Can patient's Nutritional Status and Nationality Predict the Cause of Admission and Hospital Length of Stay of Hajj Patients Admitted at the Medical Department in a Tertiary Hospital, Makkah

هل من الممكن ان تنبئ الحالة التغذوية للمريض الحاج وجنسيته عن سبب مرضه و مدة بقائه في المستشفى ؟

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ملخص البحث

تستقبل مكة كل عام ملايين الحجاج من كافة انحاء المعمورة مما يزيد العبء على الخدمات الصحية في العاصمة المقدسة اثناء فترة الحج و يبين اهمية التنبؤ بالتشخيص المرضي و مدة اقامة المريض بالمستشفى.

الطريقة والنتائج

تم اجراء البحث على عدد ١٦٣ مريض حاج تم تنويمهم بقسم الباطنة بمستشفى النور التخصصي بمكة المكرمة في الفترة من الاول الى الخامس عشر من ذي الحجة عام ١٤٣٠ . تمت دراسة المرضى من حيث بيانات المريض و حالته التغذوية و الفحوصات المعملية الاساسية و مدة بقائه في المستشفى.

بينت النتائج ان متوسط العمر للمرضى كان (11 ± 59.4) سنة وان 57.7 ٪ منهم كانوا من الرجال و ان متوسط مؤشر كتلة الجسم كان (5.6 ± 23.8) كيلو جرام لكل متر مربع المساحة السطحية للجسم و كان تصنيفهم كالتالي : 45.5% من المرضى مؤشر كتلة الجسم طبيعي 23.9% يعانون من نقص مؤشر كتلة الجسم عن الطبيعي(سوء تغذية) و 18% يعانون من وزن زائد و

12.6% يعانون من السمنه . وكان سبب التنويم في المستشفى كالتالي : امراض الجهاز التنفسي في 44.2% من الحالات و وأمراض الجهاز الهضمي في 22.1% من الحالات و الامراض العصبية في 11% و المشاكل المتعلقة بمرض السكري في 10.4% من الحالات و نسبة 12.3% لأمراض اخرى. وكان متوسط بقاء المرضى في المستشفى هو 2.47 ± 3.9 يوم وان 17.8 % من المرضى مكثوا في المستشفى لمدة اطول من المدة المتوقعة وكانت نسبة النساء فيهم اكثر من الرجال (26% للنساء و 11.7%من الرجال). وكانت اقل فترة مكوث في المستشفى في المرضى ذوي مؤشر كتلة الجسم الطبيعي (2±3.64 يوم) بينما كانت اطول فترة مكوث في المستشفى في المرضى الذين يعانون من السمنة 4.1±4.52 يوم. و ترجع جنسيات المرضى الى 34دولة يمكن تقسيمها الى 6 مجموعات: مجموعة دول جنوب أسيا (31.9%) الدول العربية (25.8%) دول جنوب شرق أسيا (23.3%) وسط أسيا (11.7%) الدول الافريقية غير العربية (4.3%) و دول اخرى (3%). يزداد سوء التغذية في كبار السن (84.6%) و في المرضي الافارقة (57% منهم) و القادمين من جنوب شرق أسيا(39.5%) بينما كانت النسبة تبلغ 15% او اقل في المجموعات الاخرى.

في المرضى الذين يعانون من نقص مؤشر كتلة الجسم عن الطبيعي تزداد نسبة الاصابة بالأمراض الصدرية (35%) بينما تقل نسبة الاصابة بالأمراض العصبية (5.6%) . بينما في المرضى الذين يعانون من السمنة و زيادة الوزن تقل نسبة الاصابة بالأمراض الصدرية (21%) و تزداد نسبة الاصابة بالأمراض العصبية (61%).

الخلاصة: جنسية المريض الحاج و حالته التغذوية يمكن ان تساعد في التنبؤ بالتشخيص المرضي و مدة اقامة المريض في المستشفي مما يساعد الفريق الصحي في تقديم افضل خدمة صحية للحجاج.

Abstract

Hajj is the annual holly pilgrimage for Muslims coming from all around the world. Makkah hosts 2-3 millions of Muslims during the month of Hajj; this increases the burden on the health care facilities. The aim of the study was to assess the nutritional status and nationality of Hajj patients admitted at the medical department, Al Noor hospital, Makkah, and its relation to the cause of admission and hospital length of stay (HLOS). Patients and methods: 163 patients were admitted during the hajj season (1st - 15th Zul Hijjah, 1430). All patients were studied as regards the demographic characters, nutritional status, hospital length of stay and cause of admission. Nutritional status included weight, height, mid arm circumference, mid arm muscle circumference and triceps skin fold thickness. Results: The mean age of patients was 59.4 ± 11 yrs., and 57.7% of patients were males. Mean body

mass index (BMI) was 23.8 ± 5.6 kg/m2, (45.4% of patients had normal nutrition status, 23.9% had under-nutrition status, 18% of patients were overweight and 12.7% were obese). The commonest cause of admission was respiratory diseases (44.2%) followed by Gastrointestinal diseases (22.1%), Neurological diseases (11%), Diabetes Mellitus complications (10.4%) and other diagnosis (12.3%). The mean HLOS was 3.9±2.47 days and prolonged HLOS (more than 5 days) was reported in 17.8% of patients. HLOS was significantly more in females compared to males (26% vs11.7%). The shortest duration of HLOS was in normal BMI patients (3.64±2 days), while the longest was with the obese patients (4.52±4.1 days). Patients' nationality includes 34 countries gathered in 6 groups: 31.9% of patients were from South Asia, 25.8% were from Arabic countries, 23.3% from South East Asia, 11.7% from central Asia, 4.3% from sub-Saharan Africa and 3% from other areas. There was a statistically significant increase of undernutrition in patients aged 60 ≥ years (84.6% versus 15.4%). MAC, TSF and MAMC are statistically significant indicators of nutrition status (p 0.00). Undernutrition was significantly more in African patients (57%) and South East Asian (39.5%) while it was less than 15% in other groups. Also, in undernourished patients, respiratory diseases were more common (35%) and neurological diseases were less common (5.6%) on the other hand; in overweight and obese patients, the respiratory diseases were less common (21%) and the neurological diseases were more common (61%). In conclusion: In 1430 Hajj season, 163 patients were admitted at the medical department, the mean age was 59.4 ± 11 yrs., males were more than females (57.7% vs 42.3), 32% came from south Asia, undernutrition was found in 23.9% of patients, while 12.7% were obese, respiratory diseases were the commonest cause of admission (44.2%); it was more common in undernourished and less in obese patients in the reverse to neurological disease which is commoner in obese patients. Mean hospital length of stay was 3.9±2.47 days; HLOS was more prolonged in females and in obese patients.

Introduction

Hajj is a cosmopolitan conference, which takes place annually in the 12th month of the Islamic lunar calendar, it is one of the largest, most culturally and geographically diverse mass gatherings in the world. Makkah hosts over 2 million of Muslims coming from more than 140 countries (Memish *et al*., 2012).

Performance of the Hajj is physically demanding. Extreme physical stressors such as sun exposure, crowding and traffic congestions increase health risks. Also, pilgrims tend to be older and many have medical comorbidities (Gautret *et al.,* 2009), these factors exacerbate existing risk for disease, fluid and electrolyte abnormalities, and respiratory and other infectious diseases (Mandourah *et al.,* 2012)

Pilgrims are coming from all around the world differing in their health and nutrition states. According to the Medical Subject Headings (MeSH®) nutrition status is the state of the body in relation to the consumption and utilization of nutrients and malnutrition is defined by the European Society of Clinical Nutrition and Metabolism (ESPEN) as "a state of nutrition in which a deficiency or excess (or imbalance) of energy, protein, and other nutrients causes measurable adverse effects on tissue/body form (body shape, size and composition) and function, and clinical outcome" (Lochs *et al.,* 2006)

The purpose of nutritional screening is to rapidly identify patients at high nutritional risk. The purpose of nutritional assessment, however, is to define a patient's nutritional status, to define clinically relevant malnutrition and to monitor changes in nutritional status (Kyle and Coss-Bu, 2010)

The King Saudi Arabia (KSA) provides free healthcare to all pilgrims during the Hajj. In 2009, the KSA Ministry of Health prepared 24 hospitals with a total bed capacity of 4,964 beds (Memish, 2010). HLOS has been used as a surrogate marker for patients' well-being during hospital treatment and as an indicator of health care efficiency (Murphy and Noetscher, 1999). HLOS is defined by the Mosby's Medical Dictionary as the period of time a patient remains in a hospital or other health care facility as an inpatient **.**

The aim of the study was to assess the demographic characters and the nutritional status of Hajj patients admitted at the medical department, Al Noor hospital, Makkah, and its relation to the cause of admission and HLOS.

Patients and methods: This is a prospective, descriptive cross-sectional study including 163 consecutive Hajj patients admitted at the medical department, Al Noor Specialist Hospital, which is a 550-bed tertiary care teaching hospital, in Makkah, KSA. The inclusion criteria included all adult non-Saudi hajj patients, admitted during the period (1 to 20/12/1430 H – 18/11 to 7/12/2009). All patients were evaluated for demographic characters: age, sex, and

nationality; cause of admission, nutritional status including anthropometric measures and HLOS:

The cause of admission includes:

A. Respiratory diseases: mainly respiratory tract infections and respiratory failure.

B. Gastroenterology cases: mainly GI bleeding and liver diseases.

C. Neurology cases: mainly cerebrovascular stroke patients.

D. Diabetic patients: mainly the complications of hyper or hypoglycemic states.

E. Others: other diagnosis as chronic renal failure cases.

Cardiac patients were admitted in the cardiology department.

Nationality: patients were classified according to their nationality into 6 groups; Arabic countries, African (non-Arabic), South Asian, South East Asian, Central Asian and others. (table 1)

Length of stay: the number of nights of hospital admission, it is considered prolonged if more than 5 days.

The anthropometric indicators were:

Weight (W) using with an electronic scale with a maximum capacity of 150 kg and accuracy of 0.1 kg and 200 cm for height.

Height (H): within the electronic scale max 200 cm approximated to the nearest cm.

Mid arm circumference (MAC).

Triceps skin fold thickness (TSF).

Body Mass Index (BMI): weight in Kg/ (height in meters)^2 (kg/m^2).

Mid Arm Muscle Circumference (MAMC): MAMC = MAC − (0.314 × TSF).

According to the World Health Organization criteria (WHO) (WHO, 1998), the Nutritional Status was classified according to the BMI as follows: BMI <18.5 = Under-nutrition; 18.5 < BMI < 24.9 = Normal; 25 < BMI < 29.9 = Overweight; BMI > 30 = Obese. The BMI for elderly patients (60 years or older) was classified according to Lipschitz (Lipschitz DA. 1994) BMI < 22 = Under-nutrition; 22 < BMI < 27 = Normal; 27< BMI < 29.9 =

Overweight and BMI > 30 = Obese. The skin fold was measured with a measurement range of 0-60 mm and accuracy of ± 1.0 mm, and a 150-cm inelastic tape measure with accuracy of 0.1 cm was used for the other measures. MAC and TSF were normalized according to Frisancho AR. 1981, since they represent different gender and age, as: data x 100, divided by data of 50th percentile. The data were transformed into dichotomous variables: TSF < 70% (severe depletion) or TSF > 70% (not severe depletion) and MAC < 25 cm (with depletion) or MAC > 25 cm (without depletion), as previously defined and used by Powell-Tuck (Powell-Tuck J and Hennessy EM 2003).

Types of diseases were classified to respiratory, digestive, neurological, diabetic or others.

Age was stratified as adult (< 60y) and elderly (60y or more). The LOS was categorized into two groups: up to 5 days (short) and >5 days (long).

Reference Values for Mid-arm Muscle Circumference

Age	50^{th} Male	50^{th} females
18 - 24	27.2	20.6
25 - 34	28.0	21.4
35 - 44	28.7	22
45 - 54	28.1	22.2
55 - 64	27.9	22.6
65 - 74	26.9	22.5

Developed from data collected during the NHANES I, 1974. (Bishop, C.W. *et al.*, 1981)

Reference Values for Mid-arm Muscle Circumference

Males (cm percentile)

Age	10th	25th	50th	75th	90th
18 - 24	24.4	25.8	27.2	28.9	30.8
25 - 34	25.3	26.5	28.0	30.0	31.7
35 - 44	25.6	27.1	28.7	30.3	32.1

45 - 54	24.9	26.5	28.1	29.8	31.5
55 - 64	24.4	26.2	27.9	29.6	31.0
65 - 74	23.7	25.3	26.9	28.5	29.9

Females (cm percentile)

Age	10th	25th	50th	75th	90th
18 - 24	18.5	19.4	20.6	22.1	23.6
25 - 34	18.9	20	21.4	22.9	24.9
35 - 44	19.2	20.6	22	24	26.1
45 - 54	19.5	20.7	22.2	24.3	26.6
55 - 64	19.5	20.8	22.6	24.4	26.3
65 - 74	19.5	20.8	22.5	24.4	26.5

Developed from data collected during the NHANES I, 1974. Bishop, C.W. *et al.*, 1981.

Statistical analysis

Demographic, nutritional parameters, nationality and cause of admission data were collected. IBM SPSS Statistics 17 program was used for data analysis. Dichotomous or categorical variables were presented as number and percentage. Continuous variables were presented as mean ± standard deviation. Univariate analysis by using Pearson Chi square test was used to compare dichotomous or categorical variables, and two tailed t test for continuous variables. Dichotomous variables considered to be risk factors for longer length, undernutrition, age; gender and anthropometric variables were analyzed using a logistic regression model. Significance was considered at P value 0.05 or less. (Levesque, R. 2001)

Results: The aim of the study was to assess the demographic characters and nutritional status of Hajj patients admitted at the medical department and its relation to the cause of admission and HLOS. This may help the local health providers in their health planes

during hajj season. One hundred sixty three patients from 34 countries were admitted at the medical department during the hajj season 1430 (1 to 15/12/1430 H – 18/11 to 2/12/2009). The mean age of patients was 59.4 ± 11 yrs., and 57.7% of patients were males. More than half of the patients (52.1%) were old age patients (age ≥ 60 yrs.). Mean BMI was 23.8 ± 5.6 kg/m^2. No significant difference was found between male and female patients in different nutrition states (p 0.245). The mean HLOS was 3.9±2.47 days and prolonged HLOS (more than 5 days) was reported in 21 patients (17.8%). HLOS is prolonged in obese patients but not reaching the level of significance. Respiratory diseases are the commonest cause of admission (44.2%). Under-nutrition was detected in 39 patients (23.9%); thirty three of them were elderly patients (84.6%).

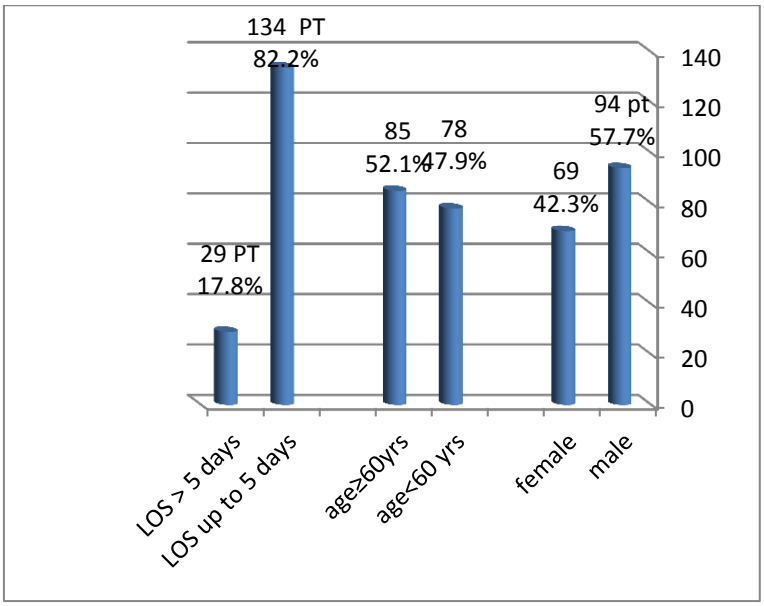

Fig (1): General parameters of pilgrims admitted to the medical floor.

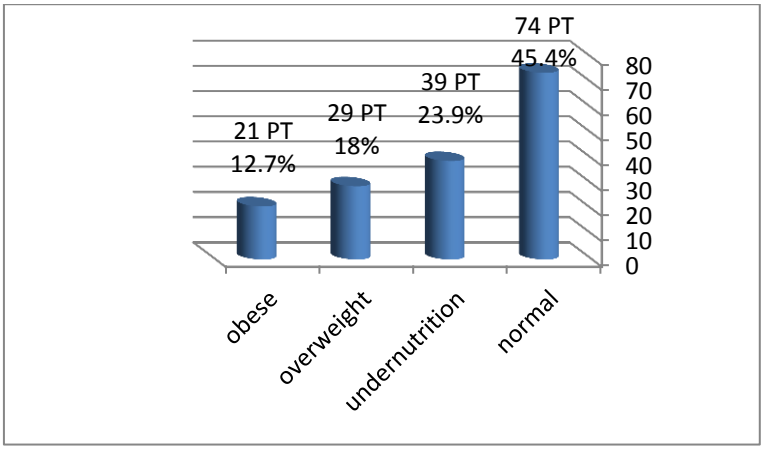

Figure (2) Nutritional status of Hajj patients admitted to the medical department.

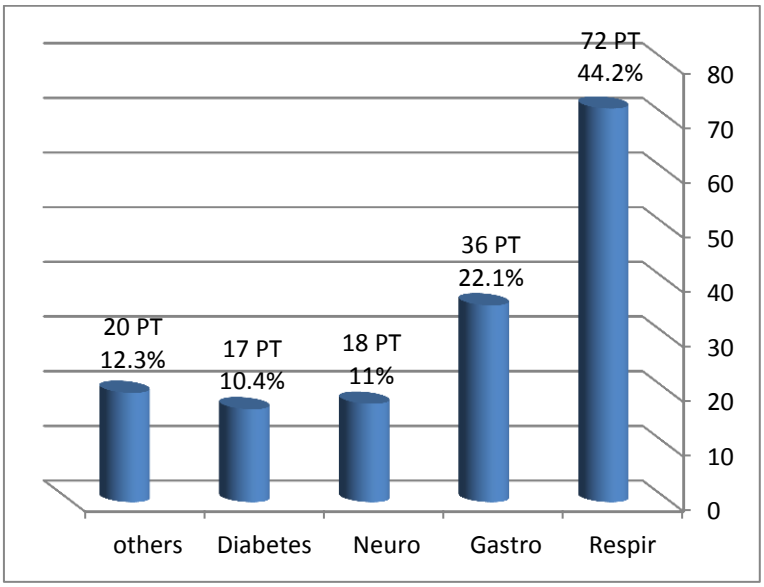

Figure (3) cause of admission of hajj patients admitted to the medical department (PT: patient, respire: respiratory cases, Gastro: Gastroenterology cases, Neuro: Neurology cases)

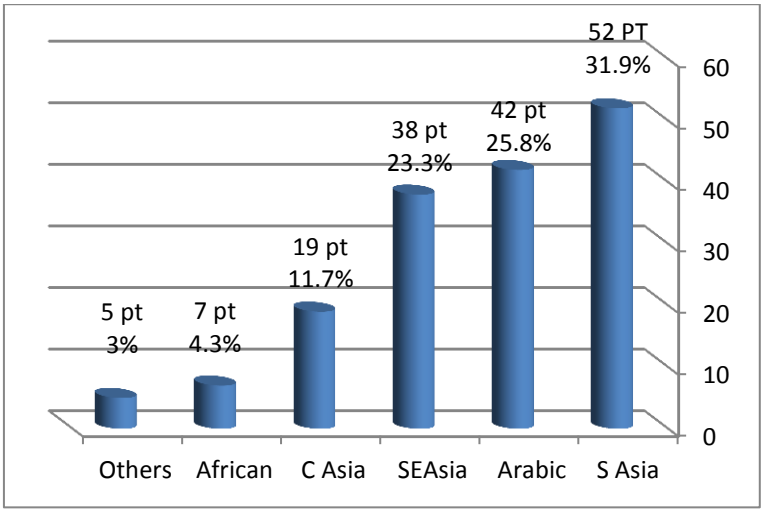

Figure (4): Nationality of Hajji patients admitted in the medical department (C Asia: Central Asia, SEAsia: South East Asia, S Asia: South Asia).

parameter	Undernutrition (39 pt.) 23.9%	Normal (74 pt.) 45.4%	Overweight (29pt)17.8%	Obese (21 pt.)12.9%	Pearson chi square P value
Age (yr.) (m ± std. dev.)	65.8±10	58.4±10.8	55.6±8.6	56.3±12.1	0.057
Age ≥ 60yrs (85 pt.) (No, %)	33/39(84.6%)	38/74(51.4%)	7/29(24.1%)	7/21(33.3%)	0.004
Nutrition parameters					
BMI (Kg/m^2) (m ± std. dev.)	17.6±2.1	23±2	27.1±1.8	33.8±5.3	0.000
MAC (cm) (m ± std. dev.)	21.7±2.8	26.2±2.7	28.6±2.9	32.7±4.5	0.000

TSF (cm) (m ± std. dev.)	0.69±0.3	1.15±0.5	1.32±0.5	1.84±.9	0.000
MAMC (cm) (m ± std. dev.)	19.5±2.5	22.6±2.7	24.5±2.7	26.9±3.3	0.003
HLOS					
HLOS (days) m ± std. dev.	3.77±2.1	3.64±2	4.4±2.4	4.52±4.1	0.078
Nationality					
South Asian (52 pt.) (No, %)	14/52 (26.9%)	22/52 (42.3%)	11/52 (21.2%)	5/52 (9.6%)	0.017
Arabic (42 pt.) (No, %)	6/42 (14.3%)	20/42 (47.6%)	10/42 (23.8%)	6/42 (14.3%)	
SEAsia (38) (No, %)	15/38 (39.5%)	18/38 (47.5%)	3/38 (7.9%)	2/38 (5.1%)	
Central Asian (19 pt.) (No, %)	0/19 (0%)	10/19 (52.6%)	4/19 (21.1%)	5/19 (26.3%)	
African (7 pt.) (No, %)	4/7 (57%)	2/7 (29%)	1/7 (14%)	0/7 (0%)	
Others (5 pt.) (No, %)	0/5 (0%)	2/5 (40%)	1/5 (20%)	2/5 (40%)	
Cause of admission					
Gastroenterology (36 pt.) (No, %)	6/36 (16.7%)	20/36 (55.6%)	7/36 (19.4%)	3/36 (8.3%)	0.017
Respiratory (72 pt.) (No, %)	25/72 (34.8%)	32/72 (44.4%)	7/72 (9.7%)	8/72 (11.1%)	
Neurology (18 pt.) (no, %)	1/18 (5.6%)	6/18 (33.3%)	5/18 (27.8%)	6/18 (33.3%)	

Diabetics (17 pt.) (No, %)	3/17 (17.7%)	8/17 (47%)	6/17 (35.3%)	0/17 (0%)	
Others (20 pt.) (No, %)	4/20 (20%)	8/20 (40%)	4/20 (20%)	4/20 (20%)	

Table (1): Comparison between patients according to their Nutritional states (BMI: Body Mass Index, pt: patient, No: number, std. dev : standard deviation. MAC: Mid Arm circumference, TSF: MAMC: Mid Arm Muscle Circumference, HLOS: Hospital Length of Stay, SEAsia: South East Asia).

parameter	HLOS >5 days (29 pt.) (17.8%)	HLOS 5 days or less (134pt) (82.2%)	P value chi-Square
Male (94 pt.) (No, %) Female (69 pt.)	11/29 (38%) 18/29(62%)	83/134 (62%) 51/134(38%)	0.017
Nutrition status			
Underweight (39 pt.) (No, %)	8/39 (20.5%)	31/39(79.5%)	0.763
Normal (74 pt.) (No, %)	12/74 (16.2%)	62/74 (83.8%)	
Overweight (29 pt.)(No, %)	4/29 (13.8%)	25/29 (86.2%)	
Obese (21 pt.) (No, %)	5/21 (23.8%)	16/21 (76.2%)	
Cause of admission			
Gastroenterology (36 pt.) (No, %)	9/36(25%)	27/36 (75%)	0.152
Respiratory (72 pt.) (No, %)	11/72 (15.3%)	61/72 (84.7%)	

Neurology (18 pt.) (No, %)	1/18 (5.6%)	17/18(94.4%)	
Diabetics (17 pt.) (No, %)	1/17(5.9%)	16/17 (94.1%)	
Others (20 pt.) (No, %)	7/20 (35%)	13/20 (65%)	

Nationality			
Arabic (42 pt.) (No, %)	6/42 (14.3%)	36/42 (85.7%)	0.593
African (5 pt.) (No, %)	1/5 (20%)	4/5 (80%)	
South Asian (52 pt.) (No, %)	8/52 (15.4%)	44/52 (84.6%)	
S. E. Asian (38 pt.) (No, %)	10/38 (26.3%)	28/38 (73.7%)	
Central Asian (19) (pt.) (No, %)	2/19 (10.5%)	17/19 (89.5%)	
Others (7) (pt.) (No, %)	2/7 (28.6%)	5/7 (71.4%)	

Table (2) comparison between patients according their hospital length of stay. (pt: patient, No: number, HLOS: Hospital Length of Stay, SEAsia: South East Asia).

parameter	South Asian (52pt) 31.9%	Arabic (42pt) 25.8%	S. E. Asian (38pt) 23.3%	Central Asian(19pt) 11.7%	*African (7pt) 4.3%*	*Others (5pt) 3.1%*	P value
Gastroenterology (36 pt.) (No, %)	10/ 52 (19.2%)	9/ 42 (%21.4)	12/ 38 (31.6%)	3/19 (15.8%)	1/7 (14.3 %)	1/ 5 (20%)	Per chi p 0.001
Respiratory (72 pt.) (No, %)	24/52 (46.1%)	14/42 (33.3%)	18/38 (47.4%)	9/19 (47.4%)	5/7 (71.4 %)	2/5 (40%)	
Neurology (18 pt.) (No, %)	4/52 (7.7%)	9/42 (21.4%)	0/38 (0%)	4/19 (21.1%)	0/7 (0%)	1/5 (20%)	
Diabetics (17 pt.) (No, %)	7/52 (13.5%)	7/42 (16.7%)	2/38 (5.2%)	1/19 (5.3%)	0/7 (0%)	0/5 (0%)	
Others (20 pt.) (No, %)	7/52 (13.5%)	3/42 (7.2%)	6/38 (15.8%)	2/19 (10.5%)	1/7 (14.3 %)	1/5 (20%)	

Table (3): Comparison between patients according to nationality and cause of admission. (pt: patient, No: number, SEAsia: South East Asia).

The aim of the study was to assess the demographic character and nutritional status of Hajj patients admitted at the medical department and its relation to the cause of admission and HLOS which may help the local health providers in their health planes during hajj season.

The mean age was 59.4 yrs., mean BMI was 23.8 kg/m^2 and mean HLOS was 3.9 days. Around 52% of patients were 60 years or older, 57.7% of patients were males and 17.8% of patients had prolonged HLOS (Fig 1).

Fig (2) showed the nutritional status of all hajji patients where 23.9% of them had under-nutrition and 12.7% of patients were obese.

Fig (3) the commonest cause of admission was respiratory diseases (44.2%) followed by gastrointestinal diseases (22.1%), neurological diseases (11%) and diabetes mellitus (10.4%).

Fig (4) showed that the largest group of hajj patients were from South Asia (31.9%), followed by Arabic countries (25.8%) and were in details as follows:

1. South Asian countries (52): (India 26, Pakistan 13, Afghanistan 4, Bangladesh 4, Iran 4, Sri lanka 1**)**,

2. Arabic countries (42): (Egypt 12, morocco 7, Sudan 7, Iraq 6, Syria 3, Algeria 2, Emirates 1, Lebanon 1, Libya 1, Somalia 1, Yemen 1),

3. S. E. Asian countries (38): (Indonesia 26, Philippine 4, china 4, Malaysia 3, Burma 1),

4. Central and West Asian countries (19): (turkey 12, Kazakhstan 2, Russia2, Uzbekistan 2, Kirghizstan 1),

5. African countries (7): (Nigeria 4, Burkina Faso 2, South Africa 1),

6. Other countries (5): (Britain 2, Norway 1, New Zealand 1, German 1).

Table (1) showed that there was a statistically significant difference between nutrition state and elderly patients (age $\geq$ 60 yrs.) where the elderly patients constitute 84.6% of the undernourished patients and one third of obese patients. There a significant difference between mid-arm circumference, mid arm skin fold and mid arm muscle circumference and nutrition state. The shortest duration of HLOS was in patients with normal nutrition

status (3.64±2 days) and the longest was in obese patients (4.52±4.1 days) but the difference was statistically insignificant.

There is a statistically significant difference between nutrition status and nationality where under-nutrition was more common in Africans (57%) and S.E. Asian (39.5%) and less common in Arabic patients (14.3%) and Central Asian and Western patients (0%). On the other hand, the percentage of obesity was 0% in Africans, and highest in central Asian and westerns. The nutrition status significantly affect the cause of admission; Under-nutrition was commoner in patients presented with respiratory diseases (35% in undernourished patients vs 11% in obese patients), while obesity was commoner in patients presented with neurological diseases (5.6% undernourished vs 33.3% obese).

In table (2) Prolonged Length of stay was significantly more in females (62% vs 38% p 0.017) while no significant difference between the short or prolonged HLOS as regards the nutrition status, cause of admission and patient's nationality.

In table (3) showed that there is a significant difference between the cause of admission as regards the patient's nationality (p 0.001), none of the SE Asian nor the African had neurological disease while it is found in around 20% of the Arabic, Central Asian and western patients. Respiratory diseases were more in Africans (71.4%), south, S.E. and central Asian patients (47%).

Discussion

The aim of this study was to elucidate the pattern of demographic characters and nutritional status of Hajj patients admitted at the medical floor and its relation to HLOS and cause of admission in order to help health policy makers to plan the future services during hajj season.

On reviewing the literatures, we found national reports studying the demographic characters and the cause of admission but we could not find studies dealing with the nutrition status or HLOS of hajj patients.

In the present study the mean age of patients was 59.4 ± 11 yrs., and 57.7% of patients were males. More than half of the patients (52.1%) were old age patients (age ≥ 60 yrs.) and respiratory diseases are the commonest cause of admission (44.2%) and

gastrointestinal diseases in 22% of patients. Approximately 32% of patients came from South Asia while 25.8% came from Arabic countries.

In a study done by Saeed *et al*, 2003, on the hajj patients admitted at medical departments in 4 hospitals in mina and Arafat (Al-Mashaer), 9th and 10th of zul Hijjah 1422. A cohort of 160 patients was collected; Males constituted 62% with the median age of 60 +/- 15years. The respiratory system was the most commonly affected (57%), and gastrointestinal tract in 6.3% of cases. Most of the admissions were from Arab countries (45.6%), Indian subcontinent (17%), non-Arab African countries (11.3%), and Indonesia and the Far East (11.3%). Another study published in 2007 by khan *et al.* It included 689 patients, belonging to 49 countries, with mean age of 62 years and male: female ratios of 1.8:1. In the same year (2007), a study published by Madani *et al.* on 140 hajj patients admitted to ICUs, fifty four percent of patients were older than 60 years and 67.6% of patients were men, pneumonia was the admitting diagnosis in 22% of patients.

Shafi *et al.,* 2008 reported 'Hajj cough' is the most frequently reported complaint. Same finding was reported by Yousaf *et al.,* 1995, Al-Ghamdi *et al.* 2003, Balkhy *et al.,* 2004, Shakir *et al.,* 2006, Madani *et al.,* 2007 and Alzeer 2009. Pneumonia is a common illness that is life-threatening to the elderly, especially those with comorbidities such as diabetes or hypertension [Mandourah *et al.,* 2012). One-third of Indonesian pilgrim mortality was attributed to respiratory diseases. (Masdalina Pane *et al.,* 2013) similar findings were reported by the Iranian hajj report (Meysamie *et al.,* 2006).

In the present study, it is found that 23.9% of Hajj patients had under-nutrition and 12.7% of them had obesity and 84.6% of undernourished patients were elderly patients. MUAC, TSF and MAMC were good indicators of nutritional status. Under-nutrition was commoner in patients presented with respiratory diseases (35% under nourished vs 11% obese), while obesity was commoner in patients presented with neurological diseases (5.6% undernourished vs 33.3% obese). In African and SE Asian hajj patients, neurological diseases were rare while respiratory diseases were common in the reverse to central Asian and western hajj patients, this may be related to the prevalence of under-nutrition.

Many international reports were found studying the prevalence of malnutrition in hospitalized patients and its relation to the admission diagnosis. Reports started as early as

the seventies of the last century and found that thirty to fifty percent of hospitalized patients may have malnutrition (Butterworth, 1974, Bistrian, *et al.*, 1976, Weinsier *et al.*, 1979 and Waitzberg, *et al.*, 2001), and despite its high prevalence, medical awareness of the patients' nutritional status was lacking (McWhirter and Pennington 1994 and Waitzberg, *et al.*, 2001)

This malnutrition was found to be prevalent even in developed countries with high standard of life as Sweden (Albiin, *et al.*, 1982), where the nutritional status was assessed in 75 consecutive patients acutely admitted to a general medical ward and obesity was found in 9% and under-nutrition was found in 22% of patients, and in a study from Poland, (Dzieniszewski *et al.*, 2005) malnutrition risk demonstrated by BMI was observed in 10.43% of patients. Vlaming *et al.*, 2001, assessed the nutrition of 1561 patients on emergency admission to hospital; they found that 18.3% of patients were undernourished.

In a national survey from Netherlands (Kruizenga *et al.*, 2003) Screening of nutritional status in The Netherlands and conducted on 7,367 patients, approximately 25% of patients in all medical fields were categorized as moderately or severely malnourished. It was found that 12% of all patients appeared to be malnourished and 13% were at risk of malnutrition. . Elderly patients were more at risk of malnutrition. Also, a Brazilian study done by Leandro-Merhi and Braga de Aquino, (2010), they studied the Nutritional status and HLOS for surgical patients. Malnutrition was diagnosed in 14.1%; in only 2.97% of the adult patients (aged ≤ 59 years) and in 36.6% of the elderly patients (aged 60 ≥ years)

In this study, Prolonged HLOS was significantly more in females (62% vs 38% p 0.017), while no significant difference between HLOS and the nutrition status, cause of admission and patient's nationality. These results need to be repeated on larger scale as many reports was different from these results, this may be explained by the small number of patients and the fact that hajj patients are not homogenous group..

In an American study published in 1997 by Chima *et al.*, Median HLOS in 56 malnourished patients was significantly greater than 117 well-nourished patients (6 vs 4 days $p < 0.01$). while in a study on a Brazilian old age patients discussing the relation between malnutrition and length of hospital stay; the mean age of patients was 50.67 +/- 17.3 years, and 50.2% of patients were males. Malnourished patients stayed in the hospital for 16.7 days vs 10.1 days in the nourished patients (Waitzberg *et al.*, 2001). The same

findings were reported by Isabel *et al.,* 2003 and Kyle *et al.,* 2005 from Switzerland. This is supported by a Brazilian study by Leandro-Merhi and Braga de Aquino, 2010, and they studied the Nutritional status and length of hospital stay for surgical patients, HLOS was more in male's vs females (median 5 vs 3 days). Another study from Brazil by Leandro-Merhi, *et al.,* published in 2011, the authors tried to find out the factors affecting the HLOS and they found that; the disease itself was the factor that influenced LOS the most in the studied population. Longer LOS prevailed in males ($P < .0001$), patients aged ≥60 years ($P = .0008$) and malnourished patients ($P = .0034$).

In this study, MAC, TSF and MAMC were considered as good indicators of nutrition status (p value 0.000, 0.000, 0.003 respectively), this is supported by James *et al.,* 1994, who variously sampled adults from selected regions of five African countries, India, China and Papua New Guinea were measured and proved that MAC was found to be a simple screening test of nutritional state. In combination with BMI it may be a better means of discriminating the at-risk underweight adults from those who are thin but not at risk. Also, Vlaming *et al.,* 2001, assessed the nutrition of 1561 patients on emergency admission to hospital; they found that there was a close relationship between BMI and MUAC. BMI was poor predictor of hospital stay. MUAC is easier to measure and predicts poor outcome better.

Summary

In 1430 Hajj season, 163 Hajj patients from 34 countries were admitted at the medical department. The mean age was 59.4 ± 11 yrs., 52.1% were elderly patients (age ≥ 60 yrs.), and 57.7% of patients were males. Under-nutrition was found in 23.9% of patients, most of them (84.6%) were elderly. The nutrition status significantly affect the cause of admission, respiratory diseases were the commonest cause of admission (44.2%); it was more common in undernourished, and less in obese patients in the reverse to neurological disease. Mean hospital length of stay was 3.9±2.47 days; it was more prolonged in females (p 0.017) and in obese patients (p>0.05). Mid upper Arm Circumference is considered as a good indicator of nutrition status which is simple and easy especially in bedridden patients**.**

Conclusion

Nutritional assessment should be routinely performed at admission for hajj patients which may help the local health authorities in their future planes. Some nationalities are more

prone to develop some diseases as respiratory or neurological diseases; this may be explained by the nutritional status and need to be validated in larger studies. MAC is considered as a good indicator of nutrition status which is simple and easy especially in bedridden patients**.**

Recommendation is to validate these results on larger scale and in other hospitals during Hajj and Omrah.

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