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Animal-Assisted Therapy and Nutrition in Alzheimer's Disease[1]

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This study examined the influence of animal-assisted therapy, specifically fish aquariums, on nutritional intake in individuals with Alzheimer's disease (AD). Sixty-two individuals with AD who lived in specialized units were studied. Baseline nutritional data were obtained followed by a 2-week treatment period when the aquariums were introduced. The treatment data were collected daily for 2 weeks then weekly for 6 weeks. Nutritional intake increased significantly (21.1%; $p < .001$*) when the aquariums were introduced and continued to increase during the 6-week weekly follow-up. Weight increased significantly (1.65 lbs;* $p < .001$*) over the 16-week period. In addition, participants required less nutritional supplementation, resulting in health care cost savings.*

Alzheimer's disease (AD) will reach epidemic proportions by the middle of this century, increasing by 350% by 2050, unless effective methods for prevention and treatment are developed (Medscape, 2000). AD affects 1 in 10 people at age 65 and nearly half of all people age 85 and over (Hingley & Ruggeri, 1998). Because a cure or method of prevention is not in the foreseeable future, efforts must be made to improve the quality of life for individuals who are afflicted with AD. AD begins with mild cognitive deficiencies, such as forgetfulness, and gradually worsens with the extensions of cerebral involvement. Other manifestations appear, causing difficulties with orientation, loss of independence, disruptive behavior, and disordered eating behavior. Many studies show that weight loss is extremely common in AD patients (Poehlman & Dvorak, 2000; Reynish, Andrieu, Nourhashemi, & Vellas, 2001; Yen, 1997). This weight loss leads to reduced muscle mass and loss of functional independence that increases the risk of falls, infections, and skin irritation or ulcerations leading to a decrease in quality of life in AD patients

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and an increase in the likelihood of hospitalization. Studies must look at innovative interventions that increase nutritional intake and prevent weight loss. This study examined the influence of animal-assisted therapy, specifically fish aquariums, on nutritional intake in individuals with AD.

AD and Nutrition

Weight loss in AD is not a new phenomenon. Alois Alzheimer first observed it in 1907. Morgan and Hullin (1982) reported that the weight of hospitalized dementia patients was lower than that of control patients in good health.

Since the mid-1980s, numerous studies systematically observed weight loss in patients with dementia, particularly AD. Energy malnutrition, wasting, and low body weight were found in approximately 50% of the older adults diagnosed with dementia (Donaldson et al., 1996). Weight loss is so common in individuals with AD that it is listed as a symptom consistent with the diagnosis by the National Institute of Neurological and Communicative Disorders and Stroke/Alzheimer's Disease and Related Disorders Association Work Group (McKhann et al., 1984). White, Pieper, and Schmader (1997) explored the association between weight changes and AD in a 2-year longitudinal study following 362 individuals with AD and 317 healthy controls. They found that almost twice as many individuals with AD experienced a weight loss of 5% or more when compared to the healthy controls.

There are several hypotheses that have been proposed to explain this weight loss. The first hypothesis is that AD individuals lose weight due to increased energy expenditure as a result of agitation, pacing, and wandering or repetitive activity. Litchford and Wakefield (1987) found that the mean energy expenditure exceeded mean calorie intake by 600 kcal per day in wandering AD individuals who resided in a long-term care facility. An international study focused on nutrition in AD found weight loss despite adequate caloric intake (Wolf-Klein & Silverstone, 1996). Two studies (Donaldson et al., 1996; Poehlman, Toth, & Goran, 1997) showed that there was no difference in energy expenditure when comparing individuals with AD and healthy controls.

Some researchers hypothesized that the weight loss associated with AD could be attributed to an elevated rate of resting energy expenditure. Donaldson et al. (1996) assessed the resting metabolic rate of 25 individuals with AD and 73 healthy controls. They found that the resting metabolic rate was not different between the AD patients and healthy controls when controlled for body composition and age. The authors concluded that the

problems of unexplained weight loss were most likely caused by low level of food intake. The findings replicate a previous study by Poehlman (1993) that found no evidence of hypermetabolic states in individuals with AD.

The impact of weight loss on individuals with AD has also been the focus of study. White, Pieper, & Schmader (1998) examined the association of weight change in AD with the severity of the disease and mortality. They found that weight loss was associated with the severity and progression of disease. When age and stage of disease is controlled, weight is a predictor of mortality in AD. A weight gain significantly decreases the risk of mortality and slows progression of the disease. It is important to study useful clinical interventions that encourage food intake to offset malnutrition and eventual weight loss.

Animal-Assisted Therapy

Environment is an important influence in managing difficult behaviors associated with AD. Lawton (1975) noted that the more vulnerable the individual, the more likely it is that he or she will be influenced by the environment. The use of animals to assist human therapeutic activities has a long history, but extensive, documented, and organized use is relatively new (Beck, 1985, 2000; Beck & Katcher, 1984, 1996; Beck & Meyers, 1996).

> Animal-assisted therapy differs from animals used as entertainment in that AAT is considered to be an applied science using animals to solve a human problem. It is an interdisciplinary approach using animals as an adjunct to other therapies. It is goal-oriented, using assessment and evaluations procedures. (Gammonley & Yates, 1991, p. 13)

At the very least, interaction with animals positively influences transient physiological states, resulting in improved morale (Beck & Katcher, 1996).

One of the first uses of animals for institutionalized older adults was the introduction of a single mascot (a cat) into each ward in a nursing home (Brickel, 1979). Although some negative outcomes were reported, such as concern about fleas and allergies, the overall impression was that the cats improved the patients' responsiveness, offering them pleasure and enhancing the general milieu of the treatment setting. More recent studies in different nursing homes report that, in general, staff members believe that programs involving animals are beneficial and do not significantly add to the work load (Cole & Gawlinski, 1995; Crowley-Robinson & Blackshaw, 1998; Kranz & Schaaf, 1989). Today, many nursing homes have either residential animals or animal visitation programs as part of their recreation

programs (Beck & Katcher, 1996). Most programs use dogs, cats, and rabbits, and the most commonly reported value is improved social interaction of the patients (Beck & Katcher, 1996; Bustad, 1980; Draper, Gerber, & Layng, 1990; Fick, 1993; Perelle & Granville, 1993). Bird feeders in a nursing home setting improve both self-reported and nurses' ratings for control, happiness, and activity (Banziger & Roush, 1983). Little research has been done on the influence of aquariums on residents in a long-term care setting.

Animals and AD

"All of us who are concerned about the health and well-being of all living things must never abandon those whom we cannot cure. We must continue to help patients maintain hope and the will to survive" (McCulloch, 1982, p. 24).

There is evidence that the presence of a dog can increase social behaviors, including smiles and laughs, in AD patients when the animal is available temporarily or permanently (Batson, McCabe, Baun, & Wilson, 1997; Kongable, Buckwalter, & Stolley, 1989; Verderber, 1991).

Although there are risks associated with any animal contact, there is little indication that animal programs are particularly dangerous, and there are few reports of adverse effects (Schantz, 1990; Walter-Toews, 1993). Use of dogs and cats with individuals with AD is problematic because of the need for constant supervision. Individuals with AD may act inappropriately by pulling the animal's tail or ears, startling the animal, which may cause it to bite or scratch. To justify any risk associated with animal contact, a value to patients must be demonstrated. The most common criticism of animal-facilitated therapy programs is that they are not goal oriented, and an evaluation of the goals is often unclear (Beck, 2000; Beck & Katcher, 1984; Draper et al., 1990; Hundley, 1991). Specially designed automated aquariums can be safely used and require minimal upkeep and staff attention.

The Health Benefits of Fish Tank Contemplation

There is now general acceptance that natural surroundings and contact with nature is good for people (Ulrich, 1993). Viewing nature scenes dominated by green vegetation is less stressful than urban scenes lacking vegetation (Ulrich, 1979). Direct contact with nature is not always possible in therapeutic settings. Fish tanks are a common way to introduce animals or "nature" in the home or therapeutic setting.

Under laboratory conditions, participants who had the opportunity to observe a fish tank experienced significant decreases in blood pressure (Katcher, Friedmann, Beck, & Lynch, 1983). In other studies, people who contemplated an aquarium were able to undergo dental surgery with much less stress (Katcher, Segal, & Beck, 1984).

One of the first uses of fish tanks for older adults was a study conducted in public subsidized housing. Compared to people who received the same services but no aquarium, the residents with a fish tank were assessed to have improved overall satisfaction with their leisure and to be more relaxed (Riddick, 1985).

PURPOSE

The goal of this study was to examine the influence of aquarium observation on nutritional intake in individuals with AD. Although many animal-assisted therapy studies have been conducted with individuals with AD using dogs, no research to date has examined the effects of aquariums on individuals with AD. This study quantitatively examined the influence of aquariums on nutritional intake and changes in body weight.

Design

A time-series design was utilized incorporating a nonequivalent control group approach (Campbell & Stanley, 1969). This design allowed for several measurements across time utilizing different groups. The participants were not randomly assigned but were studied in their existing groups within their facility.

Sample

The university's human study participants committee and the animal care and use committee approved the study. The participants were residents in one of three dementia-specific units located in extended-care facilities in Indiana. All residents of the units were invited to participate. Consent was obtained from the family, or guardian, for all participants.

The sample (males = 24, females = 38) was predominantly White (98.5%) with one African American (1.5%). The mean age was 80.1 years with a mean facility length of stay of 47.8 months. The length of stay ranged

from 1 month to 379 months. One third of the sample (35.5%) had less than a high school education, 40.3% were high school graduates, 12.9% reported some college, and 11.3% were college graduates.

The three facilities were all located in the Midwest. Two were not-for-profit facilities, and one was a veteran's facility. The residents of the facilities did not differ in relation to length of stay, level of education, and pet ownership. The veteran's facility had a significantly higher number of males and the males were significantly older when compared to the two other facilities. All facilities had a separate dining room specifically for the AD residents. The dining rooms were similar in size and configuration.

Aquariums

The aquariums that were utilized were specially developed for use in dementia units. The tanks are self-contained with locks to protect both the fish and the residents. The aquarium is set in a large wooden base for stability. Eight large brightly colored fish were placed in each tank. The aquariums have a large 30 inch $\times$ 20 inch viewing area at eye level to provide the easy viewing. The specially designed lighted background allows the fish to be seen by residents who have vision impairments.

METHOD

Demographic data on the participants were obtained prior to beginning the study. The dependent variables were body weight and nutritional intake. The independent variable was the presence or absence of a fish tank that was specifically designed for use with individuals with AD.

Baseline Data

Body weight was measured in pounds for each resident at the beginning of each month. Body weights were obtained for 3 months prior to the introduction of the fish tanks and for 4 months following the introduction of the fish tanks.

Baseline nutritional intake was obtained in all facilities for a period of 2 weeks (Weeks 1-2). All residents were served their medically prescribed diet. The food served to the residents was weighed in grams before meals. Care was taken to make sure that the residents ate only food from their trays

and that the food from various trays was not mixed. After the resident was finished eating, the remaining food was weighed. The nutritional intake was recorded as the difference in grams.

Procedure

Two of the facilities were utilized as treatment facilities and one facility was utilized as the control/treatment facility. In the treatment facilities, after the baseline data were collected, fully self-contained automated aquariums with colorful fish were introduced into the activity/dining area. In the control facility, a scenic ocean picture was introduced as a modification of the environment. This was to control for whether the effect noted, if any, was due to the aquariums or the change in the environment due to a novelty effect. Nutritional intake was then measured at each meal for a period of 2 weeks (Weeks 3-4) (see Table 1).

Treatment procedure. In the treatment group, while the fish tank remained in the dining room, intake was measured weekly for an additional 6 weeks to determine if the effect, if any, was lasting in duration or intensity (Weeks 5-10). Weekly sampling was used for cost containment and time efficiency. The weekly weights were measured on the same day each week. At the end of 10 weeks, data collection was discontinued.

Control procedure. In the control group, the picture was removed for a period of 2 weeks (Weeks 5-6) to allow for a washout period. Then the protocol utilized in the treatment-only facilities was replicated. Baseline data were then collected again for a period of 2 weeks to determine if there was an influence from the previous exposure to the picture (Weeks 7-8). The tank of fish was then introduced into the control facility and data were collected daily for a period of 2 weeks (Weeks 9-10). Nutritional intake was then measured weekly for 6 additional weeks (Weeks 11-16). At the end of 16 weeks, data collection was suspended.

FINDINGS

The sample characteristics of the three facilities were examined. No significant differences were found in baseline meal intakes when analyzed by facility, length of stay, educational level, and previous pet ownership. Older

TABLE 1: Study Design

	Weeks 1-2	*Weeks 3-4*	*Weeks 5-6*	*Weeks 7-8*	*Weeks 9-10*	*Week 11-16*
Control/treatment (1 facility, *n* = 17)	Baseline data (daily, no tank or picture)	Picture data (daily)	Washout (no picture, no data)	Baseline data (postpicture, daily)	Tank data (daily)	Tank data (weekly)
Treatment only (2 facilities, *n* = 45)	Baseline data (daily, no tank or picture)	Tank data (daily)	Tank data (weekly)	Tank data (weekly)	Tank data (weekly)	Study complete

individuals ate less (r = –.227, p = .03), and males consumed more than females (F = 4.938, p = .03). These trends were consistent throughout the study.

Nutritional Intake

Utilizing an analysis of variance, no interfacility difference was noted in mean baseline nutritional intake. In addition, no significant difference was noted between educational levels, pet ownership, and baseline nutritional intake. Males ate significantly more than females during the baseline data collection period. Age was negatively correlated with mean baseline nutritional intake with older individuals eating less. Residents with longer lengths of stay consumed more food during the baseline period.

Control. The nutritional intake for the control group was analyzed to determine if there was any statistically significant difference between the baseline mean nutritional intake (Weeks 1-2) and mean intake during exposure to the picture (Weeks 3-4). A paired samples t test was conducted comparing the baseline total with the control data. No significant difference was noted between the amount of nutritional intake before and after exposure to the scenic picture (t= –.882, p = .391). A comparison of the nutritional intake between the two baseline periods (prepicture Weeks 1-2 and postpicture Weeks 7-8) was performed. No significant difference was noted between the two baseline periods (t = 1.513, p = .150), therefore the control group could be utilized later as a treatment group.

Treatment. The influence of the aquariums was analyzed by comparing the nutritional intake for the baseline period with the treatment period (see Figure 1). In all the treatment data, level of significance was $p < .001$. All three facilities experienced a significant increase (M = 21.1%) in nutritional intake when the residents were exposed to the aquariums. The baseline intake was then compared to the 6-week posttreatment intake. A significant increase (M = 27.1) was noted in all three facilities. When data from all three facilities were combined, treatment intake (t = –7.276) and post-6-week intake (t = –7.932) were significantly increased when compared to baseline nutritional intake. Not only did the aquarium increase nutritional intake during the treatment period, nutritional intake was significantly higher (M = 4.9%) for the post-6-week period when compared to the treatment period.

When the data were analyzed by individual, the majority (87%) of participants had an increase in their dietary intake. Only 9.7% (n = 6) of the

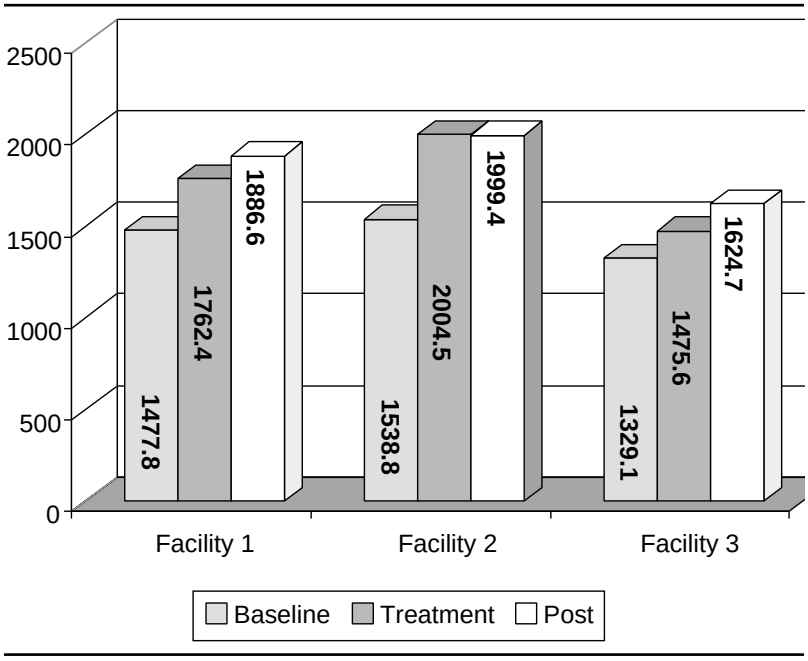

Figure 1: Food intake by facility (in grams).

patients had no change or a decrease in their dietary intake compared to the baseline.

Nutritional intake was also examined by meal. In all three meals, there was a significant increase between the baseline intake and treatment. This increase remained for all meals when comparing the baseline nutritional intake with the post-6-week intake.

Weight. Overall, most residents (n= 54 of 62) showed a significant decrease in weight in the 3 months prior to the introduction of the fish tanks (M= –1.71 lb.) (see Figure 2). There was a significant increase in weight the month the aquarium was introduced (M= 0.54 lbs.). The increase trend in weight continued throughout the study with a mean weight gain of 1.65 pounds ($p < .000$). Overall, 3 participants experienced no change in weight and 6 participants experienced a weight loss when the pretreatment and posttreatment means were compared. Two of the 6 residents were on a calorie reduction diet.

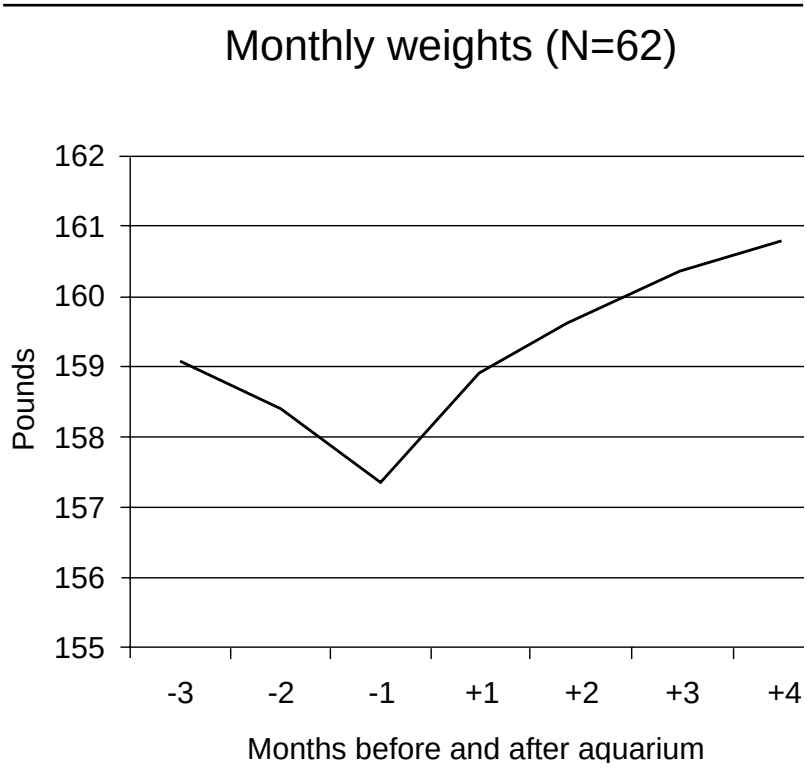

Figure 2: Mean weights on the first of each month (in pounds) before and after the introduction of an aquarium (Month 1).

DISCUSSION

Several observations were noted that suggest why people ate more in the presence of aquariums. Staff members observed that individuals with a history of pacing and wandering sat for longer periods observing the aquarium than prior to the addition of the tanks. This additional time sitting at the table led to increased nutritional intake. Individuals who tended to be lethargic were more attentive and awake in the presence of the aquariums, therefore they increased their nutritional intake. This effect lasted throughout the study period.

Another benefit of the increased nutritional intake during meals was that the use of nutritional supplements was decreased. In the facilities, a nutritional supplement such as Ensure, Sustacal, Glucerna, or Carnation Instant

Breakfast was routinely given to the patient if less than 50% of the meal was consumed. In many cases, only a small portion of the supplement was consumed, leading to expensive waste. The increase in nutritional intake during the meals led to an approximately 25% decrease in the use of nutritional supplements. This decrease in supplemental use can result in significant savings in health care costs. For example, in one facility, the pretreatment use of nutritional supplements for 24 residents was 38 cans per day. After the introduction of the aquarium, the usage decreased to 27 cans per day. This 11 can per day decrease resulted in a daily cost saving of $11.44 (11 cans at $1.04 per can).

Our study demonstrated an intervention that resulted in an increase in dietary intake through noninvasive and nonchemical means. The majority of the participants (n = 54 of 62) had an increase in nutritional intake when viewing the aquariums. Only eight individuals demonstrated no increase or a decrease in nutritional intake. Overall, the participants had a 21.1% increase in nutrition when the treatment was initiated and a 27.1% increase in the intake through the posttest period.

Nutritional problems, especially unexplained weight loss, are common clinical findings in individuals with AD. Weight loss is always of great concern for the health care provider because it is an indicator of protein-energy malnutrition in the older adult and a predictive factor of mortality (White et al., 1998). Maintenance of weight is considered landmark for AD individuals and a weight gain is rare. This supports the findings of Donaldson et al. (1996), which suggest that unexplained weight loss is most likely due to a low level of food intake.

Increasing nutritional intake in individuals with AD can have numerous positive implications. First, the increase in intake can delay muscle wasting, which can delay functional dependence and loss of autonomy. The increase in nutrition can help decrease the incidence of falls, prevent skin infections, decubitus ulcers, and sepsis. All this increases the quality of life for the AD individual and reduces the burden on caregivers (Pinchcofsy-Devin & Kaminski, 1986; Sandman, Adolfson, Nygren, Hallmans, & Winbald, 1987).

The increase in dietary intake reduced the need for supplemental nutrition. This has several benefits. Eating food provides a variety of textures and tastes, which helps to stimulate the sensory system. The facility must endure the cost of preparing and serving the meals that, if they are not eaten, must be discarded. If the patients do not eat the meal, they are supplemented with nutritional replacements that add to the cost of maintaining nutrition. If the patients consume more food during the meal, they benefit through

nutritional value and sensory sensations, and the long-term care facilities benefit by not having to cover the expense of wasted food and additional supplemental nutrition.

The use of animal-assisted therapy with AD individuals in the past has focused on the use of dogs, cats, and rabbits. Because the AD individual can act inappropriately without warning, programs using dogs and cats require direct supervision to prevent injury to the animal, whereas specifically designed automated aquariums can be safely used and require little staff attention. The use of aquariums has apparently not been studied with AD individuals.

This study demonstrated that the aquariums held the AD individual's interest and resulted in an increase in nutritional intake at mealtimes, an increase in body weight, and a decrease in the use of nutritional supplements. The aquariums had positive effects on nutritional intake on the majority of individuals (87%) and may have numerous other positive effects that were not measured in this study. For example, the aquariums facilitated interaction between the AD individual and visitors as a focus point for communication. The tanks provided a safe environment for the animals, remaining intact several years after the completion of the study. This study is important to animal-assisted therapy research because the influence of animals can be quantitatively measured, reflecting more than anecdotal results.

There are several limitations of this study that require caution in the interpretation of its results. The participants who were studied had a diagnosis of AD and were residents of specialized inpatient AD units. No testing was utilized to rule out the presence of other origins of dementia. Some of the patients may have had combination dementias or a dementia other than AD. The lack of ethnic diversity of the sample is also noted as a limitation. A convenience sample was utilized to serve as a pilot study for future endeavors.

Nutritional intake was measured giving an accurate measure of quantity of intake, but there was no measure of the quality of nutrition. Future research can incorporate both measures to monitor changes in nutritional status.

NOTE

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