The Use of Microwave Ovens by Elderly Persons With Disabilities

Tomoko Kondo, William C. Mann, Machiko Tomita, Kenneth J. Ottenbacher

Key Words: activities of daily living • cooking aids • self-help devices

Objective. This study examined the effectiveness of microwave ovens in assisting elderly persons with disabilities with cooking food.

Method. The participants were five elderly persons who had gross motor, fine motor, or vision impairments but no cognitive impairments. Before the study, none of the participants owned or operated a microwave oven. In this single-subject design of four phases (ABAB), training in microwave oven use was provided between the first A (baseline) and first B (intervention) phases. Participants had access to the microwave oven in their homes only during the B phases. Each phase lasted for 3 weeks, for a total of 12 weeks. The frequency of using cooking appliances, the number of food items prepared, and the time spent preparing meals were recorded through daily self-reports.

Results. All participants showed an increase in the frequency of using cooking appliances for at least one of the two B phases, although they showed different patterns. The number of food items prepared increased in the B phases, except for two participants who were ill. With the introduction of the microwave oven, time spent preparing meals decreased for all five participants, and their participation in meal preparation increased. Although not measured as a study variable, results suggest that the quality of diet also improved with microwave oven use.

Conclusion. Occupational therapy practitioners who serve elderly clients might consider recommending microwave ovens for those who do not have cognitive impairments but who are having difficulty with cooking because of vision impairments or physical disabilities.

Cooking is the major step in meal preparation and a challenging activity with which many elderly persons have difficulty. Prohaska, Mermelstein, Miller, and Jack (1993) estimated that 7.3% of Americans more than 64 years of age and 12.5% more than 74 years of age have difficulty with meal preparation.

Arthritis is a major chronic disease that can affect meal preparation. Arthritis affects half of all persons more than 65 years of age (U.S. Senate Special Committee on Aging, 1991). Arthritis of the lower extremities makes it difficult to stand, walk, and bend in the kitchen, and arthritis in the upper extremities makes it difficult to manipulate materials and lift food or kitchen utensils.

Vision impairment also affects a person’s ability to cook. Incidence of vision impairment among elderly persons is high, with two out of three persons with low vision being more than 65 years of age (Warren, 1995). Vision impairment makes it difficult to see controls, de-
termine whether food is properly cooked, or read directions on food packages.

Many elderly persons experience decreased endurance or loss of balance, requiring use of canes or walkers. Parker and Thorslund (1991) described the difficulty of using these mobility aids in the kitchen. In addition, decline in response time and memory not only may lead to difficulty with cooking, but also exposes elderly persons to such risks as burns, fire, gas explosion, and gas poisoning. Often, elderly persons withdraw from cooking in response to these difficulties and safety concerns.

Difficulty with meal preparation affects many aspects of an elderly person's life, especially nutrition (Roe, 1990). Although nutrition programs, such as home-delivered meal services (Nestel & Gilbride, 1990), are available to many elderly persons, they are usually not available on weekends and do not allow having the meal at a time of one's choosing. In addition, the food temperature is often not what is preferred. Dependence in meal preparation can also result in lowered self-concept (Rappoport & Peters, 1988).

Assistive devices can be used to overcome impairment, prevent accidents, and promote independence and comfort (Mann, Hurren, & Tomita, 1993). The Technology-Related Assistance for Individuals With Disabilities Act of 1988 (Public Law 100–407) defined assistive devices as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities” (as cited in American Occupational Therapy Association, 1991, p. 1076). This broad definition permits inclusion of microwave ovens as assistive devices if they improve functional capabilities of persons with disabilities.

Since their first appearance in the marketplace in 1947, microwave ovens have become increasingly popular and are owned by 85% of American families. However, less than 50% of persons more than 56 years of age own a microwave oven probably because they are perceived as costly or difficult to control (Gregoire, Nyland, & Marcos, 1993). Certainly, cost is a factor for those 25% of elderly persons living just above the poverty line (U.S. Senate Special Committee on Aging, 1991). Older persons also may not be convinced that a microwave oven will make meal preparation easier (Mann et al., 1993).

The purpose of this study was to determine whether elderly persons with physical disabilities or vision impairments participate more in meal preparation, prepare a more varied diet, and spend less time cooking when they have access to a microwave oven than when they do not have access. The findings could be useful to occupational therapy practitioners working in home health care with older persons.

Method
Participants
The participants were persons more than 60 years of age with an impairment in fine motor skills, gross motor skills, or vision and with no cognitive impairments. They were selected from the Consumer Assessments Study sample pool of the University at Buffalo Rehabilitation Engineering Research Center on Aging (RERC-Aging). The RERC-Aging maintains a sample pool of more than 500 elderly persons with disabilities. Gross motor, fine motor, and vision impairments were identified with the Sickness Impact Profile (Gilson et al., 1975) and the Health Status Instrument of the Older Americans Resources and Services procedures (Fillenbaum, 1988). Only persons who scored more than 24 points on the Mini-Mental State Examination, indicating no cognitive impairment (Folstein, Folstein, & McHugh, 1975), were selected.

Participant 1, a 92-year-old woman who lived alone in a rented apartment, had arthritis in both upper extremities and was unable to lift heavy objects, and her hands trembled slightly. She also had arthritis in her knees and a difference in the length of her legs caused by fractures of the left femur and patella that occurred 3 years before this study, making it difficult for her to stand up, walk, and bend. She required a cane and a shoe with a thickened sole for walking. Participant 1 had good vision and hearing and was able to do her basic activities of daily living (ADL). Once a week, a neighbor went grocery shopping for her. She received Meals On Wheels for lunch and dinner 5 days a week. She usually prepared tea or coffee after meals and prepared her own breakfast and Saturday and Sunday meals, using an oven, a range, or a toaster oven.

Participant 2, a 67-year-old man, lived alone in a rented two-story row house. He had arthritis in his spine, hips, knees, shoulders, elbows, forearms, wrists, and fingers. His arthritis pain limited his mobility. He had difficulty standing up, walking, bending, extending his arms, and lifting items. He also had heart trouble and asthma and sometimes became short of breath. He had slight weakness on the right side of his body caused by a stroke. He was independent in ADL but needed some help cleaning, doing laundry, and shopping. A home health aide came twice a week to prepare weekly meals and stored them in the refrigerator or the freezer. Participant 2...
usually warmed up food on a range or in an oven. He was able to prepare simple dishes such as hot dogs, scrambled eggs, and coffee or tea. He did not feel safe when cooking because he often forgot to turn off the appliance. He had a microwave oven in the past; however, it no longer worked, and he believed that he could not afford another one.

Participant 3 was an 87-year-old woman with impaired mobility. She had bone graft surgery in her lumbar spine more than 20 years ago. The muscles in her lower extremities were weak, especially in her ankles and feet. She used a standard walker or, alternatively, walked supporting herself with the wall. Her major problems were sharp pain, numbness in her lower extremities due to sciatica, and becoming easily fatigued. She was unable to walk or stand for long periods. She was independent in ADL, including intermittent catheterization. She had a helper come in three times a week to do her laundry, housework, and shopping. Participant 3 usually cooked meals herself, using a range, a toaster oven, or an electric skillet. She enjoyed cooking and ate many kinds of small dishes for her meals. However, when she was experiencing severe pain, she did not cook. She had never owned a microwave oven and believed that she did not need one, but she started to consider a microwave oven during a recent illness.

Participant 4, a 62-year-old woman with vision impairments, lived with her husband in their own house. Her vision impairment was caused by pigmentary retinitis, which started nearly 10 years before the study. She could not distinguish colors and could not read 1/2-in.-sized characters without a magnifying lens. She was able to complete ADL independently. She needed help with shopping, which she usually received from her husband or a friend. Participant 4 prepared meals for herself and her husband. When she cooked, she used the oven, broiler, range, toaster oven, electric cooking pot, and coffee maker. She usually initiated meal preparation 1 hr or 2 hr in advance. She was very careful and always remained in the kitchen when using appliances. Even though she was careful, she sometimes spilled liquids when taking dishes from the oven or serving food into other dishes, occasionally burning herself as a result. She had never owned a microwave oven and never thought it a necessity.

Participant 5, a 70-year-old woman with vision impairment, rented an apartment in a building for elderly persons. Her vision impairment was caused by diabetic retinopathy and glaucoma, leaving her totally blind in her right eye and with no peripheral vision in her left eye. She could not distinguish colors and could not read 1/2-in.-sized characters. She had pain in her left leg due to arthritis, which made it difficult for her to stand and walk for a long time. She also had heart trouble and had bypass surgery 2 years before the study. She was able to perform ADL, make her bed, clean her room, do the laundry, and go shopping. Once a month, her daughter helped her with housekeeping and shopping. Monday through Friday, Participant 5 ate a prepared lunch in the recreation room in her apartment building. She cooked every breakfast, dinner, and all meals on Saturday and Sunday with a toaster oven and range. She had a microwave oven, but it stopped working, and she did not get a new one because she believed that she could not afford it.

Instrument

The Sharp Electric R-3H851 microwave oven was selected for this study because of its easy-to-use controls and one-touch operation and because it does not require the user to estimate time to heat or defrost food. The key pad control buttons are concave and of two different sizes, both of which are useful features for persons with vision impairments or little sensation in their fingertips. For the two study participants with vision impairment, the appliance was modified by adding labels with raised characters to the numeric and other function keys.

Design and Variables

This study used a single-case experimental design (ABAB). Each phase lasted 3 weeks. The first A phase (A1) was the initial baseline in which participants used kitchen appliances they already had. The participants were encouraged to prepare food that they enjoyed and that reflected a healthy diet.

The first B phase (B1) was the initial intervention, when microwave ovens were provided. Between the A1 (baseline) phase and the B1 (intervention) phase, training in the use of the microwave oven was provided to each participant two or three times a week. The training included benefits and risks of using a microwave oven, selection of appropriate containers, avoidance of burn injury and undercooking food, and how to operate the appliance. Depending on the participants’ needs, special microwave oven functions, such as manual operation or multiple-sequence cooking, were taught.

The second A phase (A2) was a return to baseline, when the microwave oven was removed, and the second B phase (B2) was the final intervention. At the conclusion of the 12-week study, the microwave ovens were offered to the participants.

The presence or absence of a microwave oven was the independent variable. Frequency of using cooking appliances, number of food items prepared, and time spent preparing meals were the dependent variables. Meal prep-

1Manufactured by Sharp Electronics Corporation, Sharp Plaza, Mahwah, New Jersey 07430.
Data Collection

Before the A1 (baseline phase), each participant received an explanation of the self-report instrument, which was a daily log on which they were to record the food they prepared, preparation time, and type of kitchen appliances used. The daily log was used during all four phases. Recorded data were collected weekly by the primary investigator. To check for reliability of the daily logs, the investigator randomly phoned each participant, asked questions about meal preparation, and compared the responses to the logs.

Data Analysis

The data were divided by three periods in a week: Monday and Tuesday; Wednesday and Thursday; and Friday, Saturday, and Sunday. The means for dependent variables were calculated in each period and graphed. The means for each phase were compared by visual analysis of the graphed data.

Results

The correlations of the self-reports and the results of random phone calls ranged from .83 to .99 for the three dependent variables. Random phone calls to check the accuracy of the self-reports demonstrated good reliability for all five participants. For frequency of using cooking appliances, correlations ranged from .88 to .98; for number of items prepared, from .83 to .98; and for duration of meal preparation, from .91 to .99 (see Table 1).

Participant 1

During both B phases, the mean frequency of using cooking appliances of Participant 1 increased by 18.5%. The number of food items prepared also increased by a mean of 11.8%, or one item. The mean time spent preparing meals decreased by 37.2%, or 27 min. Variability also decreased during both B phases (see Figure 1).

Participant 1 prepared more food items and cooked more frequently when she possessed the microwave oven, preparing hot foods such as oatmeal, baked potatoes, and baked apples instead of cold foods such as cereal and sandwiches. The time spent preparing meals decreased significantly, especially during the weekends when she cooked entire meals because of no Meals On Wheels deliveries. It typically took her 1 1/2 hr to prepare her meals without the microwave oven and required great effort.

During the B phases, she spent less than half this time in cooking, even though she prepared more food items. She also appreciated not having to lift the kettle from the range and move it across the kitchen.

Participant 2

Participant 2 became ill as a result of renal calculus and ulcer, which began during the training phase and lasted until the end of the study. The B1 phase was postponed for 1 week, with the expectation that his health would recover. The A2 phase was shortened for 1 week because after receiving the microwave oven, he very much wanted to continue using it.

Frequency of using appliances decreased 15.1%, or .85 times, during B1, further decreased during A2, and increased 11.1% during B2. The number of food items prepared showed the same trend as frequency of using cooking appliances. The mean time spent preparing meals decreased rapidly by 80.3%, or 85.5 min, during B1; increased during A2 to approximately 40% of the mean for A1; and decreased 69.5%, or 30 min, during B2 (see Figure 2).

Participant 2 used fewer appliances and prepared fewer food items during B1 and A2 primarily because of poor health. However, when he started to use the microwave oven again, the frequency of using cooking appliances and the number of food items prepared increased, even though he continued to experience poor health. The rapid decrease in time spent preparing meals during B1 was primarily because of his poor health, but this also related to his use of the microwave for cooking. Participant 2's motivation to cook decreased because of difficulty in standing for long periods in front of the range or because of having to bend his body to put dishes in the oven. Consequently, he requested a return to the use of the microwave oven in the middle of A2, stating that the microwave oven helped him in preparing hot and nutritious food easily and decreased his worry about burning food or starting a fire.

Participant 3

The mean frequency for using cooking appliances for Participant 3 decreased during B1 by 9.5%, further decreased during A2, and increased by 15.6% during B2. During both B phases, the number of food items increased by 13.2%, or .67 items, and the mean time spent preparing meals decreased by 52.1%, or 29.5 min (see Figure 3).

Participant 3 showed a decrease in use of cooking appliances during B1, although the number of food items prepared increased. She prepared many small dishes with the range or electric skillet for each dish during A1. The microwave oven allowed her to cook several dishes at
once. As she became more familiar with the microwave oven, she used fewer traditional cooking appliances as evidenced by the decrease in frequency of using cooking appliances and number of items prepared during B2. Participant 3 stated that she did not want to cook with the conventional oven and range because it took too much time and effort; therefore, in A2, she prepared more cold food (i.e., 62.6% of the total items vs. < 50% at both B phases). She described the advantages of the microwave oven, including eliminating the need to wash many pans, moving around less in the kitchen, and being able to cook quickly. She also mentioned that she was enjoying cooking more than before because she was able to cook easily and spend time on the aspects of food preparation that she liked, such as reading cookbooks and trying new methods. The microwave oven not only helped with her daily cooking, but also expanded her pleasure in it as a leisure activity.

**Participant 4**

Participant 4 had many events related to meal preparation, including two parties at her house during B1, a small party during A2, and another large party at the end of A2 and beginning of B2. The mean frequency of using cooking appliances increased 19.3%, or 1.57 times, during B1; decreased during A2; and decreased 2.8% during B2. The mean number of food items increased through all phases. During both B phases, the time spent preparing meals slightly decreased by a mean of 15%, or 13.3 min (see Figure 4).

The results for Participant 4 were affected by her social events. She also explained that she did not like changing the way she did things; however, she stated that her cooking was substantially changed by the microwave oven, especially the shortened time for food preparation. She explained that she was able to spend more time doing the things she wanted to do, such as listening to recorded books and gardening.

**Participant 5**

Participant 5’s health declined during B1 but improved within the same phase. The mean frequency of using cooking appliances decreased 6.8% during B1, increased 10.6% during A2, and further increased during B2. The number of food items also showed the same tendency as the frequency of using cooking appliances. The time spent preparing meals during both B phases decreased an average of 45.3%, or 12 min (see Figure 5).

Participant 5 showed a decrease in use of cooking appliances and number of food items prepared during B1 because of her health condition, and this increased when her health improved during A2. This trend suggests that although Participant 5’s condition was stable, the frequency of using cooking appliances and the number of food items prepared increased with the use of the microwave oven. The content of meals also changed. Before using the microwave oven, she did not cook vegetables because her vision impairments made it difficult to cook them suitably. However, because the microwave oven allowed her to cook her food thoroughly, she started cooking fresh food. She also mentioned that she was able to cook frozen meals easily because she did not have to read the recipe on the package.

**Discussion**

This study demonstrated that five elderly persons with physical disabilities or vision impairments were able to cook more easily and in less time when using a microwave oven than when using conventional methods. Reducing food preparation time provided more time for leisure activities. One participant who considered cooking a leisure activity was able to expand her cooking experiences. All

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Table 1

<table>
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<tr>
<th>Participant</th>
<th>Frequency of Using Cooking Appliances</th>
<th>Number of Food Items Prepared</th>
<th>Duration of Meal Preparation (Min)</th>
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<td>13.19 (13.25)</td>
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<td>15.23 (4.74)</td>
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</table>

Note: A1 = first baseline phase; B1 = first intervention phase; A2 = second baseline phase; B2 = second intervention phase.
Each participant's frequency of using cooking appliances showed different patterns. These patterns were affected by illnesses and special events. Although the results varied somewhat for each participant, it appears that having a microwave oven available led to positive outcomes in independent cooking and quality of diet. Results for Participant 1 followed the expected pattern with increased number of food items prepared, decreased cooking time, and decreased number of appliances used when the microwave oven was present. Participant 5 showed a similar pattern, with some variation at the first intervention phase because of illness. Participant 2 was severely ill during the study, and although he did not follow the expected pattern, it was clear that the microwave oven was essential to his independent preparation of nutritious meals (e.g., he asked for the return of the microwave during the second baseline period). Participant 3 enjoyed the microwave so much that after the first intervention phase, she did not do much cooking during the second baseline phase. Participant 4 had hosted so many parties that required food preparation that visual inspection of her data is misleading. She stated that the microwave oven was important to her and to her reduced cooking time.

For participants who cooked frequently, the microwave oven seemed to facilitate efficiency. The number of appliances used decreased perhaps because the microwave oven heats different kinds of food at the same time. Participants who liked to cook, or consider it a leisure activity, were able to maintain or expand their cooking experience, even in the face of declining physical status.

The number of food items prepared increased with the presence of a microwave oven for all participants, except during illness for some. Results showed an average 13.9% increase per day at the intervention phases. Not only did the number of items increase, but the content of the meals also changed. Participants ate a wider variety of food, including more vegetables and potatoes. This new diet fits well with recommendations for health promotion in older adults (Nestle & Gilbride, 1990). Participants also used the commercial frozen dishes made available for microwave oven use, even though these were not encouraged by the primary investigator. Because frozen dishes store easily, elderly persons do not have to worry in emer-

Figure 1. Results for Participant 1. Note. A1 = first baseline phase; B1 = first intervention phase; A2 = second baseline phase; B2 = second intervention phase.

Figure 2. Results for Participant 2. Note. A1 = first baseline phase; B1 = first intervention phase; A2 = second baseline phase; B2 = second intervention phase.
Frequency of Using Cooking Appliances

Number of Food Items Prepared

Duration of Meal Preparation

Figure 3. Results for Participant 3. Note. A1 = first baseline phase; B1 = first intervention phase; A2 = second baseline phase; B2 = second intervention phase.

egency situations, such as in the event of an illness; in the absence of a caregiver; or in bad weather. Tak, Gregoire, and Morcos (1993) found that elderly persons preferred commercial frozen meals to home-delivered meals and that frozen meals are more cost-effective.

It is generally thought that eating habits are difficult to change. However, the participants changed their meals contents quickly during this study. Every participant stated that he or she had been satisfied with their meals before the study but expressed more satisfaction after starting to use the microwave oven. This finding suggests that the participants were limited in their food choices as a result of their disabilities, and the microwave oven assisted them in regaining the ability to prepare and eat preferred foods.

Participants who had difficulty standing for long periods stated that the decrease in length of time to cook food was important to them. There was an average 38% decrease in cooking time at the intervention phases (range = 10.0%–80.3%). Elimination of many steps in the cooking process, such as removing food from the oven, lifting heated kitchen utensils, and washing and putting away pans, was also a benefit that participants noted with using the microwave oven.

Safety was another advantage in using a microwave oven. Participants reported that they were very careful when cooking with standard ovens and ranges (i.e., turning off the appliance after cooking, avoiding burning themselves, taking care not to spill food). However, they cooked with less anxiety with the microwave oven because it stopped cooking automatically, did not become hot, and decreased some hazardous steps. Powell and Tanz (1993) found that burns by microwave ovens tend to be smaller and less severe compared with burns by conventional ovens and ranges.

Participants also stated that ease of operation was important to them. They did not have to estimate time for cooking each food item. This function was especially helpful for one participant who had vision impairments. With the sensor function, she could cook without failure. In addition, she stated that the sensor function helped her to prepare frozen meals without reading directions. This function may also be helpful for persons with mild to
Cooking with microwave ovens offers many advantages over conventional appliances. It is more cost-effective (Cremer & Pizzimenti, 1992) and results in a higher nutritional value in some foods (Hoffman & Zabik, 1985). However, there is still room for improvement in microwave ovens. For example, the flat surface of the control panel provides less tactile feedback and is difficult to use for persons with limited sensation in their fingertips. Flat panels are also not effective for persons who are blind. One solution is the use of concave buttons of different sizes and colors. Voice feedback also would be helpful for not only elderly persons, but also many other potential consumers.

Training is important for ensuring satisfactory assistive device use (Bynum & Rogers, 1987; Mann et al., 1993). Participants expressed the need for training in the use of the microwave oven before being provided with the oven. This aspect must be considered when a microwave oven is recommended to an elderly client.

Limitations

This study used single-subject methods, and generalizability of findings is limited. All the participants cooked before the study started. The effectiveness of the microwave oven for persons who are unable to cook, or who have never cooked, needs to be examined. Data collection included self-report, which may be less accurate than direct observation. Because participants were required to write down each food item that they prepared, they were more conscious of the food they were cooking and may have increased the number of food items they prepared. Meal preparation was also affected by other aspects of the participants’ life, such as their health, special events, and changes in dining partners. This had an impact on day-to-day results, making it more difficult to find remarkable trends. Despite these limitations, results for each participant suggest positive outcomes for the use of the microwave oven by elderly persons.

Acknowledgment

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Training is important for ensuring satisfactory assistive device use (Bynum & Rogers, 1987; Mann et al., 1993). Participants expressed the need for training in the use of the microwave oven before being provided with the oven. This aspect must be considered when a microwave oven is recommended to an elderly client.

Limitations

This study used single-subject methods, and generalizability of findings is limited. All the participants cooked before the study started. The effectiveness of the microwave oven for persons who are unable to cook, or who have never cooked, needs to be examined. Data collection included self-report, which may be less accurate than direct observation. Because participants were required to write down each food item that they prepared, they were more conscious of the food they were cooking and may have increased the number of food items they prepared. Meal preparation was also affected by other aspects of the participants’ life, such as their health, special events, and changes in dining partners. This had an impact on day-to-day results, making it more difficult to find remarkable trends. Despite these limitations, results for each participant suggest positive outcomes for the use of the microwave oven by elderly persons.

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References


