

# Effects of Watching Aquariums on Elders' Stress

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## Abstract

Experimental group members watched a fish aquarium or a fish videotape, while control group members viewed a placebo videotape. Three eight-minute treatment sessions were held one week apart. Members of all three groups perceived their treatments as relaxing. Aquarium observers tended to experience a decrease in pulse rate and muscle tension and an increase in skin temperature. Theoretical and practical implications of the results and ideas for further research are discussed.

## Introduction

Stress is a physiological response to environmental challenges and threats. There is no singular cause of it; rather, any event that makes the body adapt produces stress. The presence of too much or too little stress over an extended period of time can be physically or psychologically damaging (Allen 1983). One segment of the American population at particularly high risk for stress-related disorders is the elderly (National Council for Health Statistics 1983).

Preliminary findings suggest one modality that reduces physiological stress is exposure to the presence of an animal (Friedmann *et al.* 1983; Katcher, Segal, and Beck 1984). Viewing a stocked aquarium constitutes such exposure. (Katcher *et al.* 1983; Riddick 1984). However, it has been noted that studies focusing on animal-human interactions, for the most part, have not been scientifically rigorous (Beck and Katcher 1984; Wilson and Netting 1987; Zeglen, Lee, and Brudvik 1984). More specifically, the bulk of earlier reports on the topic have been atheoretical, lacked baseline or pretest data, and/or failed to include a control group in the research design.

Regarding possible theoretical underpinnings for stress research, one alternative is Benson's (1975) relaxation theory. This theory proposes that four basic elements underlie the elicitation of the relaxation response: the presence of an object on which to focus, a quiet environment, a passive attitude, and a comfortable position.

The purpose of this study was twofold. First, it aimed to test the relaxation theory by having elderly persons view an aquarium (either live or on videotape) and recording their perceptions as to the relaxation nature of the activity. Second, it sought to determine whether engagement in this activity evoked a relaxation response or reduced physiological stress in elders. Since not all individuals respond to stressful stimuli with maximal arousal in the same organ system (Bridges 1974), it was hypothesized that, after experiencing a stressor, members of two fish-gazing groups relative to a control group would experience a reduction in pulse rate, an increase in skin temperature, and a reduction in muscle tension.

## **Methodology**

### **Sample**

Study participants ( $N = 27$ ) were residents of a publicly subsidized housing unit for primarily elderly persons in Prince George's County, Maryland. Criteria for selection were that individuals had to be 62 years of age or older, volunteer to be in the study, and sign a consent form.

The study employed a research design using pretest and posttest control groups. The study participants were randomly assigned to one of three groups (nine persons per group), each to watch a fish aquarium, a fish videotape, or a placebo videotape. The rationale for including the fish videotape was to introduce a control for real fish watching. This type of control was deemed to be desirable for at least two reasons. First, the relaxation theory presents no perspective on whether objects are more or less relaxing to view if they are animate. Second, it may be more practical for some individuals to use a fish videotape than to care for a live aquarium. Regarding the inclusion of a placebo group in the research design, such a group controls for the possibility that study participants' stress responses are reduced only because they had expected the intervention to relax them (Felts 1983). Another reason for the inclusion of the placebo group was that it served as a control for television watching.

Overall, the groups were similar in terms of gender and age composition. The fish aquarium group consisted of eight females and one male, with a median age of 75 years. The fish videotape group was comprised of seven females and two males and had a median age of 73. And the placebo group had six females and three males and a median age of 76.

### **Intervention**

The interventions for this study lasted eight minutes each and were offered once a week over a three-week period. During each session, participants individually watched a fish aquarium, a fish videotape, or a placebo videotape.

The fish aquarium was a landscaped ten-gallon tank stocked with nine fish (two black mollies, two red wag swordtails, two gold wag moons, two pineapple swordtails, and one catfish).

The fish videotape was a modified version of a videotape produced by the Candle Corporation that showed (almost exclusively in close-up shots) a variety of colorful tropical fish swimming in an

aquarium. The audio portion of the videotape was enhanced by superimposing the sound of a stream trickling over rocks.

Each of the three placebo videotapes began with a speech (delivered by an individual experienced in developing placebo tapes) designed to convince the study participants that the tape they were about to see contained subliminal messages that would help them relax by affecting the subconscious. In actuality, the placebo videotapes were color tapes of television lines and static.

## **Instrumentation**

In total, four measures were used to conduct this study. As a manipulation check, a Treatment Evaluation Scale was constructed using a revised version of Beard and Ragheb's (1980) shortened Leisure Satisfaction Scale (LSS). The four relaxation items in the original LSS were modified so that reference was made to the intervention that the individual observed during the sessions. Response categories were "not at all" (= 1), "somewhat" (= 2), "moderately so" (= 3), and "very much so" (= 4). The Cronbach's alpha for the Treatment Evaluation Scale was 0.84, suggesting that the scale had a high degree of internal consistency for the elderly sample (Nunnally 1978).

Stress was measured using the responses of two different organ systems—the cardiovascular and the musculoskeletal. The validity of using cardiovascular activity as a psychophysiological response indicator has been reviewed elsewhere (Stern, Ray, and Davis 1980). Cardiovascular activity was measured two ways. One approach focused on the pulse rate, which becomes elevated following exposure to stress. Regarding the validity of pulse rate measurement, DeSchrive (1984) has noted a test-retest reliability of .85 with an elderly sample. For the study described here, pulse rate was measured as beats per minute using a Lumiscope Digitronic I Model 100-041 attached to the brachial artery of a participant's dominant arm.

Another cardiovascular response used to assess stress was skin temperature, which declines as a reaction to stress. Concurrent validity for this approach has been cited as .98 (Everly 1978). The test-retest reliability of skin temperature has been recorded as .85 (DeSchrive 1984). In this study, skin temperature was measured in degrees Fahrenheit using the Yellow Springs Temperature Meter mounted on a second digit of a participant's nondominant palmar surface arm.

Musculoskeletal activity was measured in terms of general skeletal muscle tension, which becomes elevated as a reaction to stress. Bicep electromyography (EMG) is reportedly a valid indicator of general skeletal muscle tension (DeVries 1970). The test-retest reliability coefficient for EMG with an elderly sample has been noted as .56 (DeSchrive 1984). Bicep EMG was recorded in microvolts by a Coulbourn Autoclinic 2001 connected on the bicep muscle of a participant's nondominant arm.

## **Procedures**

*Set-up.* Study participants were tested individually in the arts-and-crafts room (measuring approximately 25 by 22 feet) of the apartment complex where they resided. At the time of testing, no organized activities were conducted in or near this room. The room was converted into a laboratory setting by adding a padded armchair, a television tray stand (with a dimension of 1 by 2

feet), padded with a foam-rubber cover to enable the study participant's arm connected to testing apparatus to rest comfortably on the table, a landscaped fish aquarium, a 26-inch color television connected to a videotape recorder, the equipment used to measure the study participant's physiological responses, and a room divider that shielded the researcher and testing equipment from the participant's view.

*Testing Protocol.* The testing protocol consisted of the principal investigator greeting the study participant and then asking him/her to sit in the chair, which was positioned in front of either the fish aquarium or the television set. During their testing sessions, individuals who were not in the fish aquarium group could not see the fish tank, which was covered with a white sheet before the study participant entered the room and positioned behind the television set.

*Data Collection.* Although data were recorded at all three of the testing sessions, only the information collected during the third was used to analyze the stated hypotheses, because two testing experiences are considered necessary to acclimate individuals to testing procedures (R. J. Allen, pers. comm., 1988). An examination of the study participants' baseline scores from the three testing sessions revealed that they indeed acclimated to the testing procedures (i.e., pulse and EMG rates decreased and skin temperature increased when comparing baseline data from session 1 to session 2 and session 2 to session 3).

A cognitive stressor (reading aloud an emotionally stirring article for three minutes) was used in conducting the study (Allen 1983). The rationale for using a cognitive stressor is that the stressors individuals experience throughout their lives are primarily cognitive (affecting perceptions or thoughts) rather than physiological in nature. The article chosen described a tragic accident involving a woman firefighter who fell from a fire truck and her long and eventful recovery (Robinson 1984). During the first two sessions, the stressor was omitted from the testing procedures to reduce the probability of study participants habituating to it (Allen 1983).

Pretest scores for pulse rate, skin temperature, and muscle tension were derived by taking the arithmetic mean average of two readings done one minute apart in the baseline stage of testing. The posttest scores for the three measures were calculated by using the arithmetic mean average of eight readings done one minute apart in the treatment phase of the study.

After physiological testing in the third session had concluded, study participants were asked to respond to the Treatment Evaluation Scale questionnaire. Additional information concerning data collection has been reported elsewhere (DeSchrive 1984).

## Results

The Treatment Evaluation mean scores for the fish aquarium, fish videotape, and control groups were 12.33, 12.89, and 12.23, respectively. The difference among these scores was statistically insignificant ( $F [2, 24] = .08, p = .93$ ), suggesting that all three groups perceived their treatments as relaxing.

Table 1 presents pretest and posttest data on each of the dependent variables across the three groups. Regarding pulse rate, the fish aquarium pretest  $M = 72.02$ , posttest  $M = 73.19$ ) and the placebo group (pretest  $M = 72.39$ , posttest  $M = 72.61$ ) experienced an increase, whereas the fish

videotape group experienced a decrease (pretest  $M = 71.50$ , posttest  $M = 71.32$ ). Nevertheless, an insignificant change emerged on pulse rate when controlling for baseline differences on this measure ( $F [2, 24] = .50, p = .24$ ). Members of all three groups underwent an increase in skin temperature, with the biggest jump occurring in the fish videotape group (pretest  $M = 91.16$ , posttest  $M = 91.81$ ) relative to both the fish aquarium (pretest  $M = 94.08$ , posttest  $M = 94.23$ ) and the placebo group (pretest  $M = 91.92$ , posttest  $M = 91.98$ ). Intergroup comparisons, however, revealed an insignificant change in skin temperature after controlling baseline scores on this measure ( $F [2, 24] = .50, p = .30$ ). Both the fish aquarium (pretest  $M = 23.46$ , posttest  $M = 21.40$ ) and the fish videotape group (pretest  $M = 26.24$ , posttest  $M = 24.04$ ) registered a decrease in muscle tension as compared to the placebo group, which experienced an increase in muscle tension. No one group, however, relative to the other groups experienced a significant reduction in muscle tension ( $F [2, 24] = 37, p = .35$ )

Qualitative evaluations elicited from fish-gazing study participants revealed an overall sentiment that watching fish was a beneficial and enjoyable activity. Illustrative of this are such comments as "I was totally relaxed while watching the fish," and "I forgot about my problems while watching the fish." Moreover, at the conclusion of the study, a number of the study participants and their friends continued to observe the live aquarium on a daily basis.

## Discussion

In summary, there was a trend for aquarium observers to experience a decrease in pulse rate, an increase in skin temperature, and a decrease in muscle tension. In particular, the results of this study indicated that watching a videotape of a live fish aquarium had a greater impact on elderly persons' physiological stress than did watching a live fish aquarium or a placebo videotape.

More study is needed to substantiate the internal validity or efficacy of fish gazing as a means to affect the psychophysiological health of elders. It remains to be seen whether watching an aquarium for more than three sessions would substantially decrease pulse rate and muscle tension and increase skin temperature or simply result in habituation. Furthermore, the study results suggest that an object need not be animate in order to evoke relaxation—a point not addressed by this theory. Future investigators need to replicate the study using larger sample sizes. Such follow-up studies would determine whether statistically significant differences on the various dependent variables eventually emerge among the three groups.

Another key factor not accounted for in the relaxation theory is the importance of the participants' feelings toward the activity. As Heywood (1978) has pointed out, any experience labeled as "recreative" by participants reduces physiological arousal or stress. It is possible that viewing a live fish aquarium and/or television lines or static is out of the ordinary and not considered to be recreational by many elderly persons. On the other hand, watching a fish videotape is similar to a favorite pastime pursued by many elderly—namely watching television (Harris 1978).

The findings are nonetheless suggestive. Leisure and health-care professionals may find that providing opportunities for elderly clientele to view a stocked aquarium may help maintain or promote their psychophysiological health. The use of a fish videotape instead of a live fish aquarium would make sense when the viewing audience is unable or unwilling to maintain a live

fish aquarium and/or when the health-care staff has neither the time nor the expertise to monitor and care for a live aquarium.

In instances where live aquariums are feasible, practitioners may find that the viewing clientele will derive more from the experience if they are given an opportunity to decide on tank decorations and/or the responsibility of caring for the tank. Sociopsychological literature has noted that a concomitant effect of giving elderly people something alive to care for is improvement in health (Langer and Rodin 1976; Riddick 1984).

It may also be advisable to suggest or encourage members of the viewing group to name the fish. In the study described here, it was noted that each viewer of the live tank took particular interest in one or two fish and was often overheard conversing with others between sessions about these favorite fish. It became apparent to the investigators that the live fish acted as a social lubricant. In addition, individuals who were initially reticent to interact with the investigators became more animated, personable, and revealing when they learned that they had been selected to view a live fish aquarium. Indeed, the presence of an aquarium in a health professional's practice setting may serve as a catalyst for establishing a dialogue and an alliance with elderly clientele.

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**Table 1. Means and Standard Deviations for Dependent Variables by Group**

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Variable	<i>Group</i>					
	Fish aquarium ( <i>N</i> = 9)		Fish videotape ( <i>N</i> = 9)		Placebo videotape ( <i>N</i> = 9)	
	M	SD	M	SD	M	SD
<b>Pulse rate<sup>1</sup></b>						
Baseline	72.02	19.79	71.50	9.06	72.39	10.73
Treatment	73.19	17.27	71.32	9.60	72.61	8.71
<b>Skin temperature<sup>2</sup></b>						
Baseline	94.08	2.42	91.16	5.91	91.92	8.19
Treatment	94.23	2.60	91.81	5.12	91.98	8.38
<b>Muscle tension<sup>3</sup></b>						
Baseline	23.46	8.79	26.24	4.01	26.26	6.08
Treatment	21.40	11.12	24.04	4.89	24.62	6.50

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1. Pulse rate was measured as beats per minute.
2. Skin temperature was assessed in degrees Fahrenheit.
3. Muscle tension was recorded in microvolts.