



## Original Article

# Fluid Intake Status and its Relationship with Cognitive Impairment among Elderlies of Naein City, Iran

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## ABSTRACT

### Article history

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**Introduction:** Water, as one of the most essential nutrients, is involved in almost all biochemical processes of the human body. Although different degrees of dehydration have various symptoms such as physical and mental decline, severe dehydration is associated with decreased survival capacity in the physiological environment of the body that can put individuals, especially the elderly, at the risk of death. The present study aimed to determine the status of fluid intake and its association with cognitive impairments in the elderly people of Naein City in 2018.

**Methods:** This cross-sectional study was conducted among 225 randomly selected elderlies in Naein City. Data collection tools included demographic questionnaire, Mini-Mental State Examination, and 24-hour food recall questionnaire. The obtained data were analyzed using ANOVA, t-test and chi-square via SPSS software.

**Results:** The mean of total fluid intake was  $2637.05 \pm 772.35$  ml / day. Among 225 participants, 36.4%, 37.3%, and 26.2% had normal, mild, and moderate cognitive impairment, respectively. Cognitive impairment had a significant relationship with gender, occupational status, level of education, marital status, and place of residence ( $p < 0.05$ ). No significant relationship was observed between the mean of water consumption and cognitive impairment ( $p = 0.6$ ).

**Conclusion:** The amount of fluid intake in elderly people living in Naein City was at a satisfactory level. Since no significant relationship was observed between the amount of fluid intake and cognitive impairments and more than half of the participants had cognitive impairments, we hypothesize that other factors are involved in prevalent of cognitive impairment.

**Keywords:** Aged, Cognitive impairments, Fluid Intake

### Introduction

The importance and necessity of water in the body is well known (1). Adequate hydration to the body is essential for proper physical and mental functions. Although different degrees of dehydration have various symptoms such as physical and mental decline, severe

dehydration is associated with decreased survival capacity in the physiological environment of the body that can put individuals at the risk of death (2). Dehydration occurs when the body lacks enough fluid and cannot function properly. Depending on the amount

of fluid loss, dehydration is divided into mild, moderate, or severe types (3). Dehydration occurs normally during the day following sweating, breathing, shedding tears, and saliva secretion. Fluid loss is usually compensated by drinking fluids and foods containing fluids. Dehydration or heatstroke occurs if too much fluid is expelled from the body while the person does not drink enough fluids (4.)

Some causes of dehydration in the elderly include natural changes in old age, unwillingness to drink fluids and water, movement problems in preparing and drinking water, mental and psychological problems that reduce the need to consume water and fluids, as well as intake of diuretics (5). Some changes such as weight loss of kidneys, decreased blood supply to the kidneys, decreased ability to control body salts, decreased urinary concentration, and reduced feeling of thirst diminish the elderly's ability to maintain fluid balance, so that they are easily at risk of fluid loss (1, 6). Evidences show that decreased cognitive function occurs with moderate levels of hypohydration. Mild dehydration can worsen brain function and even cause delirium. Delirium is defined as a disorder of short-term (from a few hours to a few days) fluctuating consciousness, attention, and concentration that usually begins abruptly and is associated with impaired orientation, short-term memory impairment, changes in sensory perception (hallucinations), abnormal thought processes, and disordered behavior (7). The literature shows that mild dehydration also impairs the short-term memory (6-9). Inability to absorb and retain the required amount of water can lead to cognitive dysfunction, emotional dysfunction, and decreased physical performance (10, 11). Mild symptoms of dehydration include dizziness, headache, and fatigue, which may lead to the loss of consciousness and ability to concentrate consequently. Feeling thirsty can lead to negative mental effect (up to 10%). In other words, mental function decreases by the increase of dehydration (12, 13).

According to the previous study, only 22% of the required water for body can be supplied by food intake (14, 16-19). Considering the scarcity of research on the fluid intake status and its relationship with some diseases, especially among the elderly people in Iran, the present study was conducted to determine the status of fluid intake and its relationship with cognitive impairments in the elderly people in Naein City.

## Methods

### *Participants and procedure*

The present descriptive cross-sectional study was conducted among the health centers of Naein city, Isfahan in 2018. This city has nine urban and rural health centers, of which two urban centers and one rural center were selected by cluster sampling method. Considering the 95% confidence level, the standard deviation in the frequency of fluid consumption per day  $S = 2.5$ , and the measurement error of  $E = 0.4$ , the sample size was calculated as 150. According to the probability of sample loss, 225 people were finally selected by clustered random sampling (5).

The study participants were recruited via multi-stage cluster sampling method from the elderly people aged 60 years and over who referred to the determined health centers and met the inclusion criteria. Inclusion criteria in this study were having 60 years of age and older, not taking high dose blood pressure and depression medications, not having Alzheimer or Parkinson's disease, and not addicted.

### *Instruments*

The data collection tools included a demographic questionnaire completed for the participants followed by obtaining their informed written consent forms. The questionnaire consisted of individual characteristics, including age, gender, occupation, level of education, marital status, and place of residence. Furthermore, the elderly's fluid intake status was investigated using a 24-hour food recall questionnaire and Mini-Mental State Examination (MMSE) was used for determining their cognition status. The 24-hour food recall questionnaire not only determines the frequency of food consumption using checklists, but also monitors the 24-hour food recall information. Lists designed for double control usually include a large number of foods. They may contain too many foods or only foods with specific ingredients, such as the amount of water in the food depending on the purpose of the checklist. This questionnaire was validated by Rashid Khani et al. in 2011 (20).

The MMSE, administered to identify memory impairment in the elderly, includes orientation, attention and calculation, language, and construction components. This questionnaire was designed in 1975 by Folstein et al. (21) Seyedian et al. (2006) validated the Persian version of this questionnaire (22). This questionnaire consists of 20 questions and its maximum attainable score is 30, so that obtaining a score within the range of 27 -30, 21-26, 11-20, and 0-10 shows that the respondent is normal, weak, moderate, and severe in terms of cognitive impairments, respectively.

### *Data analysis*

Data analysis was performed via Modified Nutritionist IV (NUT 4) software. Pearson, t-test, and ANOVA tests were used to examine the relationship between the amount of fluid intake and demographic variables such as age, gender, place of residence, education, marital status, occupation, and body mass index. Chi-square test and ANOVA test were run to examine the relationship between fluid intake and cognitive impairment. Finally, the obtained data were analyzed using SPSS software version 16.

### *Ethical considerations*

The research was approved by the Ethics Committee of the Shahid Sadoughi University of Medical Sciences (IR.SSU.SPH.REC.1397.084). The questionnaires were collected anonymously and the participants were ensured about confidentiality of the information. They were also asked to sign informed consent forms to participate in the study.

## Results

The mean age of participants was  $68 \pm 7.5$  years; 37.3% of the participants were men and 62.7% were women; and 66.2% were urban residents and 33.8% resided in rural areas. The distribution of participants in terms of age, gender, body mass index, place of residence, education level, occupation, and marital status is shown in Table 1.

The total mean fluid intake was  $2637.05 \pm 772.35$  ml / day. Total mean and standard deviation of fluid intake was  $275.28 \pm 285.789$  in men and  $2596.40 \pm 715.366$  in women.

No significant relationship was observed between the mean of consumed fluids and demographic variables.

Among 225 participants, 36.4%, 37.3%, and 26.2% had normal, mild, and moderate cognitive impairment, respectively. A statistically significant relationship was found between cognitive impairments and some variables such as gender, place of residence, educational level, occupation, and marital status ( $p < 0.05$ ). The prevalence of cognitive disorders was higher in women than men ( $p < 0.001$ ) and in elderly living in urban areas than those living in rural areas ( $p = 0.04$ ). Moreover, the prevalence of cognitive impairments was higher in illiterate participants than the literate ( $p < 0.001$ ). In terms of occupation, the prevalence of cognitive impairments was higher in participants who were housekeeper, retired, and unemployed than the employed ones ( $p < 0.001$ ). The prevalence of cognitive impairments was also higher in widows and divorced individuals than single and married ones ( $p < 0.001$ ). The frequency distributions of cognitive impairments in terms of demographic characteristics and chi-square test results are presented in Table 2.

Table 3 presents the results of ANOVA test with regard to the relationship between fluid intake and cognitive impairment, so that the total mean fluid intake was not significantly different between the normal elderly people and those with cognitive impairments ( $p > 0.05$ ).

## Discussion

Water is one of the most essential nutrients involved in almost all biochemical processes of the human body. The aim of this study was to determine the amount of fluid intake and its relationship with cognitive impairments in the elderly people of Naein City in 2018.

The mean total fluid intake was within the desired range according to the standard rate recommended by the World Health Organization (2200 to 2900 ml per day) as well as the results of a similar previous study (23). These findings can be justified by the hot weather (given that this study was conducted in the summer) as well as the climate conditions of Naein City. The findings of another study among the 18-65 year-old population in Tehran showed that increase of the air temperature from 27 to 31 °C increased the amount of fluid consumption by 35% (3). Some other factors

leading to optimal water consumption included lack of teeth and increased use of beverages and liquid foods in the elderly. Furthermore, people living in hot and dry areas have special local foods and drinks to spend hot days of the year. According to Abdollahi et al., the amount of fluids consumed by the adult population of Tehran, defined as the mean consumption rate of fluids in this study, was reported as 1900 ml per day (3). Armstrong et al. reported 1,400 ml per day as the mean per capita intake of fluid among the Canadian adults (24). In 1980, Hopkins and Elise noted that the mean per capita of fluid intake was 1,600 ml per day in the United Kingdom (25).

Based on the findings, no significant relationship was found between fluid intake and cognitive impairments, while such an association was expected according to a previous study (4). Since the mean fluid intake was at an acceptable level among the participants, we hypothesized that other factors, such as substances in water and food, may have been involved in causing cognitive impairments in the elderly people that requires further investigations. Irandoost and Mohammadzadeh examined the chemical quality of drinking water of some wells in the cities of Isfahan province and showed that the drinking water of Naein wells had the highest amount of chlorine, soluble solids including calcium, magnesium, potassium, sulfate chloride, bicarbonate, and salt sulfates. Concentrations of some of these substances were reported up to three times higher than the permissible limit (26).

**Table 1. Frequency distribution of the participants' demographic information**

Variable	N	%	
<b>Age</b>	60-69	142	62.11
	70-79	61	26.11
	80-89	20	8.90
	90-99	2	0.90
<b>Gender</b>	Male	84	37.30
	Female	141	62.70
<b>Body Mass Index</b>	Underweight	5	2.20
	Normal	111	49.30
	Overweight	69	30.70
	Obese	34	15.10
	Severe obesity	6	2.70
<b>Place of residence</b>	Urban area	149	66.20
	Rural area	76	33.80
<b>Educational level</b>	Illiterate	119	52.90
	Primary school	67	29.80
	High school	19	8.40
	Diploma	6	2.70
	University	14	6.20
<b>Occupation</b>	Housekeeper	129	57.30
	Employed	12	5.30
	Unemployed	18	8.00
	Retired	66	29.30
<b>Marital status</b>	Single	2	0.90
	Married	179	79.60
	Widow	42	18.70
	Divorced	2	0.90

Table 2. Frequency distribution of cognitive impairments in terms of demographic information

		Cognitive impairment			p-value
		Normal	Mild	Moderate	
Age	Age 60-69	25.12	21.13	13.17	0.10
	70-79	7.15	10.16	7.1	
	80-89	1.70	2.60	4.40	
	90-99	0.00	0.90	0.00	
Gender	Male	16.00	18.20	3.10	0.00
	Female	20.40	19.10	23.10	
Body Mass Index	Severely underweight	1.80	0.00	0.40	0.10
	Underweight	14.70	19.1	15.60	
	Normal	13.30	12.00	5.30	
	Obese	5.80	4.9	4.40	
	Severely obese	0.90	1.30	0.40	
Place of residence	Urban	26.20	20.90	19.10	0.04
	Rural	10.20	16.40	7.10	
Educational level	Illiterate	10.70	19.60	22.70	0.00
	Primary school	11.60	14.70	3.60	
	High school	6.20	2.20	0.00	
	Diploma	2.70	0.00	0.00	
	University	5.30	0.90	0.00	
Occupation	Housekeeper	16.90	18.70	21.80	0.00
	Employed	1.80	3.10	0.40	
	Unemployed	16.40	11.60	1.30	
	Retired	1.30	4.00	2.70	
Marital status	Married	32.90	30.70	16.00	0.00
	Single	0.90	0.00	0.00	
	Divorced	0.40	0.00	0.40	
	Widow	2.20	6.70	9.80	

Table 3. Relationship between fluid intake and cognitive impairment

Mean fluid intake	N	Mean $\pm$ SD	ANOVA
Cognitive impairment		ML/day	p-value
Normal	82	2649 $\pm$ 826.71	0.60
Mild	84	2683 $\pm$ 796.75	
Moderate	59	2553 $\pm$ 656.04	

A study over 383 French women indicated a statistically significant relationship between the consumption of aluminum-containing water and cognitive impairment (27).

Our findings showed that about 63.5% of the participants had mild or moderate cognitive impairments, but Khairkhah et al. reported that about 30% of the participants had cognitive impairments (28). In the study by Mirzaei et al. in Khorramabad, Iran, only 3.34% of the participants had cognitive impairments (31). In Patel and Singh's study in India, about 25% of the participants had cognitive impairments (29). The higher prevalence of mental disorders among our participants, compared to other studies, can be due to the improvement of public awareness about these disorders and more frequent

referral of the patients to specialized centers compared to the past.

Findings indicated that cognitive impairments had a statistically significant relationship with gender, occupation, education level, marital status, and place of residence. These results are consistent with the findings of Mirzaei et al., who showed that the prevalence of cognitive impairments was higher in female and unemployed participants (30). Patel and Singh cited education and employment status as factors influencing cognitive impairment (31). Ahmadvand et al. examined 1800 people living in Kashan, Iran and showed that cognitive impairments had a statistically significant relationship with gender, level of education, employment status, and marital status. It seems that lack of facilities and recreational places, high economic pressures of the last decade, unemployment, and low income are effective in creating cognitive impairments (11).

Among the participants with mild and moderate levels of cognitive impairment, 56% and 72% lived in the city, respectively. This high prevalence of the disease can possibly be due to stress and other problems of urban life.

## Conclusion

According to the findings, it seems that the elderly residents of Naein City receive adequate amounts of fluids, which was not far from expectation considering that this city is located in a hot and dry area. The incidence rate of cognitive impairment was 63% among the participants, which is relatively high. Given that no significant relationship was found between the mean intake of fluid and cognitive impairment, other causes should be involved in this disorder. Since people use the water from cisterns and reservoirs, more detailed studies are required over dredging methods and standardization of water reservation sites. Moreover, the presence and concentration of lead, arsenic, and other heavy metals should be examined and measured exactly in the water of these reservoirs because such hazardous ingredients can cause many diseases and disorders, including cognitive and neurological impairments.

## Study limitations

The selection of participants was limited due to some inclusion criteria, such as not taking certain drugs. Data collection was also conducted in the warm months of the year, which could affect the amount of fluid consumption.

## Conflict of interest

The authors declare that they have no conflict of interest.

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## Authors' contribution

Z. M. designed the study; Z.M. and F.K. collected the data; Z.M., H.F. performed statistical analysis; Z.M. and F.K. prepared the manuscript. All authors have read the manuscript and approved its final version.

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