±0.52[2]
Niacin, NE	16.28±3.01[4]	15.54±1.98	19.23±3.82[2]	16.31±3.43	17.81±3.36[3]	15.98±6.24

+Standard deviation; [1]p=.05; [2]p=.001; [3]p=.01; [4]p=.02

At stage II, mean vitamin A (p=.001), riboflavin (p=.05) and niacin (p=.001) densities were higher for the treatment group than for the control group. Group mean vitamin A intakes were also higher (p=.009) for the treatment group. The liver served by MOW increased these nutrient values. In the control group, the mean densities of calcium (p=.001) and thiamin (p=.001) were found to be higher than the treatment group. This is supported by the higher group mean calcium (p=.05) intake for the control group, at stage II. Food choices made by the control group and the poor contribution of MOW meals to daily calcium intake (see Table 12), in the treatment group, may have contributed to these results.

In stage III, with MOW still ongoing, the mean niacin density for the tretment group continued to be higher (p=.01) than the control group. The higher mean vitamin A and riboflavin densities in Stage II were not maintained; however, as pointed out, the higher densities were a result of the liver meal. Mean calcium density for the control group continued to be higher (p=.001) than the treatment group and mean thiamin (p=.01) and riboflavin (p=.001) densities were higher too. Group mean calcium intake data also indicated higher calcium (p=.01) intakes for the control group. Food choices made by the control group would appear to be consistently higher in calcium and less often higher in thiamin and riboflavin contents.

The comparison of stage I and II mean nutrient densities in the treatment group indicated higher iron (p=.01), vitamin A (p=.001), riboflavin (p=.001) and niacin (p=.001) densities in stage II than stage I. Similarly, higher vitamin A (p=.02) and riboflavin (p=.05) group mean

intakes were reported at stage II than stage I, for the treatment group. The MOW would appear to be positively affecting nutrient intake. The lower calcium (p=.001) and thiamin (p=.001) densities may be because of the MOW nutrient composition. Control group figures indicated lower vitamin A (p=.001) and vitamin C (p=.05) but higher niacin (p=.05) densities in stage II. The comparison of treatment and control group densities in stage II indicated significantly higher niacin (p=.001) densities for the treatment group. MOW would appear to be increasing niacin density for the treatment group.

Mean nutrient densities were higher at stage II than III for the treatment group iron (p=.01), vitamin A (p=.001), thiamin (p=.02), riboflavin (p=.001) and niacin (p=.01) densities. The same pattern for nutrient intake was previously observed. The initial positive response to MOW was not maintained and may be due to MOW nutrient composition, and non-MOW food nutrient composition being high. In the control group, vitamin C (p=.001) and thiamin (p=.001) densities decreased from stage II to III. A similar pattern was observed for control group mean nutrient intakes.

The mean protein (p=.05) and niacin (p=.001) densities, for the treatment group were higher at stage III than I. Once again, MOW may be affecting the outcome. However, mean calcium (p=.001), vitamin C (p=.001) and thiamin (p=.001) densities were lower at stage III. A similar downward pattern was observed for group mean nutrient intakes. A comparison of stage I and III nutrient intakes, using the paired difference analysis, indicated less calcium (p=.004) and thiamin (p=.01) were consumed at stage III by the treatment group.

In the control group, mean calcium (p=.02), vitamin C (p=.001) and thiamin (p=.01) densities were lower at stage III than stage I. The pattern is supported by the downward trend observed in control group mean nutrient intakes.

Mean nutrient densities, as an indication of diet quality, are not commonly reported in the literature and comparisons can not be made. The patterns of mean nutrient densities, over time, were similar to those of group mean nutrient intakes. The hypothesis "the MOW meal will increase the nutrient density of diets eaten by MOW recipients", was accepted for vitamin A, riboflavin and niacin at stage II and for niacin at stage III. The hypothesis was rejected for other nutrient densities at stages II and III.

6.3.2 Nutrient Densities for MOW- and Home-Supplied Foods

The mean nutrient densities for MOW- and home-supplied foods were examined in the treatment group to determine if there was a difference in dietary quality (Table 9). The nutrient densities of MOW-supplied foods were higher than those of home-supplied foods for protein (p=.001), iron (p=.001), vitamin A (p=.001), vitamin C (p=.01), riboflavin (p=.001) and niacin (p=.001), at stage II (Table 9). The higher mean vitamin A (p=.001), riboflavin (p=.05) and niacin (p=.001) densities for the treatment group than for the control group (Table 8) in stage II, are a reflection of the higher nutrient density of MOW-supplied foods. Calcium density of MOW-supplied foods was less (p=.001) than home-supplied foods and is reflected in the lower mean calcium density (p=.001) of the treatment group than the control group (Table 8) in stage II.

In stage III, the mean protein (p=.001), iron (p=.001), vitamin A (p=.001) and niacin (p=.001) densities of MOW-supplied foods continued to be higher than those of home-supplied foods (Table 9). This is reflected in the higher mean niacin (p=.01) density for the treatment group (Table 8) than for the control group in Stage III. Calcium density of MOW supplied foods continued to be less (p=.001) than home-supplied foods, as well as thiamin (p=.01) density (Table 9). Lower mean calcium (p=.001) and thiamin (p=.01) densities were observed for the treatment group (Table 8) than for the control group in stage III.

The quality of the treatment group diet is seen to be better at stage II than at III, which implies there is variability in the nutrient densities of MOW- and home-supplied meals.

TABLE 9

Mean nutrient densities for MOW- and home-supplied foods - Treatment group.

Nutrient	Stage II		Stage III	
	MOW	Home	MOW	Home
Protein, g	54.09±5.186[1]	29.92±8.31	52.89±7.97[1]	30.93±8.11
Iron, mg	10.01±3.42[1]	7.93±2.30	8.71±2.24[1]	7.56±1.68
Vitamin A, RE	6811.34±7618.03[1]	1248.12±2605.38	2761.74±4189.58[1]	435.23±178.68
Calcium, mg	242.38±125.64[1]	501.27±153.64	243.67±59.70[1]	509.85±219.68
Vitamin C, mg	65.49±49.13[2]	46.75±46.18	47.35±21.74	43.00±40.72
Thiamin, mg	0.69±0.23	0.65±0.22	0.60±0.12[2]	0.67±0.25
Riboflavin, mg	2.29±1.94[1]	1.22±0.88	1.14±0.99	1.13±0.48
Niacin, NE	27.08±7.87[1]	13.74±6.02	23.88±6.01[1]	12.75±3.21

[1] $p<.001$
[2] $p<.01$

6.3.3 Dietary Supplement Usage

Vitamin and mineral supplements were used by one control group woman and four treatment group women. The one control group woman used a 500 mg vitamin C supplement, a cod liver oil capsule and a mixed vitamin supplement on one day in stage 1. Two treatment group women indicated the usage of a mixed vitamin and mineral supplement on every day of the food records. The third treatment group woman took a 500 mg vitamin C supplement every second day and the fourth treatment group woman took 1 tablespoon of a vitamin and mineral tonic twice a day. The nutrient contribution of dietary supplements was not added to the subject's calculated nutrient intakes because the minority of the sample were dietary supplement users, and they had adequate nutrient intakes for those supplied by the dietary supplements.

The treatment group dietary supplement users were frequent users and represented 20%(4) of the total sample. This is less than reported by Reid and Miles (1977), where 24% of the sample took dietary supplements, and Guthrie et al. (1972), where 40% of the sample took dietary supplements. The present study dietary supplement users had adequate nutrient intakes for the nutrients supplied by the dietary supplements. In the Reid and Miles (1977) study, dietary supplements were not needed by 25% of the users, as opposed to 7% in the Guthrie et al. (1972) study.

6.3.4 Comparison Between MOW-Consumed and MOW-Served Nutrient Intakes

The mean difference and range were determine the thed between subject reported MOW-served nutrient intakes and actual supplied nutrient

intakes to determine quantity of MOW eaten and the accuracy of recording. Actual supplied nutrient intakes were calculated from hospital menus and the standard portion sizes of food supplied. The values are listed per nutrient per stage in Table 10. Positive values are indicative of a larger reported than supplied nutrient intake and negative values the reverse. The significance of differences was not determined. Mean positive values were found for all of the nutrients except energy and vitamin C in stage II and energy and thiamin in stage III. The range of values is very broad but the trend is indicated by the positive or negative mean difference.

TABLE 10

Mean difference between MOW-consumed and MOW-served nutrient intakes, n=10.

Nutrient	Stage II		Stage III	
	Mean	Range	Mean	Range
Energy, Kcal	-40.0[1]	-291.5 to 258.0	-108.0	-243.6 to 112.4
Protein, g	5.0	-4.0 to 21.3	2.4	-7.4 to 10.4
Iron, mg	0.8	-1.2 to 2.3	0.3	-1.5 to 1.8
Vitamin A, RE	1010.0	-424.8 to 4659.1	321.0	-552.1 to 1802.0
Calcium, mg	24.0	-105.8 to 337.8	17.0	-95.2 to 121.0
Vitamin C, mg	-12.3	-218.1 to 49.4	5.4	-18.6 to 23.7
Thiamin, mg	0.05	-0.1 to 0.24	-0.91	-0.13 to 0.08
Riboblavin, mg	0.3	-0.1 to 1.01	0.05	-0.25 to 0.31
Niacin, NE	3.9	-0.2 to 12.8	3.2	-2.8 to 6.8

[1] Positive differences are indicative of a larger consumed than served nutrient intake and negative values the reverse.

The mean difference may be positive due to: errors in recording the amount of food and beverage consumed; home supplied food may be recorded as MOW-consumedsupplied; leftover food from MOW-servedthe day before may be recorded and thus inflate the contribution from MOW; and lastly, variation in the amount of food supplied by the various hospitals.

The mean difference between MOW-consumed and MOW-served nutrient intakes may be negative due to: recipients not eating all of the meal sent; errors in recording the amount of food and beverage consumed; omissions in recording food consumed from MOW; and lastly, variation in the amount of food supplied by the various hospitals.

The general trend to positive mean differences seems to indicate the treatment group totally consumed the MOW meal and apparently over-recorded the amount of MOW supplied foods. The lack of significant increases in nutrient intake following the introduction of MOW, could not therefore, be due to under-recording the amounts of MOW supplied foods.

The mean, standard deviation and range of nutrient contents of meals served by MOW were calculated at stages II and III (Table 11) to determine whehter the individuals in the treatment group received comparable amounts of nutrients. The nutrient contribution of MOW meals served to each individual were used in the calculations. The standard deviation of nutrient contribution by MOW meals (Table 11) was compared to the standard deviation of nutrient consumption by the treatment group in the study (Table 6) at stages II and III. In Table 11, it is seen that the standard deviation of vitamin A in meals served (3464.0) at stage II and

III (2654.5) is higher than the standard deviation of vitamin A consumed in stages II (3394.5) and III (2575.6 in Table 6, which suggests that the contribution of the MOW meal may influence the observed vitamin A intake of the treatment group.

TABLE 11

MOW-served meals, n=10

Nutrient	Stage II			Stage III		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Energy, Kcal	642.4±201.0[1]	347.6	974.0	612.6±122.5	423.6	860.3
Protein, g	34.2±9.8	21.8	50.9	32.0±5.5	21.1	41.6
Iron,mg	6.0±1.4	4.3	8.5	5.4±1.8	3.4	8.7
Vitamin A,RE	3352.5±3464.0	74.9	7639.8	1750.0±2654.5	111.1	6840.0
Calcium, mg	160.3±120.2	33.7	411.5	148.2±40.1	65.0	206.5
Vitamin C	39.9±29.2	10.9	93.1	28.5±13.4	4.6	50.4
Thiamin, mg	0.5±0.2	0.2	0.8	0.4±0.1	0.2	0.5
Riboflavin,mg	1.2±0.8	0.3	2.3	0.7±0.6	0.3	1.9
Protein, g	16.5±4.8	11.5	25.3	14.5±4.1	7.0	20.4

[1]Standard Deviation

6.3.5 MOW Contribution to Daily Intake

Hospital menu analysis indicated variation only in calcium contribution for food record days (Table 5) in a three week menu cycle. The mean percent contribution of subject reported MOW to daily nutrient intake for stages II and III, is listed in Table 12. The level of significance for comparisons, was not determined. The contribution at both stages was similar with all nutrients, except calcium, representing at least a stage II-III mean of 42.9% of daily intake. This is to be expected because soup, a roll, hot entree and dessert are supplied at noon. The daily calcium contribution of MOW was a mean of 26.6% at stage II and a mean of 31.3% at stage III. The low calcium density of MOW meals was shown in Table 9. The range of nutrient contribution of MOW to daily nutrient intake is reflective of degree of consumption of the meal and/or extent of meal substitution with MOW. Protein, energy, iron, calcium, thiamin and niacin had the smallest ranges in nutrient contribution of MOW to daily intake. The small range and high mean contribution for all of the listed nutrients except calcium, would indicate a high degree of consumption and meal substitution with MOW as a source of nutrients. Support is lent by the general trend of positive mean differences between MOW-served and MOW-consumed nutrient intakes (Table 10).

The extent of MOW consumption at lunch is indicated in Table 13. Similar values are found in stages II and III for the mean percent contribution of MOW to lunch intake. Significance of differences was not determined. The mean contribution of MOW at lunchtime was 73.7% for all the nutrients investigated. This high value is expected because the meal is delivered at noon. The range of contribution is skewed to the

TABLE 12

Percent nutrient contribution of Meals on Wheels to daily intake.

Nutrient	Stage	Mean	Minimum	Maximum
Energy, Kcal	II	43.3	19.8	59.8
	III	46.5	34.3	59.9
Protein, g	II	57.9	35.0	69.8
	III	59.9	47.2	76.1
Iron, mg	II	48.4	26.1	71.6
	III	50.0	33.5	65.2
Vitamin A, RE	II	59.7	1.2	98.4
	III	63.5	12.8	97.6
Calcium, mg	II	26.6	10.4	45.3
	III	31.3	13.6	50.2
Vitamin C, mg	II	56.3	12.6	95.2
	III	54.5	10.0	97.8
Thiamin, mg	II	45.2	20.8	64.5
	III	44.9	24.1	54.9
Riboflavin, mg	II	53.5	9.1	76.5
	III	42.9	20.8	78.6
Niacin, NE	II	59.6	30.2	79.0
	III	61.4	45.3	76.1

right, towards the maximum value, indicative of high MOW consumption and source of nutrients. The nutrient density of MOW meals would thus be reflected by the quantity of nutrients consumed. A generally higher stage II nutrient density of MOW meals was observed (Table 9) and the nutrient intake pattern indicated a higher nutrient consumption in stage II.

The mean percent contribution of MOW to dinner intake is listed in Table 13. Of the 10 people receiving MOW, two never saved any of their meal for dinner and two did so occasionally. The contribution of MOW to dinner is bimodal with one mode at the maximum contribution and the second at the minimum contribution. The mean contribution per nutrient

TABLE 13

Mean percent nutrient contribution of Meals on Wheels to lunch and dinner.

Nutrient	Stage	Lunch			Dinner		
		Mean	Minimum	Maximum	Mean	Minimum	Maximum
Energy, Kcal	II	79.9	18.8	100	37.8	0	94.2
	III	93.3	83.3	100	34.4	0	93.5
Protein, g	II	86.8	15.4	100	45.3	0	98.0
	III	96.1	84.7	100	41.0	0	98.3
Iron, mg	II	83.3	10.0	100	43.1	0	96.3
	III	94.9	88.0	100	36.3	0	95.1
Vitamin A, RE	II	81.2	13.9	100	43.1	0	99.9
	III	96.1	81.5	100	35.0	0	97.3
Calcium, mg	II	73.7	35.4	100	28.9	0	93.6
	III	80.5	52.1	100	28.9	0	92.0
Vitamin C, mg	II	89.1	8.0	100	34.0	0	99.3
	III	90.9	32.5	100	26.8	0	99.6
Thiamin, mg	II	83.6	8.3	100	40.5	0	97.6
	III	94.4	75.1	100	35.6	0	97.1
Riboflavin, mg	II	79.1	29.9	100	45.6	0	96.7
	III	85.3	64.8	100	30.4	0	93.7
Niacin, NE	II	88.8	12.8	100	46.8	0	99.1
	III	97.5	90.6	100	40.6	0	99.9

is low, from 26.8% for vitamin C to 46.8% for niacin, because of the two modal extremes. The value of the maximum mode - in the 90% range, indicates extensive saving of the noon MOW meal for dinner. The MOW agency is aware that many meal recipients save their meal for dinner. However, the nutrient intake of MOW recipients may be compromised, because the MOW meal is not designed to meet the nutrient needs of the recipients for two meals.

6.3.6 Daily Nutrient Distribution - Treatment Group

The nutrient intake consumed at lunch in stages II and III by the treatment group is found in Table 14. MOW- and home-supplied nutrient sources were combined for a group mean percent nutrient intake. Stages II and III mean percent nutrient contributions are similar except for vitamins A and C. Levels of significance were not determined. The nutrient content of home- and MOW-supplied meals and the extent of MOW meal consumption would affect the nutrient contributions. About one-third of all nutrients, except for stage II vitamin A and calcium, were consumed at lunch. This is in contrast to the less than one-third nutrient consumption at lunch, by the control group (Table 15). As previously pointed out, MOW contributed at least a mean of 73.7% of the nutrients at lunch (Table 13). It would thus appear that the nutrient contribution of MOW to lunch is increasing the mean nutrient consumption at lunch.

In comparison to the Moore (1966) study, a lower mean percent nutrient contribution is found at lunch. The noon meal in the Moore (1966) study was reported to contribute a mean percent of 51% energy, 59% protein, 68% iron, 72% vitamin A, 35% calcium, 90% vitamin C, 58% thiamin, 46% riboflavin and 76% niacin to daily nutrient intake. The Moore (1966) sample was, however, homebound which may indicate a greater reliance upon home-delivered meals. A comparison of health status of the present sample with the Moore (1966) sample is not possible. The MOW supplied in the Moore (1966) study were reported to be higher in all nutrients, except niacin than the present study MOW. This may account for the higher nutrient contribution of MOW at lunch (Moore, 1966).

TABLE 14

Percent nutrient intake consumed at lunch and dinner[1] - Treatment group.

Nutrient	Stage	Lunch			Dinner		
		Mean	Minimum	Maximum	Mean	Minimum	Maximum
Energy, Kcal	II	37.7	22.6	51.2	33.0	23.0	46.9
	III	38.8	24.4	51.6	29.3	23.8	39.7
Protein, g	II	42.8	16.3	69.5	34.3	16.3	50.9
	III	47.1	15.5	61.8	32.1	15.5	61.8
Iron, mg	II	34.9	16.2	50.7	35.1	16.8	55.0
	III	42.2	20.3	59.8	25.3	18.7	35.8
Vitamin A, RE	II	28.2	1.2	95.5	58.4	2.6	96.7
	III	54.3	14.9	98.5	24.7	1.0	49.4
Calcium, mg	II	25.5	9.2	46.6	31.8	13.9	58.7
	III	32.7	6.0	59.0	31.9	17.1	57.3
Vitamin C, mg	II	34.5	2.6	73.0	46.7	2.1	89.0
	III	47.0	2.5	89.5	28.0	9.1	95.8
Thiamin, mg	II	39.0	19.1	67.8	26.8	18.0	43.1
	III	38.8	20.6	56.8	28.1	18.6	44.9
Riboflavin, mg	II	32.0	5.7	55.4	44.8	7.4	76.9
	III	41.2	13.8	84.0	23.9	10.8	46.2
Niacin, NE	II	40.5	12.3	70.9	39.4	13.8	59.6
	III	48.7	13.5	68.1	29.0	15.7	61.2

[1] MOW- and home-supplied nutrient sources.

The treatment group mean percent nutrient intake at dinner is found in Table 14. Stage II and III mean percent nutrient contributions are similar except for vitamin A, vitamin C and riboflavin. Slightly less than one-third of all nutrients, except for riboflavin, were consumed at dinner. As previously discussed, the percent contribution of MOW to dinner intake was bimodal with modes at the minimum and maximum contributions. Therefore, some subjects were supplying their own dinner and others were substituting their meal with MOW saved from lunch. This may have decreased the mean percent nutrient contributions at dinner to

slightly less than for the control group (Table 15). Statistical significance was not determined. It is also possible that because of the higher nutrient contribution at lunch, less food was consumed at dinner.

6.3.7 Daily Nutrient Distribution - Control Group

The control group mean percent nutrient intake consumed at lunch, in stages II and III, is found in Table 15. Stage II and III mean percent nutrient contributions are similar though significance was not determined. Less than one-third of the daily nutrient intakes were consumed at lunch. The mean lunch contribution of vitamin C intake was the lowest of all of the nutrients, with 14.0% at stage II and 12.8% at stage III. The range for vitamin C is, however, very large from 0.4% to 65.5%, in stage II and less large at stage III with contributions ranging from 1.5% to 24.7%. Choice of foods, with varying nutrient contents, may have affected the nutrient contribution.

The control group mean percent nutrient intake at dinner, in stages II and III, is found in Table 15. Stage II and III mean percent nutrient contributions are similar (significance not determined), except for vitamin C. In stage II, the mean vitamin C contribution was 23.2% with a range from 8.5% to 45.2%, while in stage III, the mean was 42.0% with a range from 6.3% to 80.8%. The choice of foods, containing varying amounts of vitamin C, could have resulted in the differences noted.

TABLE 15

Percent nutrient intake consumed at lunch and dinner - Control group.

Nutrient	Stage	Lunch			Dinner		
		Mean	Minimum	Maximum	Mean	Minimum	Maximum
Energy, Kcal	II	27.2	22.1	36.8	33.3	15.3	54.3
	III	25.9	16.7	35.3	38.6	23.9	53.9
Protein, g	II	27.2	18.9	41.5	41.9	21.7	56.9
	III	29.4	12.1	47.7	44.4	30.2	69.2
Iron, mg	II	22.7	15.9	31.2	32.0	14.8	53.7
	III	22.2	7.3	35.7	35.3	18.4	63.4
Vitamin A, RE	II	28.5	10.8	40.6	43.5	22.5	71.4
	III	28.1	4.0	74.1	48.8	11.7	94.8
Calcium, mg	II	28.1	15.5	39.8	20.9	12.4	39.2
	III	29.3	16.1	45.9	25.3	15.5	50.3
Vitamin C, mg	II	14.0	0.4	65.5	23.2	8.5	45.2
	III	12.8	1.5	24.7	42.0	6.3	80.8
Thiamin, mg	II	18.7	10.7	39.6	24.2	16.2	33.5
	III	18.3	9.7	34.5	34.8	15.9	61.1
Riboflavin, mg	II	19.6	10.4	36.1	28.1	9.3	54.4
	III	21.6	9.8	37.4	34.3	12.1	68.7
Niacin, NE	II	26.1	17.2	41.2	39.8	22.4	53.2
	III	26.5	7.5	47.2	42.7	23.5	76.0

A larger mean percent of nutrients were consumed at dinner than at lunch. About one-third of all nutrients, except for calcium at stages II and III, vitamin C, thiamin and riboflavin at stage II, were consumed at dinner. From these data, it would appear that breakfast and snacks contributed more than one-third of all nutrients, for the control group elderly.

The percentage of total daily nutrient intakes consumed in meals and snacks, was reported by Reid and Miles (1977). The 50 seniors consumed less than one-third of their daily nutrients at each of breakfast and lunch, more than one-third at dinner and about 10% at snacks. In the

present study, control group breakfast and snacks contributed more than one-third of daily nutrient intake (Table 15), as in the Reid and Miles (1977) study. The lunch and dinner contributions to daily nutrient intakes, of the present study control group, and Reid and Miles (1977) were also similar. Reid and Miles (1977) reported nutrient contributions at lunch and dinner, respectively, to be: 28% and 36% energy; 29% and 41% protein; 28% and 40% iron; 35% and 44% vitamin A; 26% and 26% calcium; 22% and 42% vitamin C; 26% and 33% thiamin; 25% and 31% riboflavin; and 26% and 43% niacin. In the present study, control group mean iron, vitamin A at lunch, calcium at dinner, vitamin C, thiamin, and riboflavin at lunch, percent contributions were less than those reported by Reid and Miles (1977).

6.4 COMPARISON OF NUTRIENT INTAKES WITH THE RECOMMENDED NUTRIENT INTAKES FOR CANADIANS

In Table 16, individual nutrient intakes per stage are compared to the Recommended Nutrient Intakes for Canadians (Canada, 1982b). Nutrient intakes per stage were determined by averaging the individual two-day food record at each stage. The recommended level for energy and protein was based on actual weight and activity to reflect present status. Thiamin, riboflavin and niacin recommended intakes were adjusted for energy intake.

In the treatment group, the number of subjects consuming 100% or more of the RNI, increased from stage I to II and III for protein and vitamin A. This may be due to MOW, better recording of food eaten, or an experimental effect. The number of subjects consuming 100% or more of the

TABLE 16

Nutrient consumption as a percent of the Recommended Nutrient Intakes for Canadian's per stage.

Nutrient	Group	Stage I[2]				Stage II[2]				Stage III[2]			
		≥100%	99-67%	66-34%	≤33%	≥100%	99-67%	66-34%	≤33%	≥100%	99-67%	66-34%	≤33%
Energy Kcal/d	Control[3]	6[4]	4			5[4]	3	2		6[4]	4		
	Treatment[3]	9	1			8	2			5	5		
Protein, g/d	Control	10				9	1			9	1		
	Treatment	9	1			10				10			
Iron, mg/d	Control	10				10				9	1		
	Treatment	10				10				10			
Vitamin A, RE/d	Control	8	2			5	2	3		6	4		
	Treatment	4	5	1		7	2	1		6	2	2	
Calcium, mg/d	Control	7	2	1		5	2	3		5	3	2	
	Treatment	2	5	3		1	5	4		1	1	8	
Vitamin C, mg/d	Control	7	2		1	8	1		1	6		2	2
	Treatment	8		1	1	7	1	2		6	4		
Thiamin, mg/d	Control	10				10				10			
	Treatment	10				9	1			10			
Riboflavin, mg/d	Control	10				10				10			
	Treatment	10				10				10			
Niacin, NE/d	Control	10				10				10			
	Treatment	10				10				10			

[1]Canada, 1982b.
[2]Two-day average; [3]n=10; [4]Number of individuals.

RNI, remained the same through all of the stages for iron, riboflavin and niacin. The number of subjects consuming 100% or more of the RNI decreased from stage I to II and III for energy, calcium and vitamin C. There was a decrease in the number of subjects consuming 100% or more of the RNI for thiamin in stages I to II which increased in stage III. As well, there was a decrease in the number of subjects consuming 100% or more of the RNI, between stages II and III for energy, vitamin A and vitamin C. Despite the decrease between stages II and III in the number of subjects consuming 100% or more of the RNI for vitamin A, the number remained higher than in stage I. The decrease in the number of subjects consuming 100% or more of the RNI for energy at stage III is almost one-half of the number at stage I. This may be due to using the MOW meal for two meals rather than one. Table 13 indicates there was a MOW contribution to dinner in the 90% range, by one mode of the distribution. There is a large drop-out rate of 49.8%, from MOW after two weeks of the program and this may be an early indication of disillusionment (Anon, 1982a).

Of concern are the number of subjects consuming 66% or less of the RNI for the listed nutrients. One person consumed 66%-34% of the RNI for vitamin A at stages I and II and two persons did at stage III. Calcium intake was the most "at risk", with the largest number of persons consuming less than 67% of the RNI. The number of persons consuming 66% or less of the RNI for calcium rose from 3 in stage I to 4 in stage II to 8 in stage III. As previously seen, MOW contain a mean of less than one-quarter of the daily recommendation for calcium but contribute a stage II and III average of 29.0% to the mean daily calcium

intake (Table 12). One person consumed 66%-34% and one person at most 33% of the RNI for vitamin C at stage I. At stage II, two persons consumed 66%-34% of the RNI for vitamin C, while at stage III all of the subjects consumed at least 67% of the RNI for vitamin C. Variability in ingestion of vitamin C-containing foods is suggested by these data and supported by the mean and range of vitamin C contribution of MOW to lunch and dinner, at stages II and III (Table 13).

The hypothesis "the MOW meal will decrease the number of MOW recipients consuming less than the RNI for daily nutrient intakes" could not be statistically tested because of the small number of subjects and small changes.

In the Moore (1966) study, the percentage of MOW recipients consuming less than the recommended nutrient intakes decreased for energy, protein, iron, vitamin A and vitamin C after meal delivery. Protein and vitamin A status improved in the present study after meal delivery also. Energy and vitamin C status decreased though, and there was no change in iron status. Both studies indicate an increase in the number of individuals consuming less than the RNI for calcium. This is possibly due to reliance upon MOW for the majority of daily food and little calcium is supplied by the MOW meals.

At least 70% of the RDA was reported to be met by 93% of the sample participating in a Congregate Meals Program, for energy, protein, calcium, iron, vitamin A, vitamin C, thiamin, riboflavin and niacin (Grandjean et al., 1981). In the present study, at least 67% of the RNI was met by 100% of the treatment group for energy, 100% for protein, 60%

Subject Identification Number: _____

Subject Diet Information from Hospital

Hospital supplying meals: St. Boniface _____
Health Sciences Centre _____

Meal Delivery Route Number: _____

Special Diet: YES _____ Type: _____ NO _____

Modifications: _____

_____

_____

_____

Hospital Menus for Subject: (attach photocopies)

Stage Number	Interview Number	Diet*					
		Regular	Modified	Diabetic	Reducing	Low Sodium	Other - Specify
1	1 (NA)						
1	2						
1	3						
2	1 (NA)						
2	2						
2	3						
3	1 (NA)						
3	2						
3	3						

*Expand upon Diet type except for a Regular Diet.

Appendix C

ANTHROPOMETRIC MEASUREMENTS OF THE SAMPLE, N=20.

Subject Number	Group[1]	Sex	Height (cm)	Weight (Kg)			Triceps Skinfold Thickness (mm)
				Stage I	Stage II	Stage III	
3	C	F	145	70.9	71.8	71.4	22
16	C	M	183	83.2	82.7	81.8	15
34	C	F	159	67.7	67.7	67.7	16
39	C	F	145	59.4	59.4	59.4	10
40	C	F	149	38.6	38.6	38.6	15
56	C	F	151	49.5	50.0	50.0	5.5
58	C	F	149	55.9	56.4	55.9	23
61	C	F	150	54.5	55.0	54.5	14
65	C	M	183	74.5	74.1	75.0	5
67	C	M	165	54.5	54.5	54.5	7.5
7	T	F	144	32.5	33.0	33.0	7
13	T	F	150	57.0	57.0	56.8	23
18	T	F	168.5	73.5	72.0	72.0	25
19	T	F	150.7	53.0	51.5	52.0	10
24	T	F	156	79.0	80.0	81.8	25
41	T	F	153	51.4	52.3	52.3	11
42	T	F	153	53.2	53.2	52.7	14
43	T	F	148	54.5	56.8	55.9	9
44	T	M	163	68.2	69.1	69.1	10
59	T	F	149	42.7	42.7	42.7	9.5

[1] C = Control
T = Treatment

at stage II and 20% at stage III for calcium, 100% for iron, 90% at stage II and 80% at stage II for vitamin A, 80% at stage II and 100% at stage III for vitamin C, 100% for thiamin, 100% for riboflavin and 100% for niacin. The percentage of MOW recipients consuming at least 67% of the RNI is less than that reported by Granjean et al. (1981) for calcium, vitamin A and vitamin C. The low calcium density, variable vitamin C content and food served (liver) as the vitamin A source, in MOW meals, may have contributed to the differences between the studies.

In the control group, the number of subjects consuming 100% or more of the RNI, did not increase from stage I to II and III for any of the nutrients whereas that of the treatment group did for protein and vitamin A. The number of control group subjects consuming 100% or more of the RNI remained the same through all of the stages for thiamin, riboflavin and niacin while the amount remained constant for iron, riboflavin and niacin, in the treatment group. The number of control group subjects consuming 100% or more of the RNI decreased from stage I to II and III for protein and calcium, but in the treatment group a decrease for energy, calcium and vitamin C was noted. There was a decrease in the number of subjects consuming 100% or more of the RNI for energy and vitamin A in stages I to II which increased in stage III. In the treatment group, a decrease was found for thiamin. As well, there was a decrease in the number of control group subjects consuming 100% or more of the RNI, between stages II and III for iron and vitamin C, while a decrease in energy, vitamin A and vitamin C occurred in the treatment group.

As in the treatment group, there were control group subjects who consumed 66% or less of the RNI for the listed nutrients. This was found for vitamin A, calcium and vitamin C for both treatment and control groups, as well as energy for the control group. Two persons consumed 66%-34% of the RNI for energy at stage II which improved at stage III for all of the subjects consuming at least 67% of the RNI. A similar improvement occurred with vitamin A, where three control group persons consumed 66%-34% of the RNI at stage II, while all of the subjects consumed at least 67% of the RNI at stage III. The number of persons consuming 66%-34% of the RNI for calcium increased from one at stage I to three at stage II and decreased to two at stage III. The number of subjects consuming at most 33% of the RNI for vitamin C increased from one at stages I and II, to two at stage III. As well, there were two subjects at stage III consuming 66%-34% of the RNI for vitamin C.

Calcium and vitamin C intakes of the control group are the most "at risk" with the largest number of subjects consuming less than 67% of the RNI. Calcium intake, however, was the most "at risk" in the treatment group. Vitamin A and energy intakes were poor at stage II but increased at stage III for the control group. Variability in ingestion of energy and vitamin A containing foods is suggested by these data and supported by the mean and range of energy and vitamin A intakes at lunch and dinner, at stage II and III (Table 15).

Other studies of nutrient intakes of the elderly reported that calcium and vitamin C intakes were less than the RDA (Davidson et al., 1962), and less than 67% of the RDA (Le Bovit, 1965; Guthrie et al.,

1972). Vitamin C intakes were found to be less than the CDS by Johnson and Feniak (1965) and less than 67% of the CDS by Reid and Miles (1977). Less than 67% of the RDA was met by calcium intakes in the elderly studied by Yearick et al. (1980) and "less-than-adequate" and "inadequate" intakes were found in the Nutrition Canada (1973) study.

In the present study, control group vitamin A and energy intakes increased at stage III but intakes less than 67% of the RDA have been reported by Guthrie et al. (1972), Yearick et al. (1980); less than the CDS by Johnson and Feniak (1965); less than 67% of the CDS by Reid and Miles (1977); and "less-than adequate" and "inadequate" by the Nutrition Canada (1973) study.

6.4.1 MOW Contribution to the Daily Nutrient Intake as a Percent of the RNI (1982)

In Table 17, the MOW contribution to daily nutrient intake (treatment group mean) is listed as a percent of the RNI for a reference woman 155 cm tall, at least 75 years of age, weighing 64 Kg and sedentary. These characteristics met the majority of the treatment group and were taken to be representative of the treatment group. MOW exceeded 100% of the RNI in vitamin A, riboflavin and niacin contents. At least two-thirds of the RNI was met by protein, iron, vitamin C and thiamin contents of MOW. More than one-third of the RNI for energy was supplied by MOW. The calcium contribution of MOW was low with 25.9% of the RNI supplied in stage II and 22.6% in stage III.

However, the nutrient content of MOW meals was calculated by Henry (1959) to provide at least 75% of the daily RDA for all nutrients except

vitamin C, for a 65 year old reference man. The calculations were based upon MOW menus and not, as in the present study, actual food consumption.

It is apparent that MOW alone supply a substantial amount of the RNI (1982) for all of the listed nutrients, except calcium. The combination of MOW- and home-supplied foods should meet or exceed the RNI (1982) for all nutrients. This is not the case if the nutrient quality of home-supplied foods decreases, or if MOW are used for several meals and thus decrease the contribution of home-supplied foods to daily nutrient intake.

TABLE 17

Comparison of MOW contribution to daily nutrient intake[1] and Recommended Nutrient Intakes for Canadians[2]

Nutrient	Stage	% RNI[3]
Energy, Kcal	II	38.4
	III	44.6
Protein, g	II	87.8
	III	73.9
Iron, mg	II	74.3
	III	90.0
Vitamin A, RE	II	132.5
	III	385.0
Calcium, mg	II	25.9
	III	22.6
Vitamin C, mg	II	64.4
	III	97.8
Thiamin, mg	II	66.7
	III	66.7
Riboflavin, mg	II	143.0
	III	143.0
Niacin, NE	II	139.0
	III	175.0

[1] Treatment group mean
[2] Canada, 1982b
[3] Reference woman 155 cm tall, at least 75 years old, weighing 65 Kg and sedentary.

6.5 RESPONSE TO MOW QUESTIONS

The contribution of MOW to daily nutrient intake, as a percent of the RNI (Table 17) was compared to the subjects' responses to MOW questions. Ninety percent, 9 persons, felt the portion sizes were adequate (Q 20). This may be a reflection of the 41.5% (stage II-III average) of the RNI for energy supplied by MOW daily (Table 17). It is pointed out that portion sizes vary and one may request more or less than the standard. All but thirty percent (3) of the subjects reported always saving part

of their noon-delivered meal for dinner or a snack (Q 21). The bimodal distribution for nutrient contribution of MOW to dinner has been noted.

The extent of the dinner or snack substitution with MOW, is of concern for nutrient intakes "at risk". The MOW meals received by the treatment group were for one meal. Calcium contribution of the meals (stage II and III average), is less than one-quarter of the RNI (Table 17), but MOW supplied a mean of 77.1% (stage II and III average; Table 13), of the calcium intake at lunch and a mean of 28.9% (stage II and III average; Table 13) at dinner. By increasing the calcium contribution of MOW, as a percent of the RNI, persons saving part of the MOW meal for dinner or a snack, might increase their calcium intake. Calcium was the only nutrient in MOW meals provided at a smaller proportion of the RNI than energy. Data for nutrient densities indicate the low calcium density (Table 9) of MOW supplied foods.

6.6 QUESTIONNAIRE RESPONSES

The subject responses to the questionnaire on social activity, health status, income and food preparation were analyzed for mean response, standard deviation and range per question. The subjects were divided into treatment and control groups and significance of differences in responses determined. Mean group responses on social activity, health status and income questions are found in Table 18.

The mean responses to all of the questions except income categorization (Q 14) were similar, with no significant differences, for both the treatment and control groups. A subjective measure of present health (Q

TABLE 18

Mean group responses to the questionnaire

Question	Present Study		Browning, 1984	
	Treatment n=10	Control n=10	Question	n=140
1 Subjective health	2.6[1]±0.84[2]	2.8[1]±1.03[2]	12	4.5[1]
2 Health comparison	2.7±0.82	2.9±0.88	13	3.5
3 Functional health	3.5±1.51	3.9±1.45	14	5.0
4 Television viewing, hr	4.4±1.80	3.3±2.00	15	2.7±1.58[2]
5 Radio listening, hr	1.5±1.98	1.6±1.49	16	2.3±1.76
6 Reading, hr	2.0±1.11	1.6±1.17	17	2.2±1.13
7 Neighbour visiting	4.0±1.56	3.7±1.83	18	not obtained from data
8 Friend visiting	3.7±1.06	4.0±1.15	19	4.0
9 Phone calls, number	3.9±2.28	2.9±3.07	20	3.7±2.5
10 Church activities	2.1±1.85	2.8±1.93	21	1.5
11 Meeting attendance	1.5±1.08	2.3±1.77	22	4.5
12 Satisfaction with free time	3.0±0.94	3.3±0.82	23	4.0
13 Social activity needs/Recreational pattern	3.4±1.35	3.1±1.45	24	4.0
14 Income	8.4±2.22	10.7±1.83	9	13.0
15 Satisfaction with income	4.0±0.67	4.4±0.52	10	4.5
16 Income comparison	2.9±0.32	3.0±0.47	11	2.5

[1] A higher number indicates better health, more social activity and better financial state.
[2] Standard deviation

1) tended to the "fair" category and was indicated to be "about the same" as one year ago (Q 2). The sample was able to meet the third category of "light domestic work" and almost meet the fourth category of "walk 1 city block" for a self-assessment of functional health (Q 3). The control group indicated watching television (Q 4) a mean of 3.3 hours daily and the treatment group a mean of 4.4 hours daily. Both groups listened to the radio (Q 5) for a mean of 1.5 hours daily and read (Q 6) at least 1.6 hours daily. They got together with their neighbours (Q 7) "at least once a week" and met with friends and relatives (Q 8) "about once a week". A mean of 2.9 phonecalls (Q 9) were reported by the control group and a mean of 3.9 by the treatment group per day. Church attendance or participating in church related activities (Q 10) was similar in both groups with the treatment group indicating a mean of "less than once a month" and the control group indicating a mean of "once a month". Meetings were attended (Q 11) a mean of "never" in the treatment group and a mean of "less than once a month" in the control group. The sample tended to be "neither satisfied nor dissatisfied" with their free time (Q 12) and were "not sure" whether their present recreational pattern met their needs for social activity (Q 13). Both of these questions may have been difficult to answer in this sample because most of their time was considered to be "free time" and their health status possibly interfered with the development of a recreational pattern to meet their social needs. The sample indicated their income currently satisfied their needs "adequately" (Q 15) and in comparison to last year, their income satisfied their needs "about the same" (Q 16). For the food preparation question (Q 17) of "Do you usually cook for yourself?", the treatment and control group indicated a

response of 1.5 ± 0.85 and 1.6 ± 0.84, respectively. This would be towards the "at least half of the time" category. Spouses were found to help with the cooking (Q 18). The treatment group indicated a response of 0.9 ± 1.7 and the control group 0.8 ± 1.32. Convenience products were used "once a week" by both groups (Q 19). The mean treatment group category for the question was 2.8 ± 1.14 and the mean control group category was 2.6 ± 1.26 which is "once a week".

The mean total annual income (Q 14) of the control group was found to be higher ($p<.05$) than for the treatment group. A mean total annual income of $10,000 - $11,999 was found for the control group while the treatment group reported a mean total annual income of $7,000 - $7,999.

The treatment group was also significantly older ($p<.05$) than the control group. This was unexpected and would seem to indicate the MOW personnel give priority service to the older and less financially endowed persons. No other significant differences in questionnaire responses were found or anticipated since both the treatment and control groups were drawn from the same population of elders who had requested MOW.

A comparison of mean questionnaire responses between the present study and the Browning (1984) study is found in Table 18. Both studies were conducted in Winnipeg, Manitoba. The Browning sample consisted of 62 men with a mean age of 70.4 years, and 78 women with a mean age of 67.8 years. Self-administered questionnaires were distributed through programs for seniors or mailed to retired organization members. The members of the present sample were predominantly female and older, with

a mean age of 76.6 years for the control group and 82.5 years for the treatment group. Questionnaire administration was by interview in the present study, with each question read by the interviewer and possible responses listed on a card which was shown to the respondent. The respondent was not given time to think about the question and possible responses, which might have occurred in the Browning study. It is possible that the responses in the Browning study were influenced by somebody being present when the questionnaire was filled out by respondents who received the questionnaire by mail. Another area of difference between the present study sample and the Browning sample is health status. MOW recipients must be in need of the service, due to inability to prepare a meal, and lack mobility to obtain food, while the Browning sample were able to participate in senior citizen organizations.

Mean responses and standard deviations per question are listed for the treatment and control groups of the present study in Table 18. Mean responses and standard deviations were available for Q 4, 5, 6, and 9, in the Browning study (1984). Approximate mean responses per question, were calculated for the remaining questions from frequency response data listed by Browning (1984). Question 3 physical activity categories were different between the studies but the degree of difficulty of physical activity was the same. It was not possible to determine a mean response to question 7 for the Browning (1984) study because of the manner in which the data were presented.

It is readily apparent that the MOW sample perceived themselves to be in poorer subjective (Q 1, 2) and functional (Q 3) health than the Browning (1984) retirees. This was to be expected because of the MOW participants' health status. The MOW sample watched more television (Q

4) but spent less daily time listening to the radio (Q 5) and reading (Q 6) than the Browning (1984) sample. The number of phone calls a day (Q 9), and frequency of visiting with friends and relatives (Q 8) are similar for both studies. The MOW sample attended church and participated in church activities (Q 10) more often than the Browning (1984) sample which may be because of their older age and closeness to death. However, the Browning (1984) sample, attended meetings (Q 11) more often than the MOW sample possibly because of greater mobility. They were also more satisfied with how they spent their free time (Q 12) and with their recreational pattern (Q 13), presumably because they were more active. While the total annual income (Q 14) of the Browning (1984) sample was substantially higher than the MOW sample, satisfaction with income (Q 15) was similar in the "adequate" to "very well" categories. The MOW sample felt their current income satisfied their needs (Q 16) at "about the same" level as last year, while the Browning sample tended to respond between the "somewhat worse" and "about the same" categories. The question was different for both samples though. The Browning (1984) sample compared their current income satisfying their needs to their income before retiring while the present sample compared their income with last year's. A different level of comparison would be involved.

The differences in questionnaire responses between the two studies were to be expected, given the sample differences of age, sex distribution and health status. The direction of differences were appropriate for the sample characteristics indicating differences in health status, activity and income, which would support usage of the questionnaire to other segments of the elderly population.

6.7 ANTHROPOMETRIC DATA

Anthropometric measurements of height, weight and triceps skinfold thickness for the sample are listed in Appendix C. Mean heights and weights per group and sex are found in Table 19. Two of the three men in the control group were above the 95 percentile for height and the third was at the median for height (Nutrition Canada, 1980). The one treatment group man was shorter, at the 25 percentile for height. One of the seven control group women was at the 5 percentile for height, one at the 10, four at the 25 and one at the 75 percentile (Nutrition Canada, 1980). One of the nine treatment group women was at the 5 percentile for height, one at the 10 percentile for height, three at the 25 percentile for height, three at the median for height and one above the 95 percentile for height. The treatment group women were taller (mean height of 152.5 ± 6.9 cm) with a larger range in height than the control group women (mean height of 149.7 ± 4.7 cm).

Recommended weight for height for each subject, according to age, sex and activity category was calculated based upon the height and weight data presented in the RNI (1982) for determining average energy requirements.

Two of the three control group men were considered to be at their recommended weight while the third man, at 77% of his recommended weight was termed very underweight. The one treatment group man was found to be at his recommended weight. Two of the seven control group women were at their recommended weight, one at 91% of her recommended weight, one at 88% of her recommended weight, one at 82% of her recommended weight,

TABLE 19

Mean height and weight of the sample.

Group	Sex	Height (cm)	Weight (Kg)		
			Stage I	Stage II	Stage III
Treatment	M[1]	163	68.2	69.1	69.1
Treatment	F[2]	152.5±6.9[3]	55.2±14.1	55.4±14.0	55.5±14.4
Control	M[4]	177.0±6.2	70.7±14.7	70.4±14.5	70.4±14.2
Control	F[5]	149.7±4.7	56.6±10.9	57.0±11.0	56.8±11.0

[1]n = 1; [2]n = 9; [3]Standard deviation; [4]n = 3; [5]n = 7

one very underweight at 63% of her recommended weight and one overweight at 118% of her recommended weight. In the treatment group, only one of the nine women was at her recommended weight, one was close, at 92% of her recommended weight, one at 89%, one at 85%, one at 84%, of their recommended weights and three very underweight at 81%, 69% and 55% of their recommended weights. One woman was considered to be obese at 123% of her recommended weight. Recommended weight of 119% was considered obese (Granddjean et al., 1981), and the reverse of 81% of recommended weight was considered to be very under weight. As can be seen from these data, there are more people who are underweight than overweight in this study sample which may be a survivor effect.

It is also evident that there was a negligible weight change for both groups for the duration of the study. This is not supported by Williams and Smith (1959) who found that volunteers delivering MOW, as well as the MOW recipients, reported a weight gain for the client. The authors

did not present before and after MOW weight data to support the subjective statement. Henry (1959) similarly reported weight gains in MOW recipients but also did not present objective data to support the statement. The reported weight gain may have been because of a larger appetite due to increased social contacts, and easement of worry and stress over food procurement and preparation. In contrast, in support of the present study, Rhodes (1977) did not find a change in weight in study participants receiving meals by mail. There was no social contact, as in MOW programs, but the participants reported improved eating habits and general well-being after starting the program. Participation in a study may have resulted in the self-reported benefits of the program.

In the elderly sample, the tissues were easily compressed which makes interpretation of the triceps skinfold thickness measurements difficult. The data are listed in Appendix C. The triceps skinfold measurements were not used in data analyses because of the measurement difficulties.

6.8 RELATIONSHIPS BETWEEN NUTRIENT INTAKE, DEMOGRAPHIC VARIABLES, SOCIAL ACTIVITY, HEALTH STATUS, INCOME AND FOOD PREPARATION

The correlations between initial nutrient intake for each of the treatment and control groups, and the associated variable of age, and interval or ratio variables of total income, hours watching television, listening to the radio, and re as well as the number of phone calls made and received in a day, were determined using Pearson's Product-Moment coefficients of correlation (r). The level of significance was set at $p<.01$, to avoid conclusions about marginal relationships. As well, the treatment and control groups were separated in case there were different relationships with the variables.

No significant correlations were found between initial nutrient intake and age, total income, television viewing, radio listening, reading, and phone calls, for either the treatment or control groups. The lack of significant relationships may be due to the small sample. Previous researchers have noted age appears to be related to a decreasing nutrient intake among the elderly (Johnson, 1964; Le Bovit, 1965; Guthrie et al., 1972). The small number of subjects in each of the treatment and control groups, and the small range of ages within the groups makes the identification of significant correlations with nutrient intakes, difficult. Similarly, small ranges of income within each of the small treatment and control groups would explain the lack of correlation between income and nutrient intake. Nutrient intakes of the elderly have been found to be positively affected by increased income by Guthrie et al. (1972), Cohen (1974), Harrill (1976), Yearick et al. (1980), and Slesinger et al. (1980).

It is believed that nutrient intake will increase if one is not alone (Pelcovitz, 1972) and satisfied with life (Harrill et al., 1976). An increase in media usage may dispell loneliness and increase life satisfaction. The relationship between increased television viewing and increased nutrient intake (Clancy, 1975) was not found in this study. A larger sample with a larger range in media usage is needed to establish a relationship.

The correlations between initial nutrient intake for each of the treatment and control groups, and the nominal variable sex, were determined using Spearman's coefficient of correlation (r_s). None of the nutrients were significantly correlated with sex because only one male was in the treatment group and three in the control group. A generally

larger nutrient intake for males than females, has been reported by Nutrition Canada (1973), Brown et al., (1977), and Stiedemann et al. (1978).

The correlations between initial nutrient intake and the 14 ordinal variables of the questionnaire, (Q 1, 2, 3, 7, 8, 10, 11, 12, 13, 15, 16, 17, 18, 19), were determined using Kendall's coefficient of correlation ( ). The nutrients, significant associated variable, Kendall's coefficient of correlation, and the significance probabilities are listed in Table 20 for the treatment group. No significant correlations were found for the control group.

TABLE 20

Correlations between initial nutrient intake and significant questionnaire ordinal variables - Treatment group.

	Kendall's tau / significance		
Question	Energy	Iron	Riboflavin
2 Health comparison	0.83 p=.002	0.72 p=.008	0.67 p=.01

In the treatment group, current health comparison with one year ago was highly significantly positively correlated with energy (p=.002) and iron (p=.008) intakes. It was also significantly positively correlated with riboflavin (p=.01) intake. As the assessment of current health improved, energy, iron, and riboflavin intakes increased. Though Guthrie et al. (1972) did not find a relationship between self-rated

health assessment and diet adequacy, Johnson (1964) reported that the diets of the elderly with poor dentition, were monotonous and unappetizing. Reid et al. (1977) found that diet rating improved ($p<.01$) with greater variety in the diet. It is possible that in the present study, improved health led to greater quantity in food consumption, variety in food choices and thus, increased selected nutrient intakes. The treatment group may believe their health was better, because they were receiving MOW.

The absence of a similar relationship for the control group is puzzling. Both groups scored similarly on the current health comparison question (Table 18). However, the control group consumed significantly more riboflavin ($p=.05$) in stage I, than the treatment group. Though mean energy and iron consumptions were not significantly different, the variation was higher in the control group. A larger sample is necessary to determine the relationship between the variable and nutrient intakes.

The lack of significant correlations in the control group and only one in the treatment group may be due to initial nutrient intake being correlated with the questionnaire variables and not stage III nutrient intakes. The questionnaire was administered in stage III.

Chapter VII

SUMMARY AND CONCLUSIONS

A group of 10 potential MOW program participants (control group) and 10 MOW program participants (treatment group) were interviewed to determine the nutritional benefits of home-delivered meals. All study participants were self-referrals, who constitute a small proportion of MOW recipients. The volunteer study participants were interviewed at three stages - prior to meal delivery, shortly after meal delivery and two weeks after meal delivery. Two-day food records per stage, anthropometric data, demographic data, and questionnaire data on health status, social activity, income and food preparation were obtained from all study participants. The questionnaire items, excluding the food preparation questions, had all previously been applied to the elderly.

The mean age of the treatment group was significantly ($p<.05$) older at 82.5 ± 4.9 years, than the mean age of the control group at 76.6 ± 6.2 years. There were 3 men in the control group and only 1 man in the treatment group. The difference was not significant. There was a difference in total annual income between the two groups with significantly ($p<.05$) less total annual income reported by the treatment group. Group mean nutrient intakes of the two groups at stage I indicated the control group consumed significantly more calcium ($p=.01$) and riboflavin ($p=.05$) than the treatment group. However, both the treatment and control groups were drawn from the population of elderly persons wishing

to receive MOW. The criteria for receiving MOW were administered by the MOW agency. The differences which appeared between the treatment and control groups may have occurred by chance. Hospital menu analysis indicated the three hospitals servicing the treatment group had significant differences in the nutrient content of food record menus for a three week cycle, for calcium only.

After nutritional intervention in stage II, group mean nutrient intake data supported the hypothesis "The MOW meal will increase daily vitamin A intake among MOW recipients". Treatment group mean vitamin A intake was significantly ($p<.009$) higher than the control group, in stage II. The hypothesis was rejected for all other nutrients at stages II and III. Paired-difference analysis which eliminates subject-to-subject variability, did not confirm these findings, therefore the hypothesis that the MOW meal will increase daily nutrient intake among MOW recipients" was not accepted for any nutrient at either stage II or III.

Stage I and II comparison of paired-differences indicated the control group consumed significantly ($p=.02$) less calcium in stage II than I. No significant differences were found between stages II and III with either the group mean nutrient intake comparison, or the paired-difference test comparison. This may indicate a maintenance of nutrient levels.

The stage I and III paired-difference test indicated the treatment group consumed significantly less calcium ($p=.004$) and thiamin ($p=.01$) in stage III than I. The low calcium intake may be due to the calcium

density of MOW-supplied and-consumed foods which was approximately one-half of the home-supplied foods. Other reasons for the low calcium and thiamin intake may be because MOW was often used for two meals rather than one and calcium and thiamin containing foods may be substituted with the MOW foods. In the control group, significantly (p=.01) less riboflavin was consumed in stage III than I.

The quality of the diet, shown by mean nutrient intake densities, indicated the control group in stage I had higher iron (p=.05), calcium (p=.001), and riboflavin (p=.001) densities, than the treatment group. At stage II and III, the mean density of calcium continued to be higher (p=.001) for the control group than for the treatment group. The low calcium density of MOW meals has been noted. After MOW, in stage II, the treatment group mean vitamin A (p=.001), riboflavin (p=.05) and niacin (p=.001) densities were higher than for the control group. Only mean niacin density (p=.01) continued to be higher for the treatment group than for the control group, in stage III. The hypothesis "The MOW meal will increase the nutrient density of diets eaten by MOW recipients" was not supported at both stage II and III. A decrease in nutrient densities, over time, as well as a general decrease in group mean nutrient intakes was observed. This may be due to the nutrient composition of foods selected, boredom with the experiment, diminished desire to please the interviewer, and a change in the accuracy of the food record.

In the treatment group, the nutrient densities of MOW-supplied and consumed foods were higher than home-supplied foods for protein (p=.001), iron (p=.001), vitamin A (p=.001) and niacin (p=.001) at

stages II and III, and vitamin C (p=.01), and riboflavin (p=.001) at stage II. MOW recipients may have to be encouraged to continue consuming nutritious home-supplied foods, despite receiving the higher nutrient dense MOW meals.

Individual nutrient intakes were compared to the RNI (1982) to determine whether there was a difference after MOW. The hypothesis "The MOW meal will decrease the number of MOW recipients consuming less than the RNI for daily nutrient intakes" could not be statistically tested because of the small sample size and small changes. However, the number of subjects consuming less than 66% of the RNI for calcium almost tripled from stage I to III. The low calcium dense MOW meals may be a factor. As well, the number of persons consuming at least 100% of the RNI for energy, decreased by 50% from stage I to III. This may be due to the MOW meals being used for dinner and/or a snack, rather than just lunch, for which it was intended.

Anthropometric data indicated more treatment than control group women were 81% or less of their recommended weight. This difference cannot be interpreted because of the small sample size.

Correlations between initial nutrient intake and demographic variables, social activity, health status, income and food preparation, indicated current health comparison with one year ago was positively correlated with energy (p=.002), iron (p=.008) and riboflavin (p=.01) intakes, for the treatment group. As the assessment of health improved, energy, iron and riboflavin intakes increased. A larger sample is needed to elucidate this relationship.

Limitations to the findings of this study include the sample consisting of all self-referrals, which comprises a small portion of new MOW program participants. The most likely individuals to participate in the study were approached by MOW to solicit study participation. The MOW population is comprised of individuals unable to prepare a meal, usually because of poor health and/or infirmities. There may be a bias in the findings because it is likely the healthiest agreed to participate. Extrapolation of results to the MOW Winnipeg population is therefore not possible, due to lack of representativeness in the sample. As well, the treatment and control groups were not truly the same initially, which was attempted to be controlled for in the sampling but not achieved completely. Some co-variate analysis could have been attempted but it was assumed that the influence of the covariates would have been small and the small sample size precluded covariate analyses.

Another limitation of the findings lies in the variability of the nutrient content of MOW-supplied meals. Generalizing about the nutrient content of MOW meals becomes difficult with the presence of greater variability. The nutritional effects of the MOW meals would be difficult to elucidate.

The use of a food record for dietary data collection limited the study to participation by the literate and physically able, who could see and write. As well, work is involved in keeping a record, so individuals must be motivated.

Suggestions for future research include focusing on another sole segment or a cluster sampling of various segments of the MOW population

and repeating the study. Methodological adjustments would have to be made in order to elicit greater participation. Group means from 24-hour recall dietary data are considered to be acceptable if the sample is large. Collaboration with a sociologist, psychologist and/or gerontologist would enable more descriptive data about the sample to be collected.

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Appendix A

MOW AGENCY STATEMENT

Statement Given by Meals-on-Wheels to Potential Subjects (produced by M.O.W.)

Hello, Mr./Mrs. _____. I am _____ from the Meals on Wheels Office. We are unable to start you on the program at this moment because of filled capacity on the route in your area. We have not forgotten you and will commence service as soon as possible. The University of Manitoba is helping us find out how we can serve our clients better. Would you mind if someone from the University came to visit you prior to your going on the program? They will ask you some questions about the food you eat. They will contact you before they come to make sure it is convenient for you. Thank you.

Appendix B

DATA COLLECTION FORMS

Research Explanation to Potential Subjects (by telephone)

Hello, _____. This is _____ from the University of Manitoba. I am helping Meals on Wheels (M.O.W.) find out if they should give different types of foods to you and the other clients. Did M.O.W. mention that I would be phoning? Do you have a few minutes for me to tell you more?

To begin with, I would like to make some short visits to your home to ask you some questions about the food you eat. Then, I hope you would make notes of what you eat between visits. I would also like to ask you some questions about yourself and measure your height, weight and arm skin thickness. O.K.?

If you want to participate, I would like to visit you three times next week, then the following week, and, finally, in about a month. Do you have any questions?

All information will be confidential. If you do not participate, you will still be eligible to receive the meals offered by Meals on Wheels. You may withdraw from the study at any time and your eligibility for service from Meals on Wheels will remain unchanged.

Would you like to participate? Could I come to see you on _____ at _____? O.K., then I will see you on _____ at _____.

Thank you, _____.

Interviewer Checklist

	Interview Number		
	1	2	3
Take to interview			
Schedule and address book	X	X	X
Subject consent form	X		
Food Record form	X	X	
Food models		X	X
Questionnaire			X
Measure, scales and caliper		X	
Ruler	X		
Steps in interview			
Introduction	X	X	X
Explain Purpose	X		
Obtain consent	X		
Explain food record	X		
Give ruler	X		
Check food record		X	X
Administer questionnaire			X
Weigh and measure subject		X	
Confirm next visit	X	X	X
Thank for cooperation	X	X	X

Subject Identification Number: _____

Subject Information

Information obtained from MOW: (by telephone)

Name: _____

Address: _____

_____

Telephone number: _____

Birthdate: _____

Language: _____

Health: _____

Ability to read/write: _____

Classification - Treatment Group: _____
Control Group: _____

Number of meals/week: _____

Date of initial referral/request: _____

Date of first meal - anticipated: _____
actual: _____

Information obtained from potential subject: (by telephone)

Agree to participate in study: YES _____ NO _____

Appointment Date for Initial Interview: _____

Information obtained from subject: (by personal contact)

Obtained written consent: YES _____ NO _____

INTERVIEW SCHEDULE

Stage One: Interview #2 _____
Interview #3 _____

Stage Two: Interview #1 _____
Interview #2 _____
Interview #3 _____

Stage Three: Interview #1 _____
Interview #2 _____
Interview #3 _____

CONSENT FORM

It has been explained to me that the purpose of this study is to help Meals on Wheels find out if they need to provide different foods to their clients.

I understand that I may be interviewed nine times. It is possible that some of the interviews will be omitted. Three interviews will occur immediately. Another three will occur in about one week. The final three will take place within six weeks of the first interview. The interviews will each be 30-45 minutes long.

I understand that I will be asked to do the following:

1) Keep a written list of foods I eat for two days.
2) Answer some questions about myself.
3) Have my height, weight and arm skinfold measured.

There will be no direct benefit of the study to me. All information will be kept strictly confidential. I may withdraw from the study at any time without penalty. I will have normal access to all services from the University of Manitoba and Meals on Wheels whether I participate or not.

I have had the project explained to me and I agree to participate.

_____ _____

(Signature) (Date)

Instructions for Keeping your Food Record

1. Please record everything you eat and drink from _____ at _____ until _____ at _____.

2. Eat as you usually do. Record all foods and beverages as soon as possible after eating. Include everything eaten away from home, between meals, etc.

3. Use a separate line for each food or drink item. Describe each item briefly eg. small baked potato, chicken breast.

4. Record the amounts of food or beverage. Use cups, tablespoons, teaspoons or units to measure most foods. See page 2 for suggested ways of measuring foods.

5. For combination items, list each item separately, for example:
   Beef Stew:

Stewing beef	1/4 pound
Small potato	1
Large carrot	1/4
Thick gravy	1/2 cup

6. Be sure to include all additions or sauces eg. margarine or butter on toast, milk or cream in tea. There is a separate column for additions or sauces. List the addition in this column, then again under "Food Item".

7. Examine sample food record

8. Begin to record foods now. You will be visited on:

   _____ at _____ to check your first record, then on _____ at _____ to check your second record. If you have any questions, please call Ms. Henry at 474-8315 or Miss Koba at 474-9554.

Suggested Ways of Measuring Foods

Food Item (including description)	
Milk (whole, 2% or skim)	- cups, tablespoons (T) glasses (large or small)
Cereals (dry, cooked)	- tablespoons (T) or cups
Bread (white, wholewheat)	- slices, large or small loaf
Potatoes (mashed, boiled, fried)	- tablespoons (T) or number
Meat (cut and type)	- slice, piece or ounce
Fruit (canned, fresh, or frozen; small, medium or large)	- number
Cookies/Biscuits (type)	- number
Puddings	- cups
Jams, sugar, sauces/spreads	- teaspoons (tsp)
Candies, Chocolates	- number or tablespoons (T)
Beverages (type)	- glasses/bottles

FOOD RECORD

Sample

PLEASE LIST ALL THE FOODS YOU EAT AND DRINK FROM now
UNTIL tomorrow at this time

FOOD ITEM (DESCRIBE BRIEFLY)	AMOUNT	ADDITIONS OR SAUCES
Cheese sandwich	1	—
Bread - 60% wholewheat	2 slices	—
Margarine - soft	2 tsp	—
Cheeseslice - cheddar, processed	1 slice	—
Tea	1 cup	milk & sugar
Milk - whole	2 tbsp	—
Sugar	1 tsp	—
Tea	1 cup	milk + sugar
Milk - whole	2 tbsp	—
Sugar	1 tsp	—
Banana	½ large	—
Egg - boiled	1	—
Toast - 60% wholewheat	2 slices	marmalade margarine
Margarine - soft	2 tsp	—
Marmalade	2 tsp	—
Tea	1 cup	milk + sugar
Milk - whole	2 tbsp	—
Sugar	1 tsp	—
Cookies - Social Tea	2	—
Tea	1 cup	milk + sugar
Milk - whole	2 tbsp	—
Sugar	1 tsp	—
Cereal - Special K	1 cup	milk + sugar
Milk - whole	½ cup	—
Sugar - brown	2 tsp	—
Tea	1 cup	milk + sugar
Milk - whole	2 tbsp	—
Sugar	1 tsp	—

FOOD RECORD

PLEASE LIST ALL THE FOODS YOU EAT AND DRINK FROM ____________________
UNTIL ________________________.

FOOD ITEM (DESCRIBE BRIEFLY)	AMOUNT	ADDITIONS OR SAUCES

Subject Identification Number: _____

Additional Food Intake Questions Interview _____ Stage _____

Is this a typical day's intake? Yes ____ No ____

If no, why not? _____

_____

Are you on a special diet? Yes ____ No ____

If yes, what kind? _____

Did you take a vitamin and/or mineral supplement? Yes ____ No ____

If yes, what kind? _____

what quantity? _____

Subject Identification Number: _____

Additional Food Intake Questions Interview _____ Stage _____

Is this a typical day's intake? Yes ____ No ____

If no, why not? _____

_____

Are you on a special diet? Yes ____ No ____

If yes, what kind? _____

Did you take a vitamin and/or mineral supplement? Yes ____ No ____

If yes, what kind? _____

what quantity? _____

Subject Identification Number: _____

Additional Food Intake Questions Interview _____ Stage _____

Is this a typical day's intake? Yes ____ No ____

If no, why not? _____

_____

Are you on a special diet? Yes ____ No ____

If yes, what kind? _____

Did you take a vitamin and/or mineral supplement? Yes ____ No ____

If yes, what kind? _____

what quantity? _____

ADAPTED FROM THE THESIS PROPOSAL OF KIM BROWNING, SEPT. 1982

Individual Data Information

(READ EACH QUESTION ALOUD AND SHOW THE RESPONDANT CARDS WITH POSSIBLE RESPONSES. HAVE THEM CHOOSE ONE ANSWER. RECORD THE ANSWER ON THE APPROPRIATE FORM.)

FIRST OF ALL, I WILL ASK YOU SOME QUESTIONS ABOUT YOUR HEALTH. I WILL READ EACH QUESTION AND SHOW YOU THE POSSIBLE ANSWERS ON CARDS. CHOOSE ONE ANSWER THAT IS THE MOST APPROPRIATE FOR YOU. THERE ARE NO CORRECT OR WRONG ANSWERS.

HEALTH

1. For your age, how would you describe your health at the present time?
   1) Very poor (health troubles or infirmities all the time, prevents most activities or requires confinement to bed). ☐
   2) Poor (very often prevents activities) ☐
   3) Fair (occasionally prevents activities) ☐
   4) Good (rarely prevents activities) ☐
   5) Excellent (never prevents activities) ☐

2. How does your current health condition compare with what it was a year ago?
   1) Much worse ☐
   2) Somewhat worse ☐
   3) About the same ☐
   4) Somewhat better ☐
   5) Much better ☐

3. From the following list, indicate which activity you feel you are physically able to do.

1) Sit or stand ☐

2) Walk slowly ☐

3) Light domestic work ☐

4) Walk 1 city block ☐

5) Walk at least 4 city blocks ☐

6) Heavy work around the house like shovelling snow. ☐

NEXT, SOME QUESTIONS ABOUT HOW YOU SPEND YOUR TIME.

4. How many hours would you say you watch television in a day: _____ hours

5. How many hours would you say you listen to the radio in a day? _____ hours

6. How many hours would you say you read in a day? _____ hours

7. How often do you get together with your neighbours?

1) Never ☐

2) About once a month or less ☐

3) A few times a month ☐

4) At least once a week ☐

5) Once a day ☐

6) Several times a day ☐

15. How well do you think your income and assets currently satisfy your needs? (including that of your spouse if applicable).

1) Totally inadequate ☐
2) Not very well ☐
3) With some difficulty ☐
4) Adequately ☐
5) Very well ☐

16. In comparison to last year, how well do you think your income and assets satisfy your needs?

1) Much worse ☐
2) Somewhat worse ☐
3) About the same ☐
4) Somewhat better ☐
5) Much better ☐

NEXT, I WOULD LIKE TO ASK YOU A FEW QUESTIONS ABOUT FOOD PREPARATION.

17. Do you usually cook for yourself?

1) Yes _____ (Go to Question 19.)
2) At Least half of the time _____
3) No _____

18. Who helps you with your cooking?

1) Husband/wife _____
2) Companion (cohabitant) _____
3) Restaurant _____
4) Other _____

19. How often do you use convenience products such as canned soups, dry soup mixes and frozen dinners?

1) Every Day _____
2) Several Times a Week _____
3) Once a Week _____
4) Occasionally _____
5) Not at all _____

(OMIT FOR THE CONTROL GROUP)

AND NOW TWO QUESTIONS ABOUT THE MEALS YOU RECEIVE

20. Do you think the quantity of food sent from Meals on Wheels is:

1) Too large _____
2) Adequate _____
3) Too small _____

21. Do you save part of the meal from Meals on Wheels for supper or a snack?

1) Always _____
2) Usually _____
3) Sometimes _____
4) Rarely _____
5) Never _____

Subject Identification Number _____

Answers to Questionnaire

Questions		Response		
		Stage 1	Stage 2	Stage 3*
Health	1.			
	2.			
	3.			
Social Activities	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			
	11.			
	12.			
	13.			
Finances	14.			
	15.			
	16.			
Food Preparation	17.			
	18.			
	19.			
Meals Received	20.			
	21.			

*Results to Questionnaire Recorded in Stage 3 Only.

Subject Identification Number: _____

Anthropometric Data

	Date		
Weight (Kg)			
Height (cm)			
Triceps Skinfold Measurement (mm)			
Activity Level (Sedentary/light)			