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Assessment of the Nutritional Status of Adult Patients with Asthma

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Abstract: The present study was carried out on 120 adult patients (sixty male and sixty female) age 42.6±1.8 years, they were selected from outpatient clinics of Tanta University Hospital, Egypt. All patients were diagnosed according to standard medical criteria as being asthmatic. Data for socioeconomic status, health history, anthropometric measurements and food habits were obtained. The 24 hour recall for three days was used for assessment of food intakes. Also, Hb, PCV, erythrocyte, leucocyte, eosinophil and lymphocytes counts and IgE were determined. The results revealed that the majority of males and females were diagnosed as having asthma because of chest allergy (50.0% and 60.0% respectively) and suffered daily asthma attacks (75.0% and 70.0% respectively). Most of the females and males had food allergy (65.0% and 75.0% respectively) particularly to eggs and fish. According to BMI, the majority of females and males were obese (55.0% and 60.0% respectively). Although mean Hb levels for the males was significantly ($P<0.05$) higher than females, the levels for both were very low (9.3±1.14 g/l vs. 8.7±1.23 g/l). Moreover, the IgE concentrations for the females were significantly ($P<0.01$) higher than males (3.2±0.58 vs. 2.9±0.65 g/l). The results revealed that the intakes of essential nutrients were lower than required for both males and females. In conclusion, in the present study the patients suffered from obesity and showed signs of Fe deficiency anaemia and nutritional deficiency.

Key words: Socioeconomic status, health history, anthropometric measurements, food habits, asthma

Introduction

Asthma is a disease in which the airways become blocked or narrowed. These effects are usually temporary, but they cause shortness of breath, breathing trouble and other symptoms (AAFA, 2004).

Asthma prevalence has increased dramatically in many countries over recent decades, demonstrating that environmental exposures play a dominant role in the etiology of this disease (Tricia and John, 2004).

Worldwide, 130 million people have asthma. The prevalence is 8-10 times higher in developed countries than in the developing countries and the prevalence is higher in low income groups (AAAAI, 2005).

In 1990, the management of asthma among USA population already accounted for more than $6 billion in medical expenditures (Camargo *et al*., 1999)

In Egypt, the WHO (2006) estimated that chronic respiratory diseases account for 6.9% of diseases and in terms of specific conditions, osteoarthritis, injuries and asthmatic bronchitis are the leading causes of disability.

There is increasing evidence from observational studies that there are a strong relationship between diet and respiratory disease. For sodium intake an unfavorable association is observed in asthmatics, but the intake of fruit and vegetables and fish is more likely to be beneficial (Smith *et al*., 1999).

Changes in dietary habits, such as increasing salt intake, decreasing intake of fruits and vegetables and changing fatty acid composition of the diet, were suggested to contribute to the rise in asthma and chronic obstructive pulmonary diseases (COPD) mortality and morbidity (Sridhar, 1995; Black and Sharpe, 1997).

Burney (1987) noted that high salt consumption was present in regions with high asthma mortality.

Magnesium has been shown to have broncho-dilating properties in experimental studies, but the epidemiological evidence is not sufficient to draw firm conclusions (Smith *et al*., 1999).

The findings of several large studies in adults suggest that high fish intake (Troisi *et al*., 1995; Hodge *et al*., 1996) vegetable consumption (La Vecchia *et al*., 1998) and fruit intake (Cook *et al*., 1997; Carey *et al*., 1998) has beneficial effects on lung function.

Although most studies observed no relationship between vitamin C and asthma or COPD symptoms, but there is substantial evidence for a beneficial effect of vitamin C on lung function (Smith *et al*., 1999; Romieu and Trenga, 2001). On contrast, no firm conclusion on the relationship between vitamin A and asthma or COPD can be drawn from the available evidence.

However, in Egypt, there isn't enough data about nutritional status of asthmatic patients, so this study aimed at clarify food habits, food consumption pattern and nutrients intake of asthmatic adult men and women.

Materials and Methods

A - Patients: This study was carried out on 120 adult man and women with asthma, their age ranged from 40

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to 48 years old, they were chosen from out-patients clinic of Tanta University Hospital, Al Gharabia Governorate, Egypt.

Inclusion criteria

1 Age from 40 to 50 years old.
2 Had bronchial asthma (mild, moderate or severe).

Exclusion criteria

1 Chronic illness like nephritic syndrome or cardiac lesion.
2 Acute illness like pneumonia or bronchitis.
3 Disabilities or handicaps.
4 Infectious diseases (like tuberculosis).

B - Methods

Recognition of asthma: This was carried out by chest specialists at out-patients' clinic under supervision of Prof. Dr. Ali Hassan the head of chest dept., Faculty of Medicine, Tanta University. Evaluation of lungs functions involves several testes that measure lung volumes and capacities, gas flow rates, gas diffusion and distribution. The following tests were carried out:

a. Forced vital capacity (FVC), measured according to Watters *et al.* (1986).
b. Forced expiratory volume in 1 second (FEV1)measured according to Strumpf *et al.* (1981).
c. Maximum voluntary ventilation (MVV) measured according to Crofton and Douglas (1981).
d. Peak expiratory flow rate (PEFR) measured according to Crofton and Douglas (1981).

Laboratory investigations: Blood samples were collected for the determination of Hb, packed cell volume, erythrocyte, leucocyte, eosinophil and lymphocytes counts and IgE.

Socioeconomic data: Include, age, sex, residency, family size, education, job, number of rooms and the socioeconomic level that calculated according to Al Shakhs (1995).

Health history: Include age at onset of asthma, family history of asthma, predisposing causes, main symptoms during asthma, number of attacks, …etc.

Food habits and consumption pattern: Include number of meals, meals types, meals amounts, preferred foods and drinks, foods that cause asthmatic reactions…etc.

Food intake: The food intake of each patient was estimated for 3 days/week by 24 hour recall. Nutritive values of the consumed foods were calculated using Egyptian food composition tables (National Nutrition Institute, 1996). The intakes from minerals and vitamins were compared with standards of WHO (2000). While the requirements from energy were calculated by equation given by Institute of Medicine and Food and Nutrition Board (2002) and requirements from protein were calculated as 1 g kg^{-1} of body weight.

Results

Table 1 shows that the mean age for males and females was 42.9±2.21 and 42.3±1.28 yr respectively, also the majority of males (85.0%) and females (90.0%) were married. On the other hand, it was clear that the majority of males (65.0%) were from intermediate socioeconomic class, while the majority of females were laid in both low (45.0%) and intermediate (45.0%) socioeconomic classes. The family income of males and females was nearly equals (383.5±97.4 and 387.5±104.4 pound/month), while per caputa of males was higher than females (90.0±48.9 vs. 79.6±38.9 pound/month) however, there was no significant differences between males and females. As for smoking, none of females were smoke, while 20.0% and 25.0% respectively of males were smoke either cigarettes alone or both of narghile and cigarettes respectively.

As shown in Table 2, all lung functions were lower than normal values for both males and females. However, the sharpen reduction was noticed in MVV values for both males and females (82.3±8.6 and 80.8±10.1 L/min respectively) that were approximately half of the normal values (160: 180 L/min) and FVC (3.4±0.37 and 3.7±0.48 milliliter respectively) that were lower than normal value (4.6 milliliter) as well. Nevertheless, the FEV1 and PEFR values were slightly lower than normal values.

The anthropometric measurements were presented in From Table 3, it could be noticed that body weight and height of males were significantly ($P<0.05$) higher than females (85.6±9.8 vs. 81.3±13.5 kg respectively and 166.4±6.7 vs. 163.8±6.8 cm respectively). Moreover, BMI values for both males and females were higher than target values and represented 31.1±4.5 and 30.2±3.8 kg/m^2 respectively, however, by classifying BMI according to WHO (2000) it could be noticed that the majority of males (60.0%) and females (55.0%) were obese (BMI > 30 kg/m^2) and 35.0% from both males and females were overweight (BMI 25: 30 kg/m^2).

Table 4 shows that, although mean Hb values for males were significantly ($P<0.01$) higher than females (9.3±1.14 vs. 8.7±1.23 g/l respectively), but these values were very lower than normal values (14:17.5 g/L) and revealed that both males and females might have signs of iron deficiency anemia. Also, erythrocyte and PCV values for both males and females were nearly equals, but still lower than normal values. As for leucocyte, eosinophil and lymphocyte, its mean values were higher than normal values and this may be due to asthma state, especially elevated eosinophil count that considered one of diagnosis factors for occurrence of

Table 1: General socioeconomic characteristics of studied subjects

		Males (n=60)	Females (n=60)
Sex			
Age (mean ± SD)		42.9±2.21	42.3±1.28
Marital status			
	Divorced	0 (0.0%)	3 (5.0%)
	Widowed	9 (15.0%)	3 (5.0%)
	Married	51 (85.0%)	54 (90.0%)
Socioeconomic class			
	Low class	15 (25.0%)	27 (45.0%)
	Intermediate	39 (65.0%)	27 (45.0%)
	High	6 (10.0%)	6 (10.0%)
Crowded ratio (mean ± SD)*		2.4±0.77	2.1±0.66
Family income (pound/month) (mean ± SD)		383.5±97.4	387.5±104.4
Per caputa (pound/month) (mean ± SD)		90.0±48.9	79.6±38.9
Smoke			
	Cigarettes	12 (20.0%)	0 (0.0%)
	Narghile and cigarettes	15 (25.0%)	0 (0.0%)
	None	33 (55.0%)	60 (100.0%)

* Persons per room

Table 2: Lung functions of asthmatic subjects.

	Normal Values	Males (n=60)	Females (n=60)
FVC (milliliter)	4.600	3.4±0.37	3.7±0.48**
FEV1 %	More than 75%	72.6±6.1	72.1±6.60
MVV (liter/min)	160:180 L/min	82.3±8.6	80.8±10.1
PEFR %	More than 80%	77.6±7.4	75.2±8.46

[a]Obtained from Pinnock and Shah (2007). ** P<0.01

Table 3: Anthropometric measurements of asthmatic subjects.

	Males (n=60)	Females (n=60)
Body Weight (kg) (Mean±SD)	85.6±9.8*	81.3±13.5
Body Height (cm) (Mean±SD)	166.4±6.7*	163.8±6.8
BMI (kg/m^2) (Mean±SD)	31.1±4.5	30.2±3.8
BMI Classification[1]		
Normal Weight (18.5: 25 kg/m^2)	3 (5.0%)	6 (10.0%)
Overweight (25: 30 kg/m^2)	21 (35.0%)	21 (35.0%)
Obesity (More than 30 kg/m^2)	36 (60.0%)	33 (55.0%)

* P<0.05. [1]Classified According to WHO (2000)

asthma. Finally, the IgE values was in the recommended range but still significantly (p<0.01) higher among females than males (3.2±0.58 vs. 2.9±0.65 mg/dL respectively).

As for food habits it was clear from Table 5 that the majority of males and females (75.0% and 80.0% respectively) consume three regular meals daily, but still 25.0% of males and 20.0% of females skip breakfast or supper. The majority of males and females (72.0% and 50.0% respectively) were preferred black tea, while 55.0% of males preferred Turkish coffee, on the other hand 40.0% of males and 45.0% of females preferred fermented milk.

Regarding consumption from specific foods, Table 5 showed that all studied patients preferred to eat fresh vegetables sometimes but not regularly, also the majority of males (85.0%) and females (83.3%) preferred to eat fresh fruits sometimes. Although, eggs may cause some adverse reactions, but 70.0% of males and 55.0% of females ate it sometimes. Unfortunately, 70.0% of males and 80.0% of females eat salty pickles regularly.

With respect to foods that might cause asthmatic reactions (based on asthmatic patients thought), the same Table 5 ascertained that 45.0% of males and 50.0% of females thought that fish is the most asthma irritant food, followed by egg (40.0% and 30.0% respectively), fruits and legumes.

Table 6 showed that both males and females failed to satisfy their requirements from total protein, calcium, magnesium and vitamin A, while males alone satisfied only 75.9% from energy requirements and females alone satisfied 54.5% from their requirements from total iron (most of it come from non heme sources). However, both males and females got enough amounts from zinc (116.4% and 146.9% respectively) and vitamin C (267.8% and 445.3% respectively).

Discussion

The results of this study revealed that most of studied patients with asthma were from either intermediate or low socioeconomic classes and have very limited income, this result agreed with other studies which proved that the prevalence of asthma is higher in low income groups (Sporik *et al.*, 1999 and AAAAI, 2005) Although, several studies (von Mutius *et al.*, 1994 and Smith *et al.*, 1999) proved that smoking is a major risk factor for lung disease and asthma, unfortunately, about one fourth of subjects still smoke either cigarettes or narghile

The results revealed that only 5% of males and 10% of females had normal body weight, while the remaining suffered from overweight or obesity. This excessive body weight may be explained by the asthma itself and treatments that obligate the patients to diminish their physical activity and therefore decrease energy expenditure. However, some studies proved that

Table 4: Blood parameters of asthmatic subjects.

	Male's Normal	Males (n=60)	Female's Normal	Females (n=60)
Hb (g/dL)	14:17.5	9.3±1.14**	12.3:15.3	8.7±1.23
RBCs (1012/L)	4.5:5.9	3.6±0.30	4.5:5.1	3.7±0,35
PCV %	41.5:50.4	26.2±0.41	35.9:44.6	26.4±0.48
Leucocyte (103/µl)	4.4:11.0	12.5±0.57	4.4:11.0	12.6±0.62
Eosinophil (109/L)	0:0.45	0.50±0.17	0:0.45	0.67±0.32**
Lymphocyte (109/L)	1.0:4.8	4.54±0.07	1.0:4.8	4.54±0.06
IgE (mg/dL)	0.1: 0.4	2.9±0.65	0.1: 0.4	3.2±0.58**

** P<0.01. Note: Normal values obtained from Henry (2004).

Table 5: Common food habits of asthmatic subjects.

		Males (n=60)	Females (n=60)
Meals state	Eat three meals	45 (75.0%)	48 (80.0%)
	Skip breakfast or supper	15 (25.0%)	12 (20.0%)
Beverages consumption (daily)	Turkish coffee	33 (55.0%)	6 (10.0%)
	Black tea	42 (72.0%)	30 (50.0%)
	Carbonated beverages	12 (20.0%)	15 (25.0%)
	Milk	15 (25.0%)	21 (35.0%)
	Fermented milk	24 (40.0%)	27 (45.0%)
Consumption pattern from selected foods	Consume fresh vegetables (sometimes)	60 (100.0%)	60 (100.0%)
	Consume fruits (sometimes)	51 (85.0%)	50 (83.3%)
	Eat eggs (sometimes)	42 (70.0%)	33 (55.0%)
	Eat fish	21 (35.0%)	18 (30.0%)
	Eat pickles regularly (salty)	42 (70.0%)	48 (80.0%)
Foods cause asthmatic reactions	Fish	27 (45.0%)	30 (50.0%)
	Egg	24 (40.0%)	18 (30.0%)
	Fruits (especially mango)	6 (10.0%)	3 (5.0%)
	Legumes	3 (5.0%)	9 (15.0%)

exercise can worsen health status of patients with asthma (Neuman *et al.*, 2000 and Mickleborough *et al.*, 2003).

Also, patients may had obesity before asthma was diagnosed, where several studies proved that obesity is one of the risk factors for asthma (Sporik *et al.*, 999 and Flaherman and Rutherford, 2006).

The association between asthma diagnosis and higher body weight or BMI was originally described in children but has also been found in adults. Camargo *et al.* (1999) found an association of increased BMI with incident asthma diagnosis in adult females.

In an agreement with our findings, Schachter *et al.* (2001) found that asthma was related to higher BMI, while Williams *et al.* (2001) found that asthma was associated with weight gain in females.

In addition, we think that the occurrence of obesity among asthma patients may due to long-term use of asthma medications especially corticosteroids that can have many side effects including weight gain

Finally, Katri *et al.* (2000) and Earl *et al.* (2003) concluded from their studies that weight loss reduces airways obstruction in obese patients with asthma. The results suggest that obese patients benefit from weight loss by improved pulmonary mechanics and a better control of airways obstruction.

The results of this study demonstrated that concentrations of hemoglobin, RBCs and PCV of patients with asthma were lower than normal values and this may predispose patients to anemia. On the other hand, the values of white blood cells, eosinophil and lymphocyte, were higher than normal values. As observed in different studies, the known risk factors for the development of pulmonary diseases include, degree of anemia, lower hemoglobin and higher steady-state white blood cell count (Castro *et al.*, 1994 and Quinn, 1999). More recently, Jessica *et al.* (2006) found lower hemoglobin and elevated white blood cells concentrations are among children with asthma when compared with non asthma children. Results and findings of the current study emphasize that patients with asthma might suffer from anemia. In addition, John *et al.* (2006) found that the overall prevalence of anemia in 7737 COPD patients was 23.1% and concluded that the high prevalence of anemia in hospitalized COPD patients gives evidence that anemia is also a comorbidity in COPD and may contribute to exercise limitation and dyspnoea.

Finally, although eosinophil cells protect us against parasites and other infectious agents, its high levels is also responsible for the allergic reaction and worsen asthma state (Zhao *et al.*, 2002). However, elevated eosinophil count is considered one of diagnosis factors for occurrence of asthma.

As for major sources of caffeine (Turkish coffee and tea) the results demonstrated that about one fourth of males and half of females drink tea, while more than half of

Table 6: nutrients intakes of patients with asthma (mean ± SD)[1]

	Males (n=60)	Females (n=60)
Energy (kcal/day [2]	1728.7±396.4 (75.9%)	1640.6±364.1 (113.9%)
Total protein (g/day)[3]	62.6±18.0 (76.7%)	61.3±16.2 (75.3%)
Calcium (mg/day)	483.2±181.6 (48.3%)	524.6±171.4 (52.5%)
Total iron (mg/day)	15.3±4.3 (109.3%)	15.8±4.7 (54.5%)
Zinc (mg/day)	16.3±5.2 (116.4%)	14.4±7.0 (146.9%)
Magnesium (mg/day)	177.8±58.5 (68.5%)	160.3±44.6 (72.9%)
Vitamin A (mcg/day)	292.9±227.9 (48.8%)	402.6±219 (80.5%)**
Vitamin C (mg/day)	120.5±85.4 (267.8%)	200.4±101.4 (445.3%)**

[1]Percentage of intake compared with WHO (2000). [2]Calculated by equation given by Institute of Medicine and Food & Nutrition Board (2002). [3]Requirements from protein were calculated as 1 g/kg of body weight. ** P<0.01.

males drink Turkish coffee. Initially, caffeine has a variety of pharmacological effects, it is chemically related to the drug theophylline which is used to treat asthma. A number of studies have explored the effects of caffeine on asthma, for example Schwartz and Weiss (1992) found that subjects who drank coffee on a regular basis had a 29% reduction in the odds of having current asthma symptoms. According to Bara and Barley (2001) caffeine appears to improve airways function modestly in people with asthma for up to four hours. Finally, Daly (2007) observed that xanthines and other caffeine have activity as analgesics and anti-inflammatories.

It was clear that the majority of patients in this study preferred to eat fresh vegetables and fruits (not every day) and some studies proved that a higher intake of fresh fruit (Butland *et al.*, 1999) and vegetables (La Vecchia *et al.*, 1998) may protect against asthma. Another survey among adults demonstrated a beneficial association between vegetable consumption and chronic bronchitis or asthma (La Vecchia *et al.*, 1998).

Unfortunately, 70.0% of males and 80.0% of females eat salty pickles regularly.

However, Mickleborough and Gotshall (2003) found that dietary salt (major source of sodium) can trigger the symptoms of asthma and suggested the salt-restrictive diets can reduce the severity of asthma.

Most of the patients thought that fish, egg, specific fruits and legumes might cause asthmatic reactions. Also, there is some evidence that intake of fish and cereals or whole grains impaired lung function and COPD in adults (Smith *et al.*, 1999 and Tabak *et al.*, 2001).

However, it remains controversial whether the intake of fish is preventive against asthma or not, but Miyamoto *et al.* (2007) emphasized in their study on females that fish consumption was independently associated with a decreased prevalence of asthma after age of 18 years.

On the other hand, one study (Helen *et al.*, 2001) confirmed that children who have food allergy (especially egg) might develop asthma at adulthood and other study carried out by Escudero *et al.* (2003) found that bakery workers have developed IgE-mediated occupational asthma to hen's egg white proteins.

In relation to nutrients intake, the findings of this study demonstrated that asthmatic patients could not satisfy their requirements from total protein, calcium, magnesium and vitamin A. The deficiency of these nutrients would worsen the health status of asthmatic patients. However, magnesium has several biological effects of potential relevance to asthma, including bronchodilatation when given intravenously in acute severe asthma (Rowe *et al.*, 2004). There is also strong cross-sectional epidemiologic evidence of protection by dietary magnesium against asthma (Tricia and John, 2004). Furthermore, two randomized clinical trials, reported evidence of protection against asthma after one week of supplementation by either a natural source of vitamin A (Neuman *et al.*, 1999), or a food extract rich in the carotenoid lycopene (Neuman *et al.*, 2000).

On the other hand, males subjects satisfied about three fourth of energy requirements. Nevertheless, females could not satisfy their requirements of dietary iron and satisfied 54.5% of their total iron requirements.

Fortunately, both males and females satisfied their requirements of zinc and vitamin C. However, there is some evidence that vitamin C intake appears to have a more important influence on lung function (Smith *et al.*, 1999). Also, vitamins C is antioxidants and may have other anti-inflammatory or anti-allergic effects as well (Tricia and John, 2004).

Conclusion: In conclusion, in the present study the patients suffered from obesity that may be a result of inactivity accompanying the disease and they also showed signs of Fe deficiency anaemia and nutritional deficiency. These findings emphasize that these patients with asthma had a poor nutritional status and that there is a need for nutritional programmes to improve their nutritional statues and recovery.

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