THE EFFECT OF ALZHEIMER'S DISEASE ON NUTRITION IN RELATION TO TASTE, SMELL, AND MEMORY

by

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(ABSTRACT)

Alzheimer's disease (AD) kills about 120,000 adults each year (1), perhaps ranking as the fourth or fifth leading cause of death in the United States (2). Progressively through its three stages, AD patients demonstrate an inability to identify familiar smells, lose weight, and develop malnutrition. This study was undertaken to compare the ability of AD patients verses non-AD patients concerning food identification and its potential influence on food intake. Another objective of the study was to assess whether an improved AD patient/caregiver relationship could improve the probability that the AD patient will accept more food items as a result of an enhanced relationship with the caregiver.

Ten food items were used in each testing. Each patient was given a list of four food items to pick from when smelling and/or tasting each test sample. A response was required, regardless of whether or not the food item was correctly identified. Three separate tests were conducted for each patient, each a week apart, by three different administrators with a different third of the control and experimental patients until each had

tested all of them.

The data showed that AD patients have lessened food identification skills when compared to non-AD patients. Patient caregivers were able to attain the best results in toto (70.8%); almost double the results from the nurse coordinator (33.3%) and the researcher (33.4%), thus supporting the theory that the closer the patient/caregiver relationship, the greater the probability that the patient will accept more food items.

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INTRODUCTION

Alzheimer's disease (AD) kills about 120,000 adults each year (1) and may rank as the fourth or fifth leading cause of death in the United States (2). AD accounts for 40 to 66 percent of all cases of dementia and affects men and women with equal frequency (1, 3, 4). Dementia (senile and presenile), a state of permanent decline in intellectual, cognitive, and memory functions that interferes with daily social activities (4), occurs in approximately 1 percent of the people under 65 years of age, 2.4 percent of those in the 65 - 69 year age group, and 22 percent of those 80 years and older (5).* Dementia presents itself by the loss of specific neurons in areas of the brain responsible for memory and cognition due to the accumulation of twisted filaments and other abnormal structures (6). Through research, more is being discovered about AD, yet its etiology remains unclear. Though AD is always considered fatal, an accurate diagnosis of the disease state cannot be confirmed without microscopic examination of the brain tissue by means of a biopsy or an autopsy at the time of death (7, 8).

AD has been defined to occur in three stages (9 through 11). Stage one involves the loss of memory, spatial disorientation, and a lack of spontaneous emotional response. In stage two, the patient demonstrates an inability to identify familiar sounds, sights, or smell.

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* No data available for the 70 - 79 year age group.

Wandering and erratic nonpurposeful movements may begin. Food is often played with or ignored. Development of stage three occurs when seizures develop, speech is lost, and the patient is found to be indifferent to his/her environment. Compulsive eating, consumption of inedible objects, or refusal to eat are typical results.

This study focused on the second and third stages of AD. A common clinical observation is that most demented patients, especially those with AD, lose weight and develop malnutrition during the progress of the disease, particularly in the final stages, despite apparently adequate dietary intake of calories, protein, vitamins, and minerals (12, 13). Sandman et al. (14) found that malnutrition was present in 50 percent of the institutionalized, demented patients, with energy-malnutrition being the most prevalent type. Within eight years of the development of the disease, over 50 percent of the institutionalized AD patients lose the ability to feed themselves (15). Consistency in daily routine, constant monitoring, and assistance in eating must become significant parts of the nursing staff's daily routine (16, 17).

Since AD patients lose the ability to feed themselves, the objective of this study was to compare the skill of food identification and its influence on food intake of the AD patients verses non-AD patients. A second objective of this study was to show that an improved AD patient/caregiver relationship can improve the probability that the patient will accept more food items from the caregiver. It was presumed that in an eating situation, an improved relationship between the caregiver and the patient will increase the daily caloric intake of the AD patient, thus reducing the amount of weight loss.

REVIEW OF LITERATURE

As people age they tend to have a lower food intake than when they were younger (18). This is due mainly to a reduction in their basal energy metabolism and reduction of physical activity (14). However, it also may be related to other reasons, such as a reduction in appetite as a result of a reduction in their ability to taste and smell (18). A reduced intake initially may not be detrimental for a slightly overweight to obese person, but could be hazardous to the health of a person who is at ideal body weight or underweight. A continued reduction in intake may lead to malnutrition, thus resulting in gradual to rapid deterioration of the body and its functions.

Many of the brain cells used in the eating process are damaged or lost as AD progresses. The association cortex of the brain (see Figure 1) is needed for the highest level of intellectual functioning, the entorhinal cortex is associated with the sense of smell, and the hippocampus and limbic systems are related to memory (19). These regions of the brain seem to be the most vulnerable during cell loss that occurs in the early stages of AD. Choline acetyltransferase, an enzyme necessary for the production of acetylcholine, is

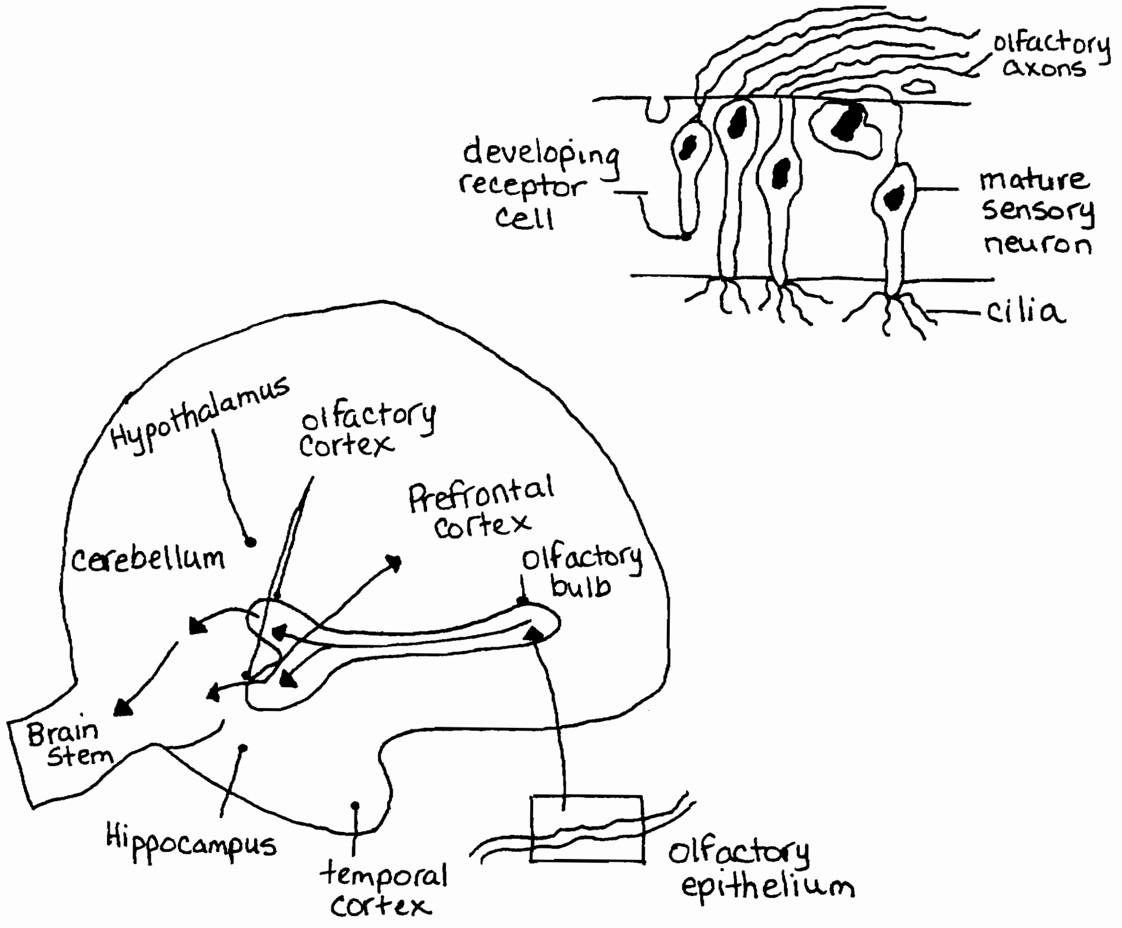

Figure 1. The olfactory part of the brain.
Source: Adapted from Altman, J. *A Nose for Alzheimer's Disease?* 337:688, 1989. (26)

diminished markedly in the stages of AD (20, 21), possibly as much as 90 percent (22). A great concern results from this diminished level since acetylcholine is the vital agent that makes much of the activity in these sections of the brain possible (23). Norepinephrine (known to enhance feeding (3, 4)), serotonin and noradrenalin (involved in the mechanism which controls eating and food choice (4, 24, 25)), and somatostatin (4) levels are all found to be low in AD patients. Levels of Substance P, which is used by the brain to recognize spicy or chili-containing food, are also found to be decreased (25).

Normal olfactory detections (the sense of smell) rely on adequate food detection, identification of each food as an acceptable item, and memory of or recollection of the food item's smell and taste (27, 28). In a study done by Kesslack et al. (28) on rats, partial lesions were made on the olfactory cortex causing a greater effect on novel rather than familiar odors. Though transition of rat research to humans may be of question, this suggests that the loss of some brain cells in the early stages of AD may produce a situation where only familiar odors can be adequately processed (28). A diminished sense of smell presents problems for the AD patients, such as a decreased appetite that may lead to weight loss and poor nutritional status (29).

Eating is a multidimensional event (16). It uses the brain functions of taste, smell, and memory. It assists in meeting the nutritional, psychological, social, and cultural needs of each person (16). With the AD patient, mealtime becomes quite fragmented (16). Apraxia, the inability to carry out purposeful movement; agnosia, the inability to attach meaning to sensation (e.g., the inability to recognize food by smell, sight, or taste); and impaired visuoperceptual abilities impede the AD patient's ability to feed himself/herself (29). A cross-sectional study by Volicer et al. (30) indicated that approximately eight years after the onset of the AD symptoms, 50 percent of the institutionalized patients lose the ability to feed themselves. These changes in eating habits may lead to malnutrition and dehydration, which by themselves could lead to high infection rates and hospital stays (13, 27, 30).

Wandering, restlessness, and repetitive movements increase the chances of malnutrition and weight loss by increasing the caloric needs of the AD patients who are reducing their food consumption (3). A mean energy expenditure that exceeded normal mean caloric intake by 600 kcal was found in those AD patients classified as wanderers. Even in the nonwanderers, energy expenditure was found to exceed caloric intake by 200 kcal (3, 6). One study indicated that the best acceptance of food occurs at breakfast where only 4.6 percent of the AD patients refused food as compared to a 21 percent refusal at dinner (3). Nutrient supplements are often added to diets of AD patients to increase nutrient and caloric consumption, thus reducing the probability of malnutrition and weight loss (4).

Self initiation of eating is a problem that many caregivers observe in AD patients. Their food consumption is decreased due to the reduction in their recognition of food by smell or sight. AD patients may not realize that it is time to eat or recognize and interpret hunger signals properly (15). These patients tend to forget that they are in the process of eating and may leave the table before the meal is completed. The opposite case, forgetting that they have just eaten, also can be found in some cases (15).

Impaired brain functioning also has been related to the AD patient's inability to differentiate between food and nonfood items (15). Inedible objects are often consumed. This is considered a loss of the "acquisition of disgust" or "revulsion at the prospect of oral incorporation of offensive subjects." In many cases, this may be the underlying factor why items such as feces are consumed (25).

A few other changes occur within the diet of the AD patients in the middle to later stages of the disease process. They seem to prefer sweet and/or spicy foods (25). In some cases, this intense desire for sweets has caused caregivers to feel that they must restrict the amount of sweets that are consumed (31). Some patients also exhibit a change in preference for the type of nonalcoholic beverage that they consume (e.g., a change from drinking coffee to drinking tea) (25). Studies suggest that this increased desire for sweets is a direct result of brain serotonin levels, carbohydrate consumption levels (31), and metabolism. Laboratory results indicate this by low fasting blood glucose and high insulin levels (3). Occasionally, the desire for sweets leads to binge eating (32, 33).

Alzheimer's patients also lose the ability to recognize utensils and fail to remember how to use them. In their study on the eating habits in dementia, Morris et al. (25) reported that 60 percent of their patients had altered their eating style after the onset of the disease. Eleven of the 16 subjects "used utensils in an abnormal way or were unable to use them at all; nine used their hands to pick up food; and one tried to eat using a pair of scissors."

A final problem that caregivers may discover, especially in the final stage of AD, is related to dysphagia or swallowing difficulties, which "refer to the 'perceived impaired transit of a bolus during the act of swallowing' " (17, 32). This may be related to the patients' inability to chew or open their mouths (17), drooling, choking, nasal regurgitation, squirreling of food, delayed swallowing, and/or overstuffing of their mouths (34). Due to apraxia, patients may not recognize the object provided by the caregiver as food; therefore, they may keep their mouths closed, thus appearing to refuse the food. In this case, the patient's cues must be known by the caretaker and vice versa (31). A relationship needs to be developed between the patient and caregiver to aid in the reduction of such problems. Additionally, Sandman et al. (14) stated that institutionalized, demented patients who are fed by caregiver personnel have a higher food intake than those who eat by themselves. Norberg and Sandman (16) noted that the caregiver previously must establish a trustful relationship with the patient. Thus, the review of literature seems to indicate that an improved caregiver/patient relationship may increase the patient's food item recognition and intake.

METHODS

Information on sex, age, and diagnosis, including stage for patients with AD, was recorded for each patient participating in this study (see Appendix A). Staff members who were familiar (primary caregivers and nurse coordinator) and not familiar (researcher) to the patients were used in the study. The primary caregivers were nursing home staff members who were not related to the patients. Each patient's name was used by the administrators (the researcher (R), the nurse coordinator (NC) of the unit, and the primary caregiver (PC)) during the testing period. However, the researcher assigned a patient identification number to each participant, which has been used in study tables and analyses, to maintain patient confidentiality. The researcher maintains the only file that links patient names to identification numbers.

Twelve residents (4 male, 8 female) (see Table 1) from the dementia unit of Meridian Healthcare Center at Aspenwood (Meridian), Silver Spring, Maryland, were used as the experimental group. These patients were determined to be in the second stage of AD, with patients EM 14 and EF 19 progressing into the third stage. Both of these patients were unable to communicate the majority of the time. Although still able to speak some words,they mostly moan, grunt, or say no to all questions that are asked. An equal number of nondemented patients (2 male, 10 female) (see Table 1), also from Meridian, were used in the control group. An equal number of males were not available in the control group to match the ages in the experimental group, so two additional females were added to form equivalent groups.

TABLE 1
Experimental and control group age and gender description

Experimental group members	**Age**	**Control group members**	**Age**
EF 13[a]	84	CF 01[b]	83
EF 14	81	CM 04[c]	85
EM 15[d]	93	CM 07	91
EM 16	70	CF 02	72
EF 17	78	CF 12	80
EF 18	74	CF 10	76
EF 19	64	CF 03	71
EF 20	72	CF 05	72
EF 21	88	CF 08	82
EM 22	74	CF 11	79
EF 23	85	CF 06	86
EF 24	78	CF 09	81
Mean	78.4		79.8

[a]EF = Experimental Female Group
[b]CF = Control Female Group
[c]CM = Control Male Group
[d]EM = Experimental Male Group

A study done by D.L. Rezek (35) showed that age may affect the results of this study. AD patients recognize 2.0 $\pm$ 0.5 percent of odors at 60 to 70 years and 1.5 $\pm$ 0.6 percent from 70 to 80 years. Nondemented subjects have recognition of 4.2 $\pm$ 0.3 percent and 4.1 $\pm$ 0.4 percent respectively. An attempt was made to have the span of ages of the test patients match those specified in references 2 and 35 (i.e., between 60 and 80). The mean age of the experimental group was 78.4 years (64 to 93) and 79.8 years (71 to 91) for the control group (see Table 1). Five patients in the experimental group and four in the control group were above 80 years. All available Alzheimer patients at Meridian, with the exception of the severly agitated or paranoid, were used as the experimental group in this study. This caused some of the patients to exceed the high end of the referenced age band. Ages in the control group were matched to the experimental group as closely as possible.

In a study done by Warner et al. (29), certain criteria were used to eliminate poor candidates. These criteria also were used in this study. The exclusion criteria are:

- Any acute medical problems or chronic neurological problems
- Viral infections or allergies in the past 2 weeks
- Any history of head injury with resultant loss of consciousness
- Any use of medication in the past month or the presence of a disease that has been associated with olfactory deficits, with the exception of hypothyroidism.

Hypothyroidism has been associated with smell defects and appears to be reversed by thyroid treatment.

Testing was done in the morning, since the best acceptance of food has been found to occur at this time (3). There were three separate tests for each subject in both the control and experimental groups. The same food items were used in each of the testings. As done by Koss (27) in his test on olfactory dysfunction, 10 separate odors, which are either pleasant, unpleasant, or neutral quality, were used.

The 10 food items used were Giant Foods instant coffee grounds, Crown Colony peppermint extract, Giant Foods cooked ground beef, Sunkist fresh orange slices, NSA filtered tap water, Giant Foods vinegar, Giant Foods semi-sweet chocolate flakes, McNess clear vanilla extract, Giant Foods flaked coconut, and Giant Foods lemon juice. One teaspoonful of each food item was placed in a sterile, clear, plastic, medicine-type cup and sealed for administration. Each food item was out of the patient's sight until administered separately. Each patient was given a list of four food items to pick from when seeing, smelling, and/or tasting each test sample. The lists are shown in Appendix B. Kesslak et al. (29) provide the genesis for the use of four items per test sample. A response was required regardless of whether or not the patient actually felt he/she could correctly identify the food item (36). The results were recorded in Appendix C format by the test administrator, using the keyed designators to indicate how the food item was identified (i.e., taste, smell, sight, some combination of these senses). Each patient was requested to smell and/or taste each item instead of using visual identification. The administrator only queried the patient if the means of food item identification was not obvious.

A pilot study on both demented and nondemented patients was conducted by the researcher before the study tests were administered. In conducting the trial test, patients were able to complete the testing without fatigue. The researcher conducted a sample testing, using NC and PCs as the "patients," to train the test administrators in test methodology and recording of test results. The test data indicated that the study tests could be conducted by the proposed administrators with probable meaningful results.

Three separate tests were performed, each a week apart from the other. Three different administrators (R, NC, and PC) were involved in each test. Each administrator tested a different third of the mixed population (the experimental subgroups are Groups A, B, and C; the control subgroups are Groups D, E, and F) on each test occasion, until each had tested all of the patients. For example, Group A was tested first by a PC, next by R, and finally by NC; Group B was tested by NC, then by a PC, and finally by R. The researcher was the least familiar to the patients; NC (one administrator) was familiar, but not on a one-to-one basis; and the PCs (seven - numbered PC 1 through PC 7) had daily one-to-one contact with the patients. The researcher maintains the only file that links PC names to their identification numbers.

Testing was conducted in well-ventilated rooms with shades closed over the windows, to avoid distractions. If any signs of stress or agitation occurred during the testing process, the test was stopped and repeated on another day. This occurred on three separate occasions. Generally unresponsive patients, as predetermined by the medical staff, were eliminated from the study. All responses were recorded by the person administering the test, even if the product could not be identified. Comments made by the patient, along with facial expressions were recorded. The patient circled or marked the item on their own on enlarged versions of Appendix B, if desired; otherwise, results were recorded by the test administrator.

RESULTS

An attempt was made to keep the patient age span in the 60 to 80 year range, as designated in the methods. The mean age of the participating experimental group was 78.4 years (64 to 93) and 79.8 years (71 to 91) for the control group. The 12 patients in the experimental group were all of the Meridian AD patients in residence at the time of the study who were not excluded by the criteria on pages 11 and 12. Therefore, some patients exceeded the referenced age range. The control group, likewise, differed from the reference age grouping due to patient availability.

The data resulting from this study were evaluated to determine if the recognition of food items by AD (demented) patients, when using the senses of taste and smell, was the same or different from the recognition of the same food items by non-AD patients. It was anticipated that sampling identification by nondemented patients would be more accurate than that by demented patients. The data in Tables 2 and 3 show that demented patients have lessened food identification skills when compared to non-AD patients. This confirms the first study hypothesis on page 2. This skill decreases by a factor of 1.5 to 3.8, as shown in Table 3 data.

The test results provided data to determine if caregiver/patient familiarity becomes a dominant factor in food item recognition and acceptance. This was determined by examining the results from each patient at the end of the testing period and the resultant matrices of these data by administrator, type of patient (i.e. experimental, control), and testing period (Tables 2 and 3). Because of the small sampling population and few sampling periods, straight average statistical methodology sufficed. It was anticipated that the demented patient's recall, in particular, would be the most accurate when the test was administered by the PCs. When comparing the results (Tables 4 and 5) from all patient tests, the PCs received the best results from 50 percent of the patients. The researcher had the best results from 16.7 percent of the patients, followed by NC with 8.3 percent of the total. All administrators (R, NC, and PC) received equal results from 8.3 percent of the patients, PCs and NC in 8.3 percent, and PCs and R and NC and R in 4.2 percent. As predicted on page 2, 3, and 8, the PCs were able to attain the best results in toto (70.8%)

Table 2

Raw number and percentage of correct responses by patients in experimental and control groups as determined by testing period

Researcher	**Period 1**		**Period 2**		**Period 3**		**Average**
N[a]	**4**		**4**		**4**		**12**
	RNC[b]	**%[c]**	**RNC**	**%**	**RNC**	**%**	**%**
Experimental:							
Instant ground coffee	1	25	2	50	1	25	33.3
Pepperment extract	0	0	0	0	0	0	0
Cooked ground beef	1	25	1	25	0	0	16.7
Fresh orange slice	1	25	3	75	1	25	41.7
Water	2	50	0	0	0	0	16.7
Vinegar	1	25	2	50	2	50	41.7
Semi-sweet chocolate flakes	2	50	3	75	1	25	50.0
Clear vanilla extract	1	25	1	25	0	0	16.7
Flaked coconut	1	25	1	25	1	25	25.0
Lemon juice	0	0	0	0	0	0	0
Average							24.2
Control:							
Instant ground coffee	2	50	2	50	3	75	58.3
Peppermint extract	1	25	2	50	0	0	25.0
Cooked ground beef	2	50	1	25	2	50	41.7
Fresh orange slice	3	75	3	75	3	75	75.0
Water	2	50	2	50	3	75	58.3
Vinegar	2	50	2	50	3	75	58.3
Semi-sweet chocolate flakes	3	75	3	75	4	100	83.3
Clear vanilla extract	1	25	1	25	1	25	25.0
Flaked coconut	2	50	3	75	2	50	58.3
Lemon juice	1	25	2	50	1	25	3.0
Average							51.6

[a]N = Number of Patients per Test
[b]RNC = Raw Number Correct
[c]% = Corresponding Percentage of Total

Table 2 (continued)
Raw number and percentage of correct responses by patients in experimental and control groups as determined by testing periods

Nurse coordinator	**Period 1**		**Period 2**		**Period 3**		**Average**
N[a]	**4**		**4**		**4**		**12**
	RNC[b]	**%**[c]	**RNC**	**%**	**RNC**	**%**	**%**
Experimental:							
Instant ground coffee	1	25	3	75	2	50	50.0
Pepperment extract	0	0	1	25	1	25	16.7
Cooked ground beef	0	0	1	25	1	25	16.7
Fresh orange slice	2	50	3	75	3	75	66.7
Water	0	0	2	50	2	50	33.3
Vinegar	0	0	0	0	4	100	33.3
Semi-sweet chocolate flakes	1	25	1	25	1	25	25.0
Clear vanilla extract	0	0	0	0	0	0	0
Flaked coconut	1	25	2	50	1	25	33.3
Lemon juice	1	25	1	25	2	50	33.3
Average							30.8
Control:							
Instant ground coffee	2	50	1	25	2	50	41.7
Peppermint extract	1	25	1	25	1	25	25.0
Cooked ground beef	2	50	2	50	3	75	58.3
Fresh orange slice	3	75	4	100	3	75	83.3
Water	2	50	3	75	3	75	66.7
Vinegar	3	75	4	100	3	75	83.3
Semi-sweet chocolate flakes	3	75	4	100	3	75	83.3
Clear vanilla extract	2	50	1	25	0	0	25.0
Flaked coconut	2	50	3	75	3	75	66.7
Lemon juice	3	75	4	100	2	50	75.0
Average							60.8

[a]N = Number of Patient per Test
[b]RNC = Raw Number Correct
[c]% = Corresponding Percentage of Total

Table 2 (continued)
Raw number and percentage of correct responses by patients in experimental and control groups as determined by testing periods

Primary caregiver	**Period 1**		**Period 2**		**Period 3**		**Average**
N[a]	**4**		**4**		**4**		**12**
	RNC[b]	**%[c]**	**RNC**	**%**	**RNC**	**%**	**%**
Experimental:							
Instant ground coffee	3	75	2	50	1	25	50.0
Pepperment extract	0	0	0	0	1	25	8.3
Cooked ground beef	3	75	1	25	1	25	41.7
Fresh orange slice	4	100	3	75	2	50	75.0
Water	4	100	1	25	3	75	66.7
Vinegar	2	50	0	0	0	0	16.7
Semi-sweet chocolate flakes	4	100	1	25	2	50	58.3
Clear vanilla extract	0	0	0	0	0	0	0
Flaked coconut	4	100	1	25	2	50	58.3
Lemon juice	4	100	1	25	1	25	50.0
Average							42.5
Control:							
Instant ground coffee	2	50	2	50	3	75	58.3
Peppermint extract	3	75	2	50	2	50	58.3
Cooked ground beef	2	50	3	75	1	25	50.0
Fresh orange slice	4	100	4	100	4	100	100.0
Water	4	100	1	25	2	50	58.3
Vinegar	2	50	2	50	3	75	58.3
Semi-sweet chocolate flakes	4	100	3	75	4	100	91.7
Clear vanilla extract	3	75	0	0	1	25	33.3
Flaked coconut	3	75	3	75	4	100	83.3
Lemon juice	2	50	2	50	4	100	66.7
Average							65.8

[a]N = Number of Patients per Test
[b]RNC = Raw Number Correct
[c]% = Corresponding Percentage of Total

Table 3

Raw number and percentage of correct responses by subgroups in the experimental and control groups as determined by testing periods

	Mean Age in Years	Period 1		Period 2		Period 3	
		RNC[a]	%[b]	RNC	%	RNC	%
Experimental:							
Group A	78	5.25	52.5 (PC)[c]	2.25	22.5 (R)[d]	2.75	27.5 (NC)[e]
Group B	76	1.5	15.0 (NC)	2.5	25.0 (PC)	1.5	15.0 (R)
Group C	81	2.5	25.0 (R)	3.5	35.0 (NC)	3.4	35.0 (PC)
Control:							
Group D	81	8.0	80.0 (PC)	6.25	62.5 (R)	7.25	72.5 (NC)
Group E	80	5.75	57.5 (NC)	5.5	55.0 (PC)	5.5	55.0 (R)
Group F	79	5.75	57.5 (R)	6.75	67.5 (NC)	7.0	70.0 (PC)

[a]RNC = Raw Number Correct

[b]% = Corresponding Percentage of Total

[c]PC = Primary Caregiver

[d]R = Researcher

[e]NC = Nurse Coordinator

Table 4
Percentage of correct responses by administrator

	Percent correct			Best Results
Patient	**R[a]**	**NC[b]**	**PC[c]**	
EF 13[d]	0	30	50	PC 1
EM 14[e]	20	10	30	PC 1
EM 15	20	10	20	R/PC 7
EM 16	40	50	70	PC 1
EF 17	0	0	0	R/NC/PC 6
EF 18	30	30	0	R/NC
EF 19	0	0	10	PC 1
EF 20	0	0	50	PC 1
EF 21	20	10	0	R
EM 22	0	40	80	PC 1
EF 23	50	70	60	NC
EF 24	70	60	80	PC 6
CF 01[f]	40	60	70	PC 6
CF 02	70	90	90	NC/PC 2
CF 03	70	70	70	R/NC/PC 3
CM 04[g]	60	50	50	R
CF 05	90	80	80	R
CF 06	60	70	100	PC 4
CM 07	60	50	10	R
CF 08	60	80	70	NC
CF 09	40	70	80	PC 5
CF 10	30	30	40	PC 5
CF 11	60	60	80	PC 4
CF 12	60	80	80	NC/PC 6

[a]R = Researcher
[b]NC = Nurse Coordinator
[c]PC = Primary Caregiver (1 through 7)
[d]EF = Experimental Female Group
[e]EM = Experimental Male Group
[f]CF = Control Female Group
[g]CM = Control Male Group

Table 5
Percentage of correct responses by testing period

	Percent Correct			Best Results
Patient	**1[a]**	**2[b]**	**3[c]**	
EF 13[d]	0	30	50	PC 1[e]
EM 14[f]	20	10	30	PC 1
EM 15	10	20	20	R[g]/PC 7
EM 16	50	70	40	PC 1
EF 17	0	0	0	R/NC[h]/PC 6
EF 18	30	30	0	R/NC
EF 19	0	10	0	PC 1
EF 20	50	0	0	PC 1
EF 21	0	20	10	R
EM 22	80	0	40	PC 1
EF 23	50	70	60	NC
EF 24	80	70	60	PC 6
CF 01[i]	70	40	60	PC 6
CF 02	90	90	70	NC/PC 2
CF 03	70	70	70	R/NC/PC 3
CM 04[j]	60	50	50	R
CF 05	80	90	80	R
CF 06	100	60	70	PC 4
CM 07	50	10	60	R
CF 08	70	60	80	NC
CF 09	40	70	80	PC 5
CF 10	30	40	30	PC 5
CF 11	60	80	60	PC 4
CF 12	60	80	80	NC/PC 6

[a]1 = Period 1, [b]2 = Period 2, [c]3 = Period 3, [d]EF = Experimental Female Group,
[e]PC = Patient Caregiver (1 through 7), [f]EM = Experimental Male Group,
[g]R = Researcher, [h]NC = Nurse Coordinator, [i]CF = Control Female Group,
[j]CM = Control Male Group

by almost double the results from NC (33.3%) and R (33.4%). These data confirm the second study hypothesis that the closer the patient/caregiver relationship, the greater the probability that the patient will accept more food items. The age group results in data shown on Table 6 also confirm that the PCs, in general, obtained the best results. The exception in the 90+ age group of nondemented patients will be explained later in the discussion section of the study.

The study results in Table 4 are inconclusive with regard to differences in food item identification by stage two and three AD patients. This was due to the small population of available patients at Meridian in the later part of stage two, with none available in stage three.

The study done by D. L. Rezek (35) indicated that age may affect recognition of food items (see page 11) by both AD and non-AD patients. The limited results (Table 6) from this study do not confirm that statement. The study data for the 60 - 70 (two AD, zero non-AD in Table 1) and 90+ year groups (one AD, one non-AD) are very limited and therefore, of questionable value.

Table 5 data seem to refute any hypothesis that repeat sampling of the same food items will increase recognition capability by the patients.

TABLE 6
Percentage of correct responses by age group

		Researcher		Nurse Coordinator		Primary Caregiver	
	NS[a]	RNC[b]	%[c]	RNC	%	RNC	%
Experimental:							
60 - 70 years	2	2	20.0	2.5	25.0	4	40.0
71 - 80 years	6	2	20.0	3.83	38.3	3.5	35.0
81 - 90 years	3	2.33	23.3	3.67	36.7	4.67	46.7
91 + years	1	2	20.0	1	10.0	2	20.0
Control:							
60 - 70 years	0	--	--	--	--	--	--
71 - 80 years	5	6.33	63.3	6.83	68.3	7.33	73.3
81 - 90 years	6	5.2	52.0	6.6	66.0	7.4	74.0
91 + years	1	6	60.0	5	50.0	1	10.0

[a]NS = Number of Subjects
[b]RNC = Raw Number Correct
[c]% = Corresponding Percentage of Total

Morris et al (25) noted that AD patients seem to prefer sweet and/or spicy foods in the middle and later stages of the disease. Table 7 data seem to confirm that statement, since all of the sweet food items in this study test were in the upper half of the recognition by both AD and non-AD patients. Fresh orange slices had the highest recognition by both AD (61.1%) and non-AD (86.1%) patients. The fresh orange slices used in this study were evaluated to be sweet by both the researcher and nurse coordinator. Semi-sweet chocolate flakes and instant ground coffee (44.3%) were next in recognition by AD patients, followed by flaked coconut and water (38.9%). The high recognition of instant coffee grounds and water by the AD patients is probably based on frequent usage. Flaked coconut (69.4%) ranked second for non-AD patients, followed by vinegar (66.7%), water (61.1%), then semi-sweet chocolate flakes and lemon juice (58.3%).

DISCUSSION

As stated earlier in the result section, the researcher obtained the best results with patient CM 07 (90+ non-AD age group). The researcher speculates that this was due to the rapport established between the patient and researcher while conducting the test. Patient CM 07 told stories and posed riddles for the researcher to answer throughout the test period. The researcher paid attention to the patient's stories and successfully

TABLE 7
Average response by food item

	Experimental		Control	
	RNC[a]	**%[b]**	**RNC**	**%**
Instant ground coffee	16	44.3	19	52.8
Peppermint extract	3	8.3	13	36.1
Cooked ground beef	9	25.0	18	50.0
Fresh orange slice	22	61.1	31	86.1
Water	14	38.9	22	61.1
Vinegar	11	30.6	24	66.7
Semi-sweet chocolate flakes	16	44.3	21	58.3
Clear vanilla extract	2	5.6	10	27.8
Flaked coconut	14	38.9	25	69.4
Lemon juice	10	27.8	21	58.3

[a]RNC = Raw Number Correct
[b]% = Corresponding Percentage of Total of 36

answered his riddles; therefore, the test atmosphere became very relaxed. Certain smells/tastes brought back some memories to the patient, and that is how the stories/riddles developed.

Table 4 compares the test results of all subjects and administrators. When looking at the results from all of the PCs, PC 1 received the best results from all six of his experimental group patients. PC 4 had the second best success, followed by PC 6, PC 3, PC 5, PC 7, and finally PC 2. The subjective viewpoint of the researcher, based on daily performance observation, is that the caring, friendly attitude of PC 1 caused his success in obtaining the best results. PC 1 has worked in AD units for at least five years and was one of the first candidates selected when Meridian opened its dementia unit. PC 1 almost always has a smile on his face and will not pass a resident without saying something to him/her. PC 1 seems to be able to gently prod the residents to eat, have them join in facility (unit) activities, relax them when they are agitated, or just assist them with basic activities of daily living (ADLs) such as getting dressed or brushing their teeth.

PC 2 had the worst results of these tests, yet within the dementia unit is considered to be a good primary caregiver. The subjective viewpoint of the researcher is that PC 2's quiet, laid back personality affected the study results. PC 2 quietly talks with the residents, but is not very aggressive when it comes to encouraging the AD residents to participate in activities on the unit, eating, ADLs, etc.

As supported by the data in Tables 2 through 5, the approach used by the administrators, while testing, determined the outcome and success rate for the study tests, even though the PCs received the best results from 50.0 percent of all patients tested. When a hurried, aggressive approach was used, the patients tended to become more agitated, thus reducing their identification/consumption of food items. When approached with a warm, friendly smile and voice, the patients reacted more positively. This resulted in better recognition of the food items and acceptance of the test procedures; therefore, it may follow that a warm, friendly approach by the primary caregiver can increase the chances for better dietary habits/food consumption by AD patients.

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APPENDIX A

PATIENT'S INFORMATION

1. Name/Patient Number: ______________________________

2. Sex: _____________

3. Age: ____________

4. Diagnosis: ____
____
____
____

APPENDIX B

FOOD SELECTION CHOICES

1.

- Instant ground coffee
- Tea leaves
- Dirt
- Chocolate crumbs

2.

- Spearment extract
- Cinnamon extract
- Peppermint extract
- Wintergreen extract

3.

- Cooked ground chicken
- Cooked ground beef
- Cooked ground fish
- Cooked ground pork

4.

- Fresh orange slice
- Fresh lemon slice
- Fresh lime slice
- Fresh apple slice

5.

- 7-Up
- Water
- Clorox
- Gin

6.

- SPRITE
- Vodka
- Ammonia
- Vinegar

7.

- Bacon bits
- Instant coffee grounds
- Semi-sweet chocolate flakes
- Dirt

8.

- Almond extract
- Clear vanilla extract
- Coconut extract
- Orange extract

9.

- Coconut flakes
- Powdered sugar
- Grated white chocolate
- Ground bleached almonds

10.

- Apple juice
- Olive oil
- Lemon juice
- Pineapple juice

PATIENT ____________________________

TEST ADMINISTRATOR ____________________________

APPENDIX C

FOOD SELECTION CHOICE RESULTS

1. Instant ground coffee
   - •Instant ground coffee
   - •Tea leaves
   - •Dirt
   - •Chocolate crumbs

2. Peppermint extract
   - •Spearment extract
   - •Cinnamon extract
   - •Peppermint extract
   - •Wintergreen extract

3. Cooked ground beef
   - •Cooked ground chicken
   - •Cooked ground beef
   - •Cooked ground fish
   - •Cooked ground pork

4. Fresh orange slice
   - •Fresh orange slice
   - •Fresh lemon slice
   - •Fresh lime slice
   - •Fresh apple slice

5. Water
   - •7-Up
   - •Water
   - •Clorox
   - •Gin

6. Vinegar
   - •SPRITE
   - •Vodka
   - •Ammonia
   - •Vinegar

7. Semi-sweet chocolate flakes
   - •Bacon bits
   - •Instant ground coffee
   - •Semi-sweet chocolate flakes
   - •Dirt

8. Clear vanilla extract
   - •Almond extract
   - •Clear vanilla extract
   - •Coconut extract
   - •Orange extract

9. Flaked coconut
   - •Flaked coconut
   - •Powdered sugar
   - •Grated white chocolate
   - •Ground white almonds

10. Lemon juice
    - •Apple juice
    - •Olive oil
    - •Lemon juice
    - •Pineapple juice

PATIENT ______________________________

TEST ADMINISTRATOR ______________________________

Key (means of identification):
SI = sight
SM = smell
T = taste

VITA

Cheryl Ann Hyland
18835 Summer Oak Court
Germantown, Maryland 20874
(301) 428-9658
December 17, 1959

Academic Experience:

Virginia Polytechnic Institute and State University, Telestar Campus, Falls Church, VA. Graduate studies toward a MS in Human Nutrition and Foods.

Indiana University of Pennsylvania, Indiana, PA. BEd in Dietetics and in Nutrition Education, 1981.

Professional Experience:

April, 1992 - present
Norrell Health Care, Inc, Falls Church, VA
Staff Supervisor
August, 1990 - April, 1992
Meridian Healthcare Center at Aspenwood, Silver Spring, MD
Personnel Director, Medical Records Clerk, Administrative Assistant
October, 1989 - August, 1990
Meridian Healthcare Center at Aspenwood, Silver Spring, MD
Staffing Coordinator
September, 1988 - October, 1989
Potomac Valley Nursing and Wellness Center, Rockville, MD
Diet Technician and Assistant Food Service Director, incorporated with the completion of a 6-month work experience as required by the ADA in the Masters program
March, 1988 - September, 1988
Marriott Corporation, Alexandria Hospital, Alexandria, VA
Production/Ordering Manager, Relief Catering and Cafeteria Manager
April, 1987 - March, 1988
Marriott Corporation, Alexandria Hospital, Alexandria, VA
Cafeteria Manager, Relief Catering Manager

September, 1986 - April, 1987

Marriott Corporation, Montgomery County Executive Office Building, County Council Building, and Government Center Ice Rink and Gift Shop, Rockville, MD

General Manager of All Operations

July, 1986 - September, 1986

Marriott Corporation, IBM Corporation at the Rockledge Center, Bethesda, MD

General Manager of Cafeteria Operations

September, 1984 - July, 1986

Marriott Corporation, Montgomery County Executive Office Building, Rockville, MD

Food Production Manager/Assistant to the General Manager

August, 1984 - September, 1984

Marriott Corporation, Children's Hospital, Washington, DC

Relief Cafeteria Manager

August, 1982 - August, 1984

Marriott Corporation, North Carolina Baptist Hospital, Winston-Salem, NC

Penthouse Cafeteria Manager

August, 1981 - August, 1982

The Magic Pan, Inc, Chevy Chase, MD

Assistant Manager

Cheryl A. Hyland

Cheryl A. Hyland