INTRODUCTION

Mild cognitive impairment (MCI) is a syndrome defined as cognitive decline greater than expected for an individual's age and education level but that does not interfere notably with activities of daily life *(Gauthier et al., 2006)*. The overall prevalence of MCI increases with age from 19% in population younger than 75 years to 29% in those older than 85 years *(Lopez et al., 2003)*.

Some people with mild cognitive impairment seem to remain stable or return to normal over time, but more than half progress to dementia within five years *(Gauthier et al., 2006)*. A study shows that elderly patients with MCI can convert to Alzheimer's disease at a rate of 10-15% yearly *(Gimzal and Yazgan, 2004)*.

Central auditory processing disorder (CAPD) is defined as deficit in the perceptual processing of auditory stimuli and the neurobiological activity underlying that processing. This type of disorder may occur with normal hearing or may co-exist with, or occur secondary to peripheral hearing loss *(Beck and Bellis, 2007)*.

CAPD may lead to difficulties in various auditory functions that are important for listening and comprehending spoken language and difficulty with lateralization localization, auditory discrimination, auditory pattern recognition and other temporal processing deficits *(Beck and Bellis, 2007)*.

CAPD is common among elderly population; it may affect up to 75% of them. In addition, CAPD can compromise success with hearing aids *(Beck and Bellis, 2007)*. Studies show that Central auditory function was affected in patients with mild memory impairment *(Gates et al., 2008)*.

Central auditory speech-processing deficits may be an early manifestation of probable Alzheimer's disease and may precede the onset of dementia diagnosis by many years. It has a positive predictive value for subsequent probable Alzheimer's disease of 47% with a sensitivity of only 17.5% *(Gates et al., 2002)*.

Gates et al. (2008) studied central auditory dysfunction in older persons with memory impairment. They recommended application of central auditory testing as a part of comprehensive, individualized program to assist their needs in both aural

rehabilitative and the cognitive domains. Accordingly, it is mandatory to evaluate the central auditory function in Egyptian elderly patients with and without cognitive impairment before application of central auditory testing as a part of comprehensive, individualized program.

AIM OF THE WORK

1. To study central auditory function in elderly population with mild cognitive impairment.

2. To compare the results of central auditory function in elderly population with cognitive impairment versus those without cognitive impairment.

THE HYPOTHESES

The question whether mild cognitive impairment is associated with decline in the central auditory function among Egyptian elderly or not and the pattern of affection of central auditory function.

Chapter 1

AGING OF POPULATION IN EGYPT

One of the main features of the Egyptian population over the last few decades is the gradual increase in the absolute and relative numbers of old people *(Gad Allah, 2004)*.

Change in the size and proportion of elderly in Egypt

The percent of old people (defined as 60 years of age or more) was 6.9% of the total population according to Egyptian census in 2004. The expected percentage of older people may reach 8.9% in 2016 and 10.0% in 2026. Accordingly, the expected rate of increase in total population from 1996 to 2026 is about 57%, while the expected rate of increase among older people during the same period is about 79% *(Gad Allah, 2004).*

According to preliminary results of Egyptian census in 2006 elderly will constitute 6.27% of population as shown in Table (1) Central Agency for Public Mobilization and Statistics *(CAPMAS, 2006)*.

Table (1): Demographic data for Egypt *(CAPMAS, 2006)*

	Age Group			
	Less than 60		60 or above	
	No.	%	No.	%
Male	28,728,039	92.82%	2,221,650	7.18%
Female	39,297,297	94.4%	2,332,044	5.6%
Total	**68,025,336**	**93.735**	**4,553,694**	**6.27%**

Projection for Egypt indicates that the percentage of the old-old (people aged 75 years and older) will rise in the period 1995-2025 from 0.9% to 1.5% (with a 66% increase) compared to a rise from 5.8% to 8.9% in the younger-old group(people aged 60 to 74 years) (with a 53% increase) *(Gad Allah, 2004)*.

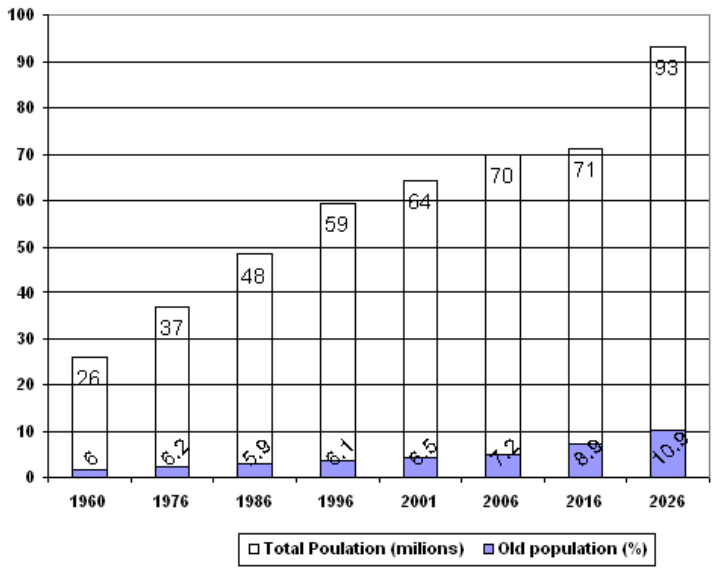

Fig. (1): Demographic data for Egypt *(Census Book, 2004)*.

Sex Ratio in Egyptian Population

In describing the various trends in population aging, it is important to take into consideration the changing proportion of females to males. A distinctive feature of the elderly population in all the countries is the higher sex imbalance among the "old-old". The preponderance of females is more pronounced in the 75 and older age group. The male to female sex ratio in Egypt is increasing over the years from 86.34:100 in 1960, 95:100 in 1976 to 99.79:100 in 1986, to less than 1 in 1996 *(Saad, 1997)*.

In Egypt, demographic data 2004 showed that for above 60 years old population the male to female ratio was 104:100 *(Badr et al., 2005)*.

Table (2): Sex distribution of the four age groups in Egypt *(CAPMAS, 2004)*

Age	Male	Female	Total
60-65	814.093	801.709	1.615.802
65-70	585.710	490.302	1.076.012
70-75	364.805	349.631	714.436
>75	277.987	260.127	538.114

Distribution of Senior Citizens in Egypt

The total area of Egypt is about 1.000.000Km^2 while the inhabited area is nearly 80.000Km^2. The population density is about 852 persons/Km^2 *(Gad Allah, 2004)*.

The majority of our population lives along the sides of Nile valley. More over, about 55% of our population lives in rural area (4100 villages) and about 45% lives in urban area(138 citizens) *(Gad Allah, 2004).*

It is important to note that 55% of the elderly in Egypt lives in rural areas, which lack the standard sanitary condition as well as health facilities. This situation leads to many health problems which in turn affect the socioeconomic development *(Cairo Demographic Center, 2003).*

While, 74% of the elderly are illiterate representing 14.3% of the total illiteracy in Egypt. Illiteracy is more common in rural area (48%) than in urban area (26%) and more in females (43%) than in males (31%) *(Cairo Demographic Center, 2003).*

Living environment of the elderly people in 2001 (CAPMAS, 2000)

According to report from this center most of elderly people (66.8%) live with sons and daughters and (13%) live with spouse. Small percentage (9.1%) of elderly people live with relatives other than mentioned before and the same percentage live alone due to different reasons.

Table (3): Marital status of senior females in Egypt *(CAPMAS 2000)*

Married	32.5%
Divorced	0.9%
Widow	65.6%
Never married	1%

Table (4): Marital status of senior males in Egypt *(CAPMAS 2000)*

Married	87.1%
Divorced	0.4%
Widow	11.8%
Never married	0.7%

The characteristics of older populations are heterogeneous within each nation. Ageing is associated with chronic degenerative diseases like hypertension, diabetes, cataract, deafness, osteoarthritis, chronic obstructive airway diseases, cerebrovascular disease and dementia, among others. Unlike younger age groups, the population aged 60 years and over has different personal and social resources, health, living arrangements and integration into social life. Because of this, individual needs alter considerably with increased age *(Ganguly, 2002)*.

Interrelated perspectives including demographic, social, economic and health are being studied and integrated measures are being suggested by developed and developing countries for better management of the conditions found among older populations *(Ganguly, 2002)*.

Chapter 2

COGNITIVE FUNCTIONS AND AGING

Definition

Sadock et al. (2001) defines it as the mental process of knowing and becoming aware; a function closely associated with judgment. *Beers and Berkow, (2000)* simply defines it as the ability to think and understand the world, And divide cognitive function into: Attention (the ability to focus and sustain thought and perception), Orientation to time and place, Memory involves learning (registration) or recalling what has been learned, Language function, Praxis (the ability to perform learned motor tasks) and Executive functions.

Jensen, (1998) states that fluid ability concept is similar to the concept of "raw" or innate intelligence that people have regardless of their culture. Fluid abilities develop over time as the brain matures neurologically and start to diminish in middle to late adulthood.

Crystalline abilities are the general knowledge of facts, strategies and skills that are the result of education, training and experience. Individuals develop these knowledge types during their lifetime

and it is often referred to as "wisdom" in later years. There is overlap between crystal and fluid intelligence, and an individual differences exist between fluid and crystallized abilities, which mean that some people are better at processing information for tasks than others *(Horn, 1987)*.

Cognitive function and effect of aging

Cognitive impairment becomes more common with advancing age. In a study of over 1000 physicians, there was an 18% decline in the total cognitive score between 40 to 70 years of age *(Powell, 1994)*.

The effects of cognitive decline are not noted before the age of 70 years, which involve the intellectual capacities, the attention, the processes of elaboration and the memory *(Motta et al., 2008)*.

Cognitive abilities decline with normal aging. Fluid abilities such as psychometric speed and problem solving show declines from early adulthood, and crystallized abilities such as knowledge and expertise increase until old age. These changes do not inevitably lead to dementia *(Anstey and Low, 2004)*.

With age, cognitive functions may remain stable or decline. In general, cognitive functions that remain

stable include everyday communication skills, many language skills, the ability to comprehend discourse, and simple visual perception. Vocabulary can improve even in persons in their 80s. Cognitive functions that decline include selective attention, naming of objects, verbal fluency, complex visuospatial skills, and logical analysis. Learning complex new tasks and foreign languages becomes more difficult with age *(Beers and Berkow, 2000).*

Intellectual abilities peak during the 30s, plateau throughout the 50s and 60s, and variably decline during the late 70s. Elderly persons may have difficulty with activities requiring a quick reaction time or high degree of precision, although they maintain the ability to understand their situation and learn from new experiences. Reduced reaction time can be compensated for by allocating more time for tasks *(Beers and Berkow, 2000).*

Deteriorating cognitive function in late life substantially increases the risk for dementia, other non-cognitive morbidity, dependency, and early death *(Cervilla et al., 2000)*. Declining cognitive function is a determinant of a number of unfavorable outcomes among the elderly, including increase limitations in

activities of daily living (ADL) and problems with independent living *(Freedman et al., 2002; Zsembik et al., 2000)*. It often leads to placement in a nursing home, hospitalization, and death *(Sloan and Taylor, 2002).*

To some extent, the general cognitive decline may reflect the growing inefficiency of general neurophysiologic systems, blood supply, neural connectivity, dopamine depletion and poor glucose metabolism *(Craik, 2008)*.

Deficits in learning and memory can occur with aging, but little is known about what causes them. Studies demonstrated age-related deficits in a variety of learning tests. Interestingly, cells in the brain become progressively less excitable with age, and previous studies suggested that this decrease in excitability could cause deficits in learning and memory *(Murphy et al., 2006)*.

There are at least 5 major memory systems, and that these systems show very different rates of decline in the course of aging. Episodic memory (for specific events) and working memory (for information held and manipulated in conscious awareness) typically fall off relatively rapidly, whereas memory for perceptual