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EFFECT OF RAMADAN FASTING ON THE VARIATIONS OF CERTAIN BIOCHEMICAL PARAMETERS IN TYPE II DIABETIC PATIENTS TREATED WITH SULPHAMIDES (AMAREL® AND DIAMICRON®)

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ABSTRACT

The purpose of this study is to analyse the development of some anthropometric parameters as well as biochemical measurements in the blood, of patients suffering from diabetes of the second type. The evolution of these parameters was followed during two periods: the 5th week before Ramadan and the 3rd week of fasting. The sample included 54 patients in the age bracket between 45 to 55, and undergoing hypoglycaemic medication with two Sulphamides treatments: Amarel® and Diamicron®.

Body mass index (BMI) remained stable ($p > 0.05$) in most cases within both periods. However patients taking Amarel® have experienced a reduction in the Body Mass Index (BMI) and hence of corporal mass compared to patients on Diamicron® ($P<0.05$). Patients on Diamicron® revealed a significant ($p <0.05$) increase in blood glucose in the to be revised in the table fasting period. The rates of cholesterol, triglyceride and LDL-C in the plasma decreased significantly ($p < 0.05$) during the fasting, whereas that of HDLC has increased significantly ($p < 0.05$) compared to before Ramadan. Amarel® seems to have better effect in improving the lipid profile in patients, compared to Diamicron®, particularly during the fasting period. As for proteinous compounds (protein, crestinin and urea), their plasma rates all increased substantially ($p < 0.05$) in patients on both drugs during fasting period of the month of Ramadan.

INTRODUCTION

The practice of fasting is very important. It has been used since very ancient times for purpose of self healing. In nature, Animals stop from nourishment when they are ill or wounded. The complete fast consists of stopping entirely from eating and drinking (except from water) for a varied period in order to rest, detoxify and regenerate the organism. Its proponents claim that fasting is as important to maintain good health as having a good diet, doing physical exercise as well as having a good emotional balance. People

who undertake fasting usually do it in order to provide ideal conditions for self-curing **(Koné, 2004)**. It is also a religious obligation. The month of Ramadan is the 9th month in the lunar calendar and Muslims are prescribed to fast during daylight (from dawn to dusk). It consists of refraining from feeding and drinking during a period extending no more than 14 hours a day during one month.

Despite numerous studies evidencing the beneficial attributes of fasting, its use for medicinal purposes remains controversial. Some believe it is a dangerous and unhealthy practice whereas others advance that this physiological rest is essential to a good healthy life style. Broadly, fasting provides a moment of respite to the organism wherein different organs can recover, a reason that can prop up this practice in the case of certain illness of metabolic nature. Also, we acknowledge its benefits in purifying the body from toxins, restoring tissues and functions that were disturbed by over-eating, malnutrition or a bad intake of nutriments. Furthermore it is an efficient way to prevent certain diseases and assure a better hormonal balance **(Afifi, 1997; Fakhrazadeh et al, 2003 and Koné, 2004).**

Researches that tried to investigate the positive effect of fasting as well as its innocuousness have shown very supportive evidence especially in the treatment of a number of metabolic disorders, such as diabetes (type 2) which results from two interdependent anomalies: first it is the resistance to insulin where a lesser sensitivity is displayed by the relevant cells (Adipose tissue, liver and muscles) and second it is the lesser hormonal secretion by the pancreas in response to a high glucose rate in the blood **(Rodier, 2001 and Koné, 2004)**.

Amarel® whose active ingredient is the Glimepiride is an anti-diabetic drug of the sulfonylurea type used in conjunction with a strict alimentary diet and physical exercise for patient with high concentration of glucose in the blood. It is prescribed for case of diabetes of type 2 (non-insulin dependent) and stimulates a normal production of insulin by the body and helping efficaciously controlling sanguine glycaemia, and preventing the development of various ailments (of the heart, the kidneys, blindness.....), problems of blood circulation and sexual disorders (such as sexual impotence) **(Charles and Clarks 1998).** Diamicron® composed of Gliclazide active ingredient is also an hypoglycaemic substance that belongs to the sulfonylurea group. It acts by improving the discharge and the secretion process of insulin by the beta cells of Langerhans in the pancreas.

Following these observations our study will have as an objective, the effect of fasting Ramadan month on the variations of body mass index (BMI) and certain biochemical parameters in type 2 diabetic patients treated with two sulphamides (Diamicron® containing 30mg of Gliclazide and Amarel® containing 3mg of Glimepiride) and aged from 45 to 55 years.

MATERIAL AND METHODS

Patients

The trial population included Muslim men suffering from type 2 diabetes (according to World Health Organization criteria **W.H.O, 1985**) who practiced Ramadan fasting. An explanatory session was given by the investigators in both French and Arabic languages, and written consent was received from each willing participant.

Fifty four patients from the Mostaganem region located in the West of Algeria participated in this study. Their ages ranged from 45 to 55 years (mean ±SD =49.73±3.33), they had a BMI of 25.65 ± 01.95 kg/m^2 (mean ± SD) and treated in mono-therapy with two types of Sulphamides drugs: Amarel® containing 3mg of Glimépiride® and Diamicron® containing 30mg of Gliclazide®.

Patients were excluded from the trial if they had certain heart diseases (congestive heart failure, angina pectoris, previous myocardial infarction); impaired kidney or liver function; severe uncontrolled hypertension, severe diabetic complications; and had received therapy with insulin. The study protocol was approved by the local hospital's ethical committee.

Study design

The study was performed in October 2005, which coincided with the holy month of Ramadan. All participating patients were studied five weeks before Ramadan, and in the third week of Ramadan fasting. A 10 ml blood sample was obtained from 12 hours fasting subjects by venous puncture into dry tubes for the pre-fasting period. To respect the 10 am – 12 am fast in the pre-Ramadan period, the blood sampling during Ramadan must be done at 1 pm. Samples were allowed to clot, and the serum centrifuged, divided into aliquots, and stored at -18° C until analysed. On both test days, glucose, triglycerides, cholesterol, high-density lipoprotein cholesterol (HDL-c), low density lipoprotein cholesterol (LDL-c), proteins, creatinin and urea were measured from each of the 54 blood samples. During Ramadan, the subjects slept uninterruptedly from 2am to 8am and their average sleep time was thus 1 h shorter during Ramadan than it had been during the control period. Daily working hours in Ramadan are from 9 am to 3 pm; but on the a non-fasting day, work starts at 8 am and finishes at 5 pm.

Measurements

Anthropometric measurements were performed on subjects in light clothing and without shoes. Height was measured to the nearest 0.5 cm and body weight was measured on a level balance calibrated daily and recorded to the nearest 0.1 kg. Body mass index (BMI) was calculated as weight (kg) divided by height (in m) squared **(Tchobrousky and Guy-grand 1997)**. Blood samples were drawn after at least 12 hours of fasting for determination of serum levels of glucose, Total cholesterol (Tot-c), high-density lipoprotein cholesterol (HDL-c), triglycerides (TG), proteins (P), creatinin (C) and urea (U) by enzymatic methods using Merck reagent kits and Elan 2000 auto-

analyser. High density lipoprotein cholesterol (HDL-c) was measured in the supernatant after precipitation of apolipoprotein B-containing lipoproteins with dextran sulfate and magnesium chloride. LDL cholesterol was calculated with the Friedewald formula [LDL-c= Tot-C-(TG/5+HDL-c)] when triglycerides concentration were <5.0 mmol/L; subjects with triglycerides levels >5.0 mmol/L were excluded **(Friedewald et *al*,1972)**. Trained interviewers administered a structured questionnaire to collect information about age, medication and the consumed diet.

Statistical methods

Data were analysed using the StatBox 6 and are expressed as mean and Standard Deviation (SD). Parametric values were compared with ANOVA followed by comparison of the means with Newman-keuls test. The level $p < 0.05$ was considered as the cut-off value for significance.

RESULTS

The results of the study have been summarised in (Table 1).

Body Mass Index (BMI)

During the two periods under study (before fasting and in fasting) BMI turned out to have comparable values with an average of 25.88kg/m^2 ($P > 0.05$). The average value before the fasting period was 25.65kg/m^2 which increased insignificantly to 26.10kg/m^2 in Ramadan. In addition the average value of BMI for patients treated with Diamicron® 26.34kg/m^2 was significantly higher ($p < 0.05$) than for patients following the Amarel® treatment 25.41kg/m^2. Moreover it seems that from the non fasting period to the fasting period of Ramadan both sets of patients showed values that increased albeit insignificantly ($P > 0,005$); from 25.11kg/m2 to 25.71kg/m2 (Amarel®) and from 26.19kg/m2 to 26.49kg/m2 (Diamicron®).

Blood Glucose

Results relating to glucose level in the blood show no significant ($p > 0.05$) variations between the two periods, but with an average rate during Ramadan (1.70g/l) higher than in the preceding period (1.48g/l). Also patients on Diamicron® have higher values than those on Amarel® ($P < 0.05$), they were 1.84g/l and 1.34g/l respectively. A low content of blood glucose was noticed in both groups (i.e. those treated with Amarel® and those treated with Diamicron®) of patients during the non fasting day in comparison to the third week of Ramadan ($p < 0.05$); (1.73g/l and 1.23g/l vs 1.94g/l and 1.45g/l).

Lipid Measurements

Cholesterol level in the blood has decreased insignificantly ($p > 0, 05$) from 1.76g/l to 1.67g/l on average from the first to the second period. During both periods of the study (Pre-Ramadan and Ramadan fasting) the level of cholesterol was noticeably lower ($P < 0,05$) in patients treated with Amarel® compared in those under the Diamicron® treatment;(1.48g/l vs. 1.95g/l on average).

Table 1. Change in body Mass Index, Serum Glucose, lipidic levels and proteinous concentrations in type II diabetic patients.

(Mean± SD)

Factors / Measurements	Periods (F1)		Medication (F2)		Pre-Ramadan		Ramadan		F1	F2	Int (F1XF2)	Normal
	Pre-Ramadan (n=54)	Ramadan (n=54)	Amarel® (Glimépiride) (n=54)	Diamicron® (Gliclazide) (n=54)	Amarel® (Glimépiride) (n=27)	Diamicron® (Gliclazide) (n=27)	Amarel® (Glimépiride) (n=27)	Diamicron® (Gliclazide) (n=27)				
Body Mass Index (kg/m)	25.65 ± 01.95	26.10 ± 01.84	25.41 ± 01.99	26.34 ± 01.80	25.11 ± 02.78	26.19 ± 03.16	25.71 ± 02.98	26.49 ± 03.39	NS	*	NS	20-25
Glucose level g/l	01.48 ± 00.51	01.70 ± 0.54	01.35 ± 0.49	01.84 ± 0.55	01.23 ± 00.44	01.73 ± 0.66	01.46 ± 0.51	01.94 ± 0.65	NS	**	NS	0.80-1.2
Total Cholesterol (g/l)	01.76 ± 00.33	01.67 ± 0.41	01.48 ± 0.37	01.95 ± 0.37	01.55 ± 00.36	01.96 ± 00.48	01.40 ± 00.51	01.94 ± 00.50	NS	*	NS	Inf-2.25
Triglycerides g/l	01.21 ± 00.45	01.12 ± 00.63	01.11 ± 00.55	01.23 ± 00.54	01.23 ± 00.52	01.19 ± 00.40	00.98 ± 00.69	1.26 ± 0.75	NS	*	NS	0.40-1.40
HDL cholesterol (g/l)	00.63 ± 00.32	00.82 ± 00.25	00.66 ± 00.28	00.79 ± 00.29	00.57 ± 00.09	00.69 ± 00.30	00.74 ± 00.54	00.89 ± 00.42	**	*	*	0.40-0.60
LDL cholesterol (g/l)	00.87 ± 00.17	00.68 ± 00.08	00.64 ± 00.17	00.91 ± 00.08	00.72 ± 00.52	01.02 ± 00.62	00.56 ± 00.68	00.79 ± 00.63	NS	*	*	Inf-1.60
Proteins (g/l)	76.71 ± 06.13	81.39 ± 04.25	76.21 ± 6013	81.89 ± 03.10	74.60 ± 10.86	78.81 ± 30.26	77.82 ± 15.29	84.96 ± 23.53	*	*	*	60-80
Creatinin (mg/l)	07.92 ± 01.46	09.16 ± 00.65	08.09 ± 01.46	08.99 ± 00.65	07.66 ± 01.83	08.18 ± 1.79	08.52 ± 00.08	09.80 ± 01.73	*	*	*	5-12
Urea (g/l)	00.32 ± 0.09	00.44 ± 0.04	00.43 ± 0.09	00.32 ± 0.04	00.32 ± 00.13	00.31 ± 00.14	00.54 ± 01.74	00.33 ± 00.14	*	*	*	0.15-0.50

F1 & **F2** : Studied factors (Periods and Medication), **Int** : Interaction studied factors(F1XF2), **NS** : Non significant effect (P>0.05), *: Significant effect (P<0.05), **: High significant effect (P<0.01), n: Number of Diabetics patients.

As for plasma triglyceride (TG) all patients have a lower average value (1.12g/l) during the fasting period not statistically different compared to that registered before Ramadan fasting (1.21g/l) ($P > 0.05$). Amarel® intake has engendered a more substantial and significant effect in reducing the level of TG among diabetics compared to Diamicron® ($P< 0.05$), their recorded values are 1.11g/l and 1.23g/l, respectively. Furthermore the highest average value in TG 1.23g/l sampled in the first period among Amarel® patients has substantially decreased ($P < 0.05$) to 0.98g/l during Ramadan.

Values of HDL-c in the blood were statistically higher ($P<0.05$) in Ramadan (0.82g/l) than in the first period before Ramadan (0.627g/l). Also, it is higher for patients on Diamicron® (0.79g/l versus 0.66g/l among the Amarel® group). The average levels of HDL-c found in the blood before fasting period were 0.57g/l among the Amarel® group and 0.69g/l in the Diamicron® group, both of which have increased, during fasting substantially ($P< 0.05$) to 0.74g/l and 0.89g/l, respectively.

The average rate of plasma LDL-c was significantly lowers ($P< 0.05$) during the second period; it decreased to 0.68g/l during Ramadan from an initial average value of 0.87g/l. As for, between "treatment-groups, comparison, much higher levels were found among patients on Diamicron® (0.91g/l on average) compared to significantly lower levels ($P < 0.05$) found among the Amarel® group (0.64g/l on average). Across periods, the detailed levels for the two groups reveal a clear reduction in the fasting period, average levels are given as; 0.56g/l from an initial 0.72g/l among the Amarel® gourp and 0.79g/l from an initial 1.02g/l in the other group, ($P < 0.01$).

Protein measurements

During Ramadan the average content of plasma proteins among diabetic patients were remarkably higher than during the non-fasting period ($P < 0.05$); 81.39g/l versus 76.17g/l. Also protein level in the Diamicron® group (81.89g/l on average) turned out to be significantly ($P< 0.05$) superior to the level found in the other group (76.21g/l on average). In Ramadan the values registered for protein content in the blood were 77.82g/l for Amarel® patients and 84.96 for Diamicron® patients, their initial values were respectively 74.60g/l and 78.80g/l; a significant abatement ($p < 0.05$).

Plasma creatin content was significantly higher in the second period (i.e. Ramadan) a value of 9.16mg/l compared to 7.92mg/l in the first period before fasting. Moreover the highest sampled levels were found among patients treated with Diamicron® (9.99mg/l) and lower rates ($P < 0.05$) among Amarel® patients (8.09mg/l). Besides the average content of creatin during Ramadan (8.52mg/l) was significantly higher ($P < 0.05$) among patients treated with Amarel® than in the previous period (7.66 mg/l). A similar pattern was recorder in the group treated with Diamicron®; 9.80mg/l in the fasting period and 8.18mg/l before.

Finally urea was statistically ($P < 0.05$) hisher during fasting than non fasting period; 0.44g/l versus 0.32g/l on average). Amarel® patients had higher

($P < 0.05$) levels of urea on average (0.43g/l) compared to Diamicron® patients (0.32g/l).

DISCUSSION

1. Body Mass Index (BMI)

During the fasting period BMI was seen to be stable, of which values were close to those obtained in the first "normal" period before Ramadan. What could explain this finding is the constant global caloric content of patients' diets during both periods. Similar finding were reported by **Belkhadir et al (1993)**, **Sulimani et al (1998)** and **Abadou et al (1999)**, all found that variations in body mass were insignificant among sufferers of diabetes of type 2. Nevertheless these BMI values are higher than the norm found in a healthy person that varies between $20kg/m^2$ to $25kg/m^2$. This can be explained presumably by indolence of patients who by fear of hypo or hyper glycemic episodes and hence who tend to reduce physical effort especially during the month of Ramadan. These reactions could ultimately be traced to the fact that patients do not strictly adhere to a hypocaloric diet **(Nomani et al 1989)**. Our results do not agree with those obtained by **Quejec (2002)** and **Fakhrazadeh (2003)** who found a clear reduction in BMI during the fasting period. Patients treated with Glimepiride (Amarel®) have had a significant fall in their body weights (and BMI) in contrast to patients on Gliclazide (Diamicron®) ($P < 0.05$). Amarel®'s sliming effect is in line with research done by **Martin et al (2003)** and **Ramund and Rosa (2003)**.

2. Blood glucose

During the course of the experiment the period effect did not show statistically significant variation in levels of blood glucose, albeit higher levels were found during Ramadan. This higher rate could be attributed to the lower level of insulin secretion due to adaptation mechanism occurring among patients while fasting **(Nomani et al 1989)**. These observations are in accordance with **Iraki et al, 1997**; **Nagra et al, 1998**; **Laajam, 2003** and **Yarahmadi et al, 2003**. However other authors **(Nomani et al, 1989; Larijani et al, 2003 and Fakhrazadeh et al, 2003)** have reported a significant decrease in blood sugar during the whole month of Ramadan. **Nomani et al (1989)** explain this by the adherence of patients to a hypo-caloric diet. In order to reconcile these opposing findings one can suggest the quantitative as well as qualitative disparity in foods consumed and food habits across the studied populations. Other factors such as the regularity of medicines' administering **(Azizi and Siahkolah, 2003)**, the daily length of fasting, the individual variations in the quantity of blood glucose and the lack of physical exercise were also found to influence the outcome **(Larijani 2003)**. As for the effect of the difference in treatment, better results were observed in the Amarel® group confirming the work done by **Schade et al (1998)**. They reported a positive effect of Amaral which acts by mimicking insulin, inhibiting glycolgenolysis and instigating production of 2,6 fructose synthetase stopping gluconeogenesis

and consequently reducing the level of blood glucose during fasting and postprandial. Glucose increased daring Ramadan on both drugs . In fact the decrease of insulin secretion while fasting **(Nomani et al 1989)** is made up for by the action of the drugs **(Vony and Tkow 2002)**. However, the low level of blood glucose during the first period (i.e. non fasting) is related to high insulin rate probably caused by the stimulating hyper caloric effect induced by glycolysis. This in turn provides important energy in the form of ATP to the synthesis of insulin by the pancreas **(El Ati et al, 1995)**. The lower blood glucose rate during the first period can also be explained by the hypoglycaemic effect of sulphamids on extra-pancreatic tissues including a potentiation effect on the action of insulin in the liver by reducing its production of glucose as well as in skeletal muscles by improving glucose carriage **(Charles and Clarks 1998)**. Despite of physiological effect of fasting on decreasing insulin production, it is possible that it does not prevent a compensating and mitigating action by sulphamides on beta cells in the pancreas and stimulating the secretion of this hormone. It is an established fact that Glimipiride® regulates the secretion of insulin by closing the ATP dependent potassium channels at the membrane level of beta cells in the islets of Langerhanse, this in turn provokes depolarisation engendering a higher influx of calcium in the cell (by opening calcium channels) and ultimately stimulating outpour of insulin by exocytosis **(Udaya and Kabadi 2004)**.

3. Lipid measurements

During Ramadan the total rate of cholesterol recorded among diabetic patients seems to have taken normal values found in a healthy person (less than 2,25g/l). In the non fasting period those values remain within the norms found in healthy subjects but significantly higher than in Ramadan. These results are the consequence of subjecting patients to non balanced diet. According to **Mahley et al (1998)** excess intake of saturated fatty acids and animal fats raise inevitably the total level of cholesterol. Nevertheless this finding was disputed by other authors who suggest an increase in cholesterol during Ramdan **(Yarahmadi et al 2003)**. This might be the cause in heterogeneity of the samples under different studies. A similar efficacious role was seen in both drugs and in both periods. Nonetheless Amarel® seems the better pick overall. Also the level of plasma cholesterol seems to depend on alimentary composition and the de facto richer in animal fat diet during the pre fasting period. Finally according to **Martin et al (2003)** sulphamides based drugs assurely affect the level of plasma lipoproteins (HDL-c and LDL-c) which as a consequence directly affect the level of plasma cholesterol.

Triglycerides was not significantly ($P > 0.05$) altered during the two periods, albeit the rates recorded during fasting were lower. The same observation was made by **Sarrafzadeh et al (2000)** and **Yarahmadi et al (2003)**, while **Nagra et al (1998)** reported an opposite result i.e. an increase in TG during Ramadan which they attribute to lipolytic nature of fasting. **Afrasiabi et al (2003)** explained this fall in the level of TG by a self-imposed

low calorie diet and intense physical exercise during fasting. The homeostasis of TG was recorded during fasting particularly among patients following Amarel® treatment showed the lowest levels, a result confirmed by **Gonzalez et al (1999)** who found that Amarel® improves lipid content of the blood among patients suffering from non-insulin dependent type of diabetes. The evolution of average blood levels of TG through both periods indicates the efficiency of Amarel® compared to Diamicron®. A fact that can be explained by the important role of Amarel® in improving insulin secretion as well as its conducive role in acquiring carrying agent GLUT4; glucose carried within cells can provide an energy source for adipocytes and provide glycerol which can then be converted into AG especially in the liver, fat cells and also in acini in lactating mammary glands. Drugs by imitating insulin improve the harnessing of glucose and activating glycolysis which ends up in forming pyruvate, also, through Krebs' cycle forming citrates which when exist in excess may help in the synthesis of fatty acids in the cytoplasm. Insulin acts like these drugs, in addition it acts directly on this synthesis by stimulating acetyl-COA carboxylase. The TG is then stored within adipose cells in the liver, combining with specific types of proteins, cholesterol and phospholipids in order to form low very density lipoproteins (VLDL-c) which are then secreted in the plasma **(Muller et al 1995).**

The level of HDL-c in the blood is higher during the month of Ramadan, higher even than the normal rates (varying from 0.40g/l to 0.60g/l). This is very likely to be the cause of rich dietary regime followed by the studied patients during Ramadan, who consume a higher quantity of traditional dishes which are rich in carbohydrates and animal fat **(Ennigrou 2001).** On the contrary to our results some authors report no significant changes in the level of HDL-c **(Yarahmadi et al 2003).** The diabetic medications also proved during the fasting period to have a beneficial role in increasing the plasma level of HDL-c among patients treated with Diamicron® and Amarel® ($p < 0.05$) in comparison to the period before Ramadan. Apparently subjects showed resistance to insulin which induced a strong flow of hepatic HDL-c and VLDL-c towards the peripheral tissues and this is to compensate for the lack of cell energy during the course of the strict diurnal diet **(Temizhan et al 2000).**

Finally low levels of plasma LDL-c were recorded during the month of fasting while much higher levels were seen in the period before Ramadan ($P > 0.05$). This confirms the results of some authors such as **Fakhrazadeh et al (2003)** and **Quejec et al (2002)**, whereas the studies of **Nagra et al (1998)** and **Yarahmadi et al (2000)** indicate an increase of LDL-c during fasting. Which was explained as a result of a significant hydrolysis of VLDL-c and a reduction of hepatic intake of LDL-c **(Chapman, 1982 and Verges, 1999)**. According to **Streicher et al 1996** during an alimentary fasting insulin increases gene expression of hepatic receptors of LDL-c this explains the low rates during Ramadan. In contrast to HDL-c, LDL-c's level increases in response to high carbohydrate diet **(Leenen, 1997)**. As for the effect of the different drugs on LDL-c's level, Amarel® had better result than Diamicron®. These results are

in line with those of **Muller et al (1995)**, who advanced that certain sulphamides such as Amarel® can mimic insulin in the translocation of transporters GLUT4, the synthesis of glycogen, the lipogenesis and the synthesis of VLDL-c whose hepatic catabolism can generate LDLc.

4. Protein measurements

Comparing to the benchmark period (non fasting period), a significant by hisher level of proteins in the serum was found during Ramadan especially among patients treated with Diamicron®. Lower levels were found among Amarel® treated patients. This can be the result of a certain hormones over-expression during prolonged fasting periods, such as glucagons which can stimulate a higher mobilisation of some constituents of peripheral tissues such amino acids **(Jensen et al 1998)**. This amino acid surge is usually caused by the need to compensate through glucogenesis the deficit in glucose in the peripheral tissues **(Herman et al 2000)**. According to the latter authors protein levels have the same patterns as BMI and thus muscular mass. This has been confirmed by our results, where patients following Diamicron® treatment have a higher BMI than those on Amarel®.

Concerning urea the average values during the entire course of the experimentation were within the range found in a healthy person (0.15g/l to 0.5g/l). Albeit during fasting urea rates are significantly higher among Amarel® users. This might be the cause of the slight dehydration due to abstinence from drinking during fasting period which leads to a fall in diuresis and a consequent rise in urea in the blood **(Bonneau,2001)**. Also ammoniac discharge following deamination and disamidation of certain amino acids used in the process of neoglucogenesis is the primary cause of an intense synthesis of hepatic urea **(Nagra et al 1998).**

The period effect has shown a clear rise in creatinine during Ramadan, particularly among Diamicron® users. This can be explained by an absent protein mobilisation and/or low renal clearance. **Lacour (1992)** indicates that creatinine does not depend only on glomerular filtration but also on meat product rich in this element whose consumption probably increases during this month.

CONCLUSION

Dietary restriction during daylight in the month of Ramadan does not seem to cause a harmful effect on the health of diabetic patients particularly among Amarel® users. A clear and significant decrease in plasma content of triglycerides, cholesterol as well as LDL-c and a significant increase in HDL-c were recorded during the fasting period and in comparison to a benchmark non fasting period. Amarel® treatment seems to do better in improving of the lipid profile of diabetic patients than Diamicron®. In fact cholesterol and TG levels are both significantly lower among Amarel® users. In sum it appears that sufferers from diabetes of the second type and following a sulphamides-based treatments can undertake the practice of fasting provided that they strictly

abide by a healthy diet which makes fasting more beneficial. We suggest for further research the study of the effect of other drugs and also other biochemical and hormonal parameters on the physiological and metabolic adaptation of type two diabetics during Ramadan fasting.

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تأثير صيام شهر رمضان علي بعض المقاييس البيوكيميائية عند المرضي بداء السكري غير المرتبط بالانسولين و المعالجون بنوعين من السلفميدات (الأمريل® و الديامكرون®)

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الأهداف المسطرة من خلال هذه الدراسة العلمية هي متابعة اختلاف بعض العناصر الأنتروبومترية و البيوكيميائية عند الرجال المصابين بداء السكري غير المرتبط بالأنسولين أثناء مرحلتين تجريبيتين: (5) خمسة أسابيع قبل شهر رمضان و في الشهر الثالث من هذا الشهر. تمت التجربة العلمية على 45 مريض, ذو سن متراوح بين 45 و55 سنة وكانوا تحت المعالجة بنوعين من الأدوية المخفضة لنسبة السكر في الدم من نوع السلفميدات:(الديامكرون® و الأمريل®).

أظهر التحليل الإحصائي أن قيم الكتلة الجسمية (BMI) لم تتغير كثيرا ($P>0.05$) قبل و خلال شهر رمضان لدي جميع المرضى رغم اختلاف نوعية التداوي. غير أنه تبين أن هذه القيم للكتلة الجسمية كانت صغيرة نوعا ما ($P>0.05$) لدي المرضى المعالجون بالأمريل® مقارنة مع الذين كانوا تحت المعالجة بالديامكرون®. أما بالنسبة للعناصر اللبيدية, شوهد في تركيز الدم انخفاضا ملحوظا($P>0.05$) (للكلسترول الإجمالي الجليسريدات الثلاثية و LDL كلسترول) و ارتفاعا ملحوظا ($P<0.05$) لقيم HDL كلسترول و هذا أثناء شهر رمضان على خلاف المرحلة العادية التي لا صوم فيها. أكدت النتائج أن للصوم أثر ايجابيا في تطور بعض العناصر الليبيدية الدموية خاصة عند المرضى المعالجون بالأمريل ®. و أخيرا أكبر التراكيز البلازمية (للبروتينات, للكرياثنين ولليوريا) سجلت خلال مرحلة الصوم ($P<0.05$) عند جميع المصابين بداء السكري الغير المرتبط بالأنسولين و المعالجون سواء بالأمريل® أو الديامكرون®.

الكلمات المفاتيح: الصوم, شهر رمضان, داء السكري الغير مرتبط بالأنسولين, الأمريل®, الديامكرون®.