Anthropometric Measures Among Hospitalized Diabetic Patients; Case Control Study

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Abstract

Background: Although many older people with diabetes are obese, a proportion is recognized to have malnutrition or lesser degrees of nutritional impairment. This study aimed to assess the nutritional status of hospitalized elderly diabetic patient using the anthropometric measures Hospital based case control study in Tikrit teaching hospital with random sampling method of 50 hospitalized elderly diabetics compared with 50 hospitalized non-diabetics. Nutritional assessment done depending on anthropometric measures : Height, weight, BMI, mid arm circumference , and calf circumference. About 6% of diabetics had BMI <18.5 with odds ratio2.17 , 30% had BMI<22 as an indicator of high mortality with odds ratio 2.17. About 12% of diabetic group had MAC ≤ 21 cm versus 4% for non- diabetic group, with odds ratio of 3.3. Calf circumference was <31cm for 48% of diabetics, vs36% of the non-diabetic group, with odds ratio of 1.64. Hospitalized elderly diabetics had non-significant lower anthropometric measures than non-diabetics, indicating nutritional status affection and, the need for an overall nutritional assessment tool encompassing all areas of nutritional evaluation other than anthropometric measures among elderly patients.

Key wards: elderly diabetics, hospitalized elderly, nutritional assessment of elderly

Introduction

Anthropometric measurements are important indicators of an individual's nutritional status[1], which it's derangement from normality is important risk factor for sever disease and disability in elderly[2]. The process of ageing is associated with progressive metabolic remodeling, which mainly affects anthropometric, endocrine and metabolic parameters. Although it occurs successfully in some individuals, in others it fails[3], there is a slow and progressive redistribution of fat, as intra-abdominal fat tends to increase and subcutaneous fat on the limbs tend to decrease[4].

With advancing age the risk of developing malnutrition increases, particularly among institutionalized patients [5]. Protein-energy malnutrition is common in the elderly, between 23% and 62% of hospitalized patients suffer from under nutrition [6].

This may be due to age-associated reductions in

food intake combined with the presence of debilitating diseases, social isolation, altered health status, economic limitations and multiple hospital admissions [7,8].

Older people with type 2 diabetes may have needs different from younger diabetic people, so both age and life expectancy should influence management, as well as any co-morbidities they may suffer from [9]. Older people with diabetes are under-represented in clinical trials and, as a result are often treated according to guidelines based on expert opinion and the dubious extrapolation of results from clinical trials in younger people [10].Little is known about the anthropometric and nutritional status of older people with DM. For the previously mentioned reasons there's a need to study the nutritional status of the diabetic elderly. Up to researcher's knowledge this study was the first in Iraq.

This study aimed to assess the nutritional status of hospitalized elderly diabetic patient using the anthropometric measures.

Patients and Methods

Study Design: Hospital based case-control study, done in Tikrit teaching hospital during the period (November. 1, 2009 - July 1, 2010).

patients aged 60 years or more and who stayed in the hospital for one or more days were included in the study. Fifty elderly diabetic patient for more than 1 year depending on the medical history and the venous fasting plasma glucose (FPG) of ≥7.0 mmol /1according to the definition and diagnosis of diabetes mellitus, recommended by a WHO/IDF Consultation[11] chosen randomly and compared with, fifty hospitalized non-diabetic elderly patient with venous FPG < 6.1 mmol / l[11].

Exclusion criteria

1. New CVA cases.
2. Patients with malignant disease.

Data collection:

Data collection was done in the first 24-72 hours of admission by direct interview of the patient or caregiver (if the patient had dementia or some other problem that prevent communication). A questionnaire was designed by the researcher for collecting the following data; Socio-demographic and life style characteristics, DM related information.

Anthropometric measures

Measurements of the weight, height, mid-arm circumference (MAC) in cm, calf circumference (CC) in cm were recorded in the questionnaire.

Weight: was measured in (kg) using UNICEF electronic scale. To obtain an accurate weight, shoes and heavy outer clothing of the subjects was removed.

Height: The height in (m) was measured by a measuring tape which was hammered on to the wall stadiometer. Height was measured without shoes. If the patient is bedridden, or unable to stand, height was measured using indirect methods such as measuring demi-span (half arm span), according to the method used by Hickson and Forst[12], by locating the midpoint of the sternal notch with the pen, asking the patient to place the left arm in a horizontal position, then by using the tape measure,

measuring the distance from the mark on the midline at the sternal notch to the web between the middle and ring fingers. The arm was flat and wrist was straight. The reading was recorded in cm. The height was calculated by the following formula:

Females height in cm = (1.35 x demispan in cm) + 60.1

Males height in cm = (1.40 x demispan in cm) + 57.8

From these measurements, the Body Mass Index (BMI) was calculated, as weight in Kg divided by height square in meter.

Using the BMI chart provided (Appendix III), patients were divided to according to the WHO classification[13] into underweight (BMI < 18.5), normal (18.5-24.99), pre obese (25-29.99) and obese (≥30). BMI classification as an indicator of mortality and morbidity was used, any patient had BMI <22 Kg/m2 or >29 Kg/m2 was classified as at risk of increased mortality and morbidity[14].

Mid Arm Circumference (MAC): After asking the patient to bend his non-dominant arm, at the elbow at a right angle with the palm up, the distance between the acromial surfaces of the scapula (bony protrusion surface of upper shoulder) and the olecranon process of the elbow (bony point of the elbow) on the back of the arm was measured. The mid-point between the two was marked, and then the patient was instructed to let the arm hang loosely by his/ her side. The tape measure was positioned at the mid-point on the upper arm and tightened snugly[15].

Calf Circumference (CC): The CC was measured while the subject sitting with the left leg hanging loosely or standing with their weight evenly distributed on both feet with uncovered calf. The tape then wrapped around the calf at the widest part, for recording. Calf circumference <31 cm considered as malnutrition (showing a good correlation with muscle mass and functional status in the elderly)[14].

Fasting plasma glucose (FPG): Venous plasma glucose was used for measuring glucose concentrations in blood. Plasma was immediately separated after collection and then glucose was measured[11]. The test was done in hospital laboratory.

Statistical analysis and data management:

The Statistical Package for Social Sciences (SPSS, version 10) was used for data entry and analysis. Chi ($\chi 2$) square, and Fisher's exact tests of association were used to compare proportions of different factors among cases with the same proportions among controls. P value of ≤ 0.05 was regarded as statistically significant.

Results

The age range was 60-87 years with a mean of 67.4±7.3 for diabetic group and 67.2±7.1 for non- diabetic group. The age group 60-69 year represented most of hospitalized patients and it was 66% among diabetics in comparison to 62% of non-diabetic patients, and this variation is statistically not significant ($\chi 2$=1.078, df=2, P = 0.583,) as shown in Table 1.

This study revealed that 6% of diabetic group were undernourished in comparison to one of non-diabetic group; 36% of diabetic group versus 38% of non-diabetics had normal BMI; 38% of diabetic group versus 38% of non-diabetics were overweight and 20% of diabetic group versus 22% of non-diabetics were obese. These variations are statistically non- significant (χ^2=1.07, DF=3, p=0.738), as shown in Table 2.

Thirty percent of the diabetic group have BMI < 22 in comparison to 15% among non- diabetics as an indicator of mortality. This variation is statistically non significant as shown in Table 3.

The proportion of diabetic group who had MAC ≤ 21 cm was 12% versus only 4% for non- diabetic group, with odds ratio of 3.3, as shown in Table 4. This variation is statistically non -significant (Fisher's exact test, P =0.269)

Calf circumference was <31cm for 48% of diabetics, in comparison to 36% for the non-diabetic group, with odds ratio of 1.64; this difference is statistically non-significant (χ^2=1.478, df=1, p= 0.224), as shown in Fig 1.

Diabetics had 2.17 fold risks to get BMI <18.5, and 1.04 to get BMI >30. Diabetic patients were 3.27 times exposed to have MAC <21cm, 1.64 times to have CC <31cm, 2.56 to get BMI < 22, and 0.68 to have BMI >29 than non-diabetics. These variations are statistically not significant, as shown in Table 5.

Discussion

In this study most frequently affected age group was 60-69 years; this goes with the findings of previous studies that reveal a consistent increase in the prevalence of type 2 DM with increasing age with values reaching a plateau in old age then declining slightly in the very old [16, 17].

According to WHO classification of BMI; this study shows that (6%) of diabetics are in the undernutrition group with odds ratio of 3.17, this is lower than that reported in Istanbul (8%)[18], and Taiwan (8.3%) [19]. This may be explained by the use of the lowest cut-off point for malnutrition in comparison to the other two studies which used 19 Kg/m2. The undernutrition in diabetics may be attributed to the above mentioned reasons.

BMI as an indicator to mortality in elderly population showed that about one third of diabetic group with odds ratio of 2.56 had had BMI of < 22, and (26%) of >29 with odds ratio 0.68, both BMI figures are considered at high risk of mortality and morbidity[16]. These figures are higher than among non-diabetics. This agrees with studies that found a U shaped relationship between mortality and BMI, with increased mortality at low and high BMI [20,21]. This may be due to accelerated rate of skeletal muscle mass and strength loss in diabetic patients which put them at high risk for sarcopenia[22].

This study revealed a non- significant variation in MAC, where (12%) of diabetics, had MAC ≤ 21cm in comparison to (4%) of non-diabetics, and the diabetics were 3.27 times at risk to hadMAC ≤ 21cm than non-diabetics. The non-significant variation may be due to the small sample size of this study. In a study done in Istanbul MAC ≤ 21cm was (6.6%) as demonstrated among hospitalized patients [18]. This difference may be due to the differences in population health characteristics, as well as that it was done on hospitalized patients without considering diabetic history.

The undesirable CC (<31cm) was higher among diabetics 48%, than non-diabetics 36%, and the diabetics were 1.64 times at risk to had CC ≤ 31cm than non-diabetics. A study in Istanbul found it (6.6% of the patient) [18]. The sample of the Istanbul study was taken regardless to the presence of DM. In addition to the current Iraqi situation which predispose for more proportions of malnutrition and the community characteristics which put elderly in a sedentary life style.

The finding of non- significant variations in the anthropometric measures, goes with that of Turnball in UK [23] and Padmalayam let al [24] who found a similar findings of non-significant decrease in anthropometric measures among diabetics indicating the need for an overall nutritional assessment tool encompassing all areas of nutritional evaluation other than anthropometric measures among elderly patients.

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Table 1 .Age distribution of the sample

P value	χ^2	Controls		Cases		Age
		%	No.	%	No.	
		62	31	66	33	**60-69 year**
0.583	1.078	30	15	22	11	**70-79 year**
		8	4	12	6	**≥ 80 year**
		100	50	100	50	**Total**

Table 2 .Nutritional status according to WHO classification of BMI among cases and controls

p value	χ^2	Controls		Cases		BMI
		%	No.	%	No.	
		2	1	6	3	<18.5
		38	19	36	18	18.5-24.9
0.783	1.07	38	19	38	19	25-29.9
		22	11	20	10	≥30
		100	50	100	50	Total

Table 3. BMI of diabetics and non-diabetics as an indicator to mortality in elderly population

p value	χ^2	**Controls**		**Cases**		**BMI as indicator to mortality**
		%	No.	%	No.	
		16	8	30	15	**< 22**
0.182	3.4	60	30	44	22	**22-28**
		24	12	26	13	**>29**
		100	50	100	50	**Total**

Table 4 . Nutritional status of diabetics and non-diabetics according to MAC

Fisher's exact test P value	**Controls**		**Cases**		**MAC**
	%	No.	%	No.	
	4	2	12	6	**MAC ≤ 21**
0.269	96	48	88	44	**MAC > 21**
	100	50	100	50	**Total**

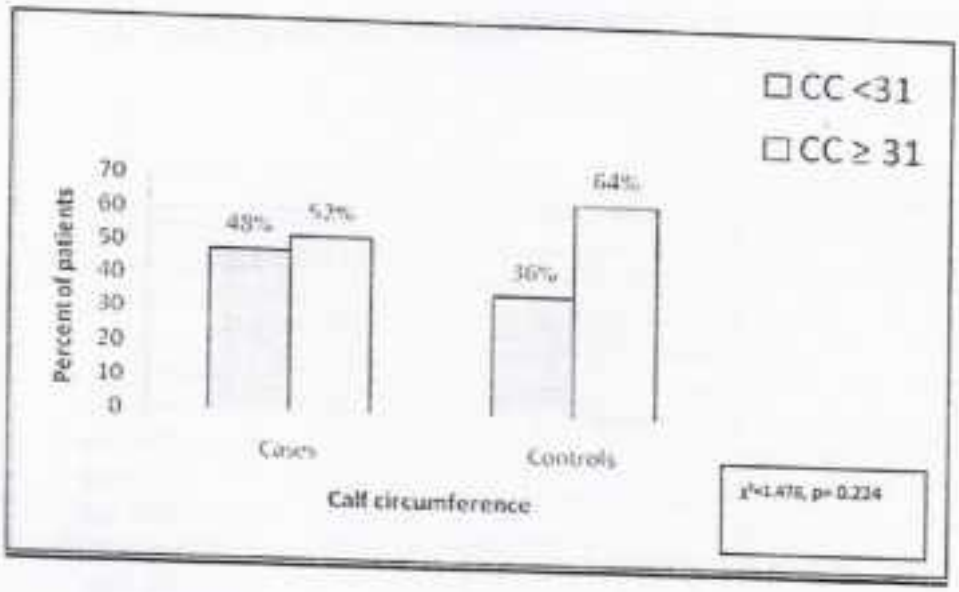

Fig 1 . Nutritional status according to CC of the elderly population among cases and controls

Table 5. The odds ratio for diabetic patients in relation to anthropometric measures.

P value	95% Confidence Interval Upper	Lower	Odds Ratio	Risk factors
			1	BMI 18.5-24.9
NS	33.31	0.30	3.17	BMI <18.5
NS	2.34	0.38	0.95	BMI 25-29.9
NS	3.04	0.36	1.04	BMI >30
			1	MAC>21cm
NS	17.07	0.63	3.27	MAC <21cm
			1	CC >31cm
NS	3.66	0.74	1.64	CC <31cm
			1	BMI 22-28
NS	7.09	0.92	2.56	BMI < 22
NS	1.76	0.26	0.68	BMI >29