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MEDICAL ASPECTS OF ISLAMIC FASTING

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INTRODUCTION

Several of the world's great religions recommend a period of fasting or abstinence, and of these, the Islamic fast during the month of Ramadan is strictly observed. One whole month of intermittent fasting every year is particular to Islam. The experience of fasting teaches Muslims self-discipline and self-restraint and reminds them of the feelings of the impoverished. Fasting is not obligatory for children. Menstruating women, as well as sick and travelling people are also excused, and pregnant and lactating women are permitted to postpone the fasting of Ramadan; however they should fast during another month of the year, when they have no reason for exemption.

In Ramadan, the majority of Muslims have two good-sized meals, one immediately after sunset and the other just before dawn. They are allowed to eat and drink between sunset and dawn but neither eat nor drink after dawn. Since the Islamic calendar employs a lunar cycle, the Islamic year contains 354 days. Therefore, Ramadan moves back eleven days every year and may be situated in any of the four seasons, making the length of fasting hours variable from 11 to 18 hours. The month of Ramadan usually contains 29 days, and every few years, 30 days.

From the physiological standpoint, Islamic fasting provides a unique model of intermittent fasting every day for one month. It is also distinct from regular voluntary or experimental fasting by the fact that the observant of the fast does not drink during fasting hours. Therefore, one may assume that physiological changes occurring during Islamic fasting would be different from those seen during a regular fast.

This review discusses physiological aspects of Ramadan fasting and its impact on some disease processes. A comparison with the effects of experimental fasting is attempted, whenever possible.

RAMADAN FASTING IN HEALTH

Carbohydrate metabolism

The effects of experimental short-term fasting on carbohydrate metabolism have been extensively studied.[1,2] Slight decrease in serum glucose to around 3.3 to 3.9 mmol/L (60 to 70 mg/dL) occurs a few hours after fasting in normal adults. However, the fall in serum glucose will cease due to increased gluconeogenesis and a decrease in both glycogen synthesis and glycolysis in the liver. These changes occur because of a fall in insulin and rises in glucagon and sympathetic activity. In children aged 1 to 9 years, fasting for 24 hours has caused a fall in blood glucose to half of baseline level. In 22% of these children, blood glucose has fallen below 40 mg/dL[3].

Few studies have shown the effect of Ramadan fasting on serum glucose. One study has shown a slight decrease in serum glucose in the first days of Ramadan, followed by normalization by the 20th day and a slight rise by the 29th day of Ramadan.[4] The lowest serum glucose level in this study was 63 mg/dL. Others have shown a mild increase[5] or variation in serum glucose concentration.[6,7] From the foregoing studies, one may assume that during fasting days which follow a rather large meal taken before sunrise (Sahur), the stores of glycogen, along with some degrees of gluconeogenesis, maintain serum glucose within normal limits. However, slight changes in serum glucose may occur individually according to food habits and individual differences in mechanisms involved in metabolism and energy regulation.

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Lipid metabolism

Studies on the effect of Ramadan fasting on blood lipids have caused variable results. Serum cholesterol and triglycerides may decrease in the first days of fasting[8] and rise thereafter to pre-fasting values.[8,9] Although some studies have reported raised concentrations of cholesterol and triglycerides with changes in apolipoproteins,[10] this is not a universal finding.[8,9,11,12] Recent evidence that a marked increase in plasma HDL cholesterol occurs after fasting of Ramadan is promising.[12] In all, changes in blood lipids seem to be variable and depend probably on the quality and quantity of food consumption and the degree of weight changes. The fall in lipids in the first week usually accompanies loss of weight, and the later increase in blood lipids may be due to further increase in food consumption which prevents weight loss in the following weeks of Ramadan. It may also be related to consuming a large meal, as it has been shown that lipids increase in individuals taking one large meal every day.[13]

Endocrine function

We have reported that no significant alterations in serum concentrations of T_4, T_3, TSH, and TSH response to intravenous injection of TRH occurs in males during Ramadan.[14] In women, total serum T_4 and T_3 may decrease in the last days of Ramadan; however, the fall is mainly due to TBG alterations, as free thyroid indices remain unchanged.[15] A small but significant increase in serum T_4 in the last days of Ramadan has been reported by some,[16] but not substantiated by others.[14,15,17-19] In experimental fast lasting more than 48 hours, many investigators have reported a fall in serum T_3 along with a rise in serum rT_3,[20-22] resulting from inactivation of 5´-monodeiodinase and decreased conversion of T_4 to T_3. TSH response to TRH has been decreased or unaltered. Refeeding with carbohydrates but not protein or fat causes an increase in serum T_3.[20] In Islamic fasting, the length of fasting is not enough to cause any alteration in the pituitary-thyroid axis or peripheral conversion of T_4.

In prolonged fasting, serum testosterone and FSH may be unchanged[23] or decreased.[24] Serum LH concentration and its response to GnRH injection remains unchanged, but FSH response to GnRH may be attenuated.[24] Serum prolactin is normal and its response to TRH injection may remain normal or diminished.[25] In Islamic fasting no alterations in serum concentrations of testosterone, FSH, LH, prolactin or prolactin response to TRH have been detected in normal males.[14] Our unpublished observation shows no change in serum concentration of PTH during Ramadan.

Renal function

During Ramadan, urinary volume, osmolality, pH, nitrogen, solute and electrolyte excretion remain normal.[26] Changes in serum urea and creatinine are small and not statistically significant.[8,27] In prolonged fasting, serum uric acid increases to abnormal values.[28] This is probably due to decreases in GFR and uric acid clearance. In Islamic fasting however, there is only a slight increase in uric acid,[8,14] due to the nature of fasting which is short-lasting and intermittent.

Liver function

We have reported a rise in serum bilirubin after ten days of Ramadan fasting in men.[4] However, the same has not been observed in the Riyadh study.[8] In experimental fasting, an increase in indirect bilirubin occurs 15 hours after fasting.[29,30] Refeeding with a normal meal or carbohydrates only, but not protein or fat diets, returns bilirubin concentration to normal values. In our observation, mean bilirubin was increased on days 10, 20 and 29 of Ramadan; however the peak increase was on the 10th day, when blood glucose levels were the lowest. The fall in bilirubin observed in the last one third of Ramadan was coincident with some rise in blood glucose concentration.[4] This result may suggest that bilirubin concentrations during fasting may somehow be related to carbohydrate metabolism. No significant changes in serum SGOT, SGPT, protein and albumin concentrations occurred during Ramadan.[4,8]

GI function

In experimental fasting, there is a fall in gastric secretion. Gastrointestinal tract movements occur every two hours.[31] It starts from the stomach and moves toward the duodenum, jejunum and ileum, evacuating all food debris, desquamated cells and GI secretions. The gallbladder empties less frequently than in the fed state, one to three times every 4 hours.[32] GI function during Ramadan remains to be investigated.

Cardiovascular function

Although bradycardia and hypotension may occur during prolonged fasting,[33,34] heart rate and blood pressure remain normal during the first few days of fasting. Changes in the ECG, including decreased altitude of QRS complex and T wave and right axis deviation seen in prolonged fasting, are not seen in short fasts.[35]

Neuro-psychiatric function

In experimental fasting, appetite is decreased after 1 to 4 days of fast,[34,36] probably due to ketosis. Beta-endorphin may also play a role in diminishing appetite during fasting.[37] No alteration in EEG has been reported, even in prolonged starvation.[38] One report has found that significantly fewer parasuicides occur during Ramadan in Jordan.[39]

Electrolytes and trace elements

Mean serum concentrations of calcium may decrease slightly 10 days after fasting in Ramadan, however no subnormal values can be seen.[4] In the last half of Ramadan,

serum calcium remains normal; however, it may be slightly increased, as compared to pre-Ramadan values.[9,8] Serum phosphorus does not change in Ramadan.[4,5] In prolonged experimental fasting, normal serum phosphorus, normal or decreased serum calcium and increased urinary excretion of calcium and phosphorus have been reported.[2]

Ramadan fasting does not cause significant alterations in serum sodium and potassium.[8] In experimental prolonged fasting, urinary excretion of 25 mEq potassium per day has been seen,[40] however serum potassium remains normal.[41] Daily urinary excretion of magnesium from 2.6 to 6 mEq without changes in serum magnesium is seen.[42] Zinc excretion increases to twice normal values and serum zinc levels rise.[43] No information on magnesium and zinc metabolism during Ramadan is available. However, the foregoing observations showed no significant alterations on the first day of experimental fasting.[42,43]

Hematological profile

No significant changes in hemoglobin, red blood cell indices, white blood cell count or the sedimentation rate have been seen.[4,8] Decreased serum iron levels and total iron-binding capacity have been reported,[8] indicating that iron stores are not significantly disturbed.

Weight loss

Weight losses of 1.7,[20] 1.8,[18] 2.0,[44] and 3.8 kg[19] after fasting of the month of Ramadan have been reported in normal weight individuals. In one study that was over-represented by females, no change in body weight was seen.[10] It has also been reported that over-weight persons lose more weight than normal or under-weight subjects.[44]

Pregnancy and lactation

Acute starvation in pregnant women results in decreased blood glucose; however, after 20 hr of fasting, blood glucose remains within normal range, above 2.8 mmol/L (50 mg/dL).[45] Animal experiments also connote that even in long term starvation, fetal energy is provided via compensatory mechanisms.[46] The outcome of pregnancy in Gambian women who fasted during Ramadan was not satisfactory; however, no control group was employed.[47] A significant fall in glucose, insulin, lactate and carnitine and a rise in triglycerides and hydroxybutyrate was reported at the end of the fasting day in pregnant women.[48] However, the outcome of pregnancy was comparable to those who did not fast. Ramadan fast did not affect the birth weights of over 13,300 babies at delivery.[49] Lactating mothers who fast may lose their body water and show changes in plasma osmolality, Na, and uric acid and lactose, sodium, and potassium content of breast milk.[50] The above-mentioned studies along with the hypothesis that starvation of pregnant women may cause some alterations in later life,[51] indicate that until further studies are undertaken, pregnant women should avoid fasting in Ramadan.

MEDICAL ASPECTS OF RAMADAN IN DISEASE

Diabetes mellitus

Available reports indicate that there are no major problems encountered with NIDDM and even controlled IDDM patients during Ramadan fasting.[52-56] Most patients show no change in their glucose control. In some patients, serum glucose concentration may fall or rise, which may be due to amount or type of food consumption, regularity of taking medications, or engorging after the fast is broken. It is recommended that IDDM patients not fast. However in mild forms of IDDM when the patient insists to observe the Ramadan fast, it is feasible to give one dose of intermediate acting insulin before Sahur, and if needed, another one before breaking fast (Fatur or Iftar). In patients with NIDDM the dose of short acting sulfonylurea should be halved during Ramadan, and given as either a single dose before Sahur or two doses before Sahur and Iftar.[57] The authors of largest series of patients treated with glibenclamide during Ramadan recommend to switch the morning dose (together with any midday dose) of this drug with that taken at sunset.[54]

Renal disorders

Patients with chronic renal failure should not fast, since fasting may increase serum potassium.[58] Subjects on hemodialysis may experience rises in serum potassium, body weight and fluid overload between dialysis sessions due to increased food consumption at night.[59] Renal transplant recipients on immunosuppressive therapy who have normal allograft function experience no harmful effects from fasting and their renal concentrating ability remains unchanged.[60] Little is known about the effect of Ramadan fasting on the incidence of renal stones. Does abstinence from food and drink for 14 to 17 hours daily for one whole month predispose stone formation in susceptible individuals? Until this matter is solved, we recommend that frequent stone formers should avoid fasting during Ramadan.

GI disorders

Patients who suffer from acute duodenal or gastric ulcers should not fast. However, asymptomatic patients may try fasting, and take cimetidine or ranitidine at Iftar and Sahur, if hyperacidity remains to be a problem. Since intestinal contractility decreases during fasting to approximately once every two hours,[31] fasting may benefit patients with spastic colitis and some other intestinal motility disorders.

Pulmonary disorders

Although dehydration and dryness of respiratory tract mucosa may worsen bronchoconstriction in asthmatic

patients, some workers have allowed asthmatic patients whose disease is stable to fast while using inhalers, slow release drugs, and suppositories.[59]

Cardiac disorders

There seems to be no contraindication to observe fasting in patients with valvular problems or subjects with mild coronary artert disease, It is not known if mild dehydration and hemoconcentration may harm those with moderate to severe coronary artery disease.

Use of medications during Ramadan

Administration of necessary medications via parenteral routes (IV or IM) or as suppositories and inhalers are allowed during fasting. However, taking oral medications are not allowed by most religious authorities.[61] The following guidelines are recommended:

1. Patients who must take their medications more than twice in 24 hours, should avoid fasting. Others may take their drugs at Iftar or Sahur (or both).

2. If possible, physicians should make every attempt to prescribe long-acting or slow-release drugs once or twice at night, and allow the appropriate patient to observe fasting.

3. Patients with epilepsy may experience convulsions if only 100 mg phenytoin is used at night;[62] however, one could control epilepsy with a single dose of 300 mg phenytoin daily,[63] allowing the epileptic patient to fast during Ramadan.[64]

4. Elderly patients and those with underlying renal disease who take non-steroidal anti-inflammatory drugs should have frequent monitoring of renal function, since fasting may increase serum urea and sodium levels in such individuals.[65]

5. Long-acting oral anticoagulant medications could be employed as a single night time dose without affecting the incidence of thromboembolic events or hemorrhagic complications.[66]

It is noteworthy to emphasize that in Islamic jurisprudence, not only are sick people prohibited from fasting, but in every condition in which fasting might harm the health of the individual, increase his pain or discomfort, or delay his recovery from a mild condition, it is strictly ordered not to observe Ramadan fasting.[61]

As perhaps 400 million people fast each year during the month of Ramadan, further scientific research on the medical aspects of the Ramadan fast in health and disease is needed. Physicians practising in Muslim countries and those caring for Muslims in various parts of the world should be aware of the physiological alterations during Ramadan, the effect of Islamic fasting on various disease conditions and pharmacodynamics of different medications during the Ramadan fast.

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