

RESEARCH ARTICLE

THE EFFECT OF RAMADAN FASTING ON SERUM MALONDIALDEHYDE LEVELS AS INDICATOR OF OXIDATIVE STRESS AND CELLULAR DAMAGE

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ABSTRACT

Background: Ramadan fasting is one of five pillars of Islam. Fasting is to refrain from eating and drinking from sunrise (*sahur*) to sunset (*ifthar*). Ramadan fasting has been shown to impact on body systems in different manners. One of the benefits of Ramadan fasting is protection against oxidative stress and cellular damage. Malondialdehyde (MDA) is a product of free radicals (hydroxyl radicals) with polyunsaturated fatty acids (PUFAs) produced from lipid peroxidation of cell membranes. This paper aims to determine the effect of Ramadan fasting on serum MDA levels.

Methods: The design of this study is quasiexperimental with one group pre and post design. The sample of this study was 16 preclinical students of FK UIN Syarif Hidayatullah Jakarta who performed Ramadan fasting for 17 consecutive

days. Blood samples were taken 1 day before Ramadan fasting and 18 days of Ramadan fasting to measure serum MDA levels. The study was conducted in the biochemical laboratory of FK UIN Syarif Hidayatullah.

Results: The mean serum MDA levels before fasting was 0.90 ± 0.54 nmol/mL. The median value of serum MDA levels after fasting was 0.43 nmol/mL, with a range between 0.03 - 2.75 nmol/mL. Ramadan fasting decreases serum MDA levels, but the decrease that occurs on the 17th day of Ramadan fasting was not significant ($p > 0.05$). There was an increase in serum MDA levels in 4 subjects (25%) after Ramadan fasting.

Conclusion: Ramadan fasting can reduce serum MDA levels as a marker of oxidative stress and cell damage. Further study is needed to investigate the various results in serum MDA levels after fasting.

Keywords: Ramadan fasting, oxidative stress, serum MDA.

INTRODUCTION

Ramadan fasting is the fourth pillar of Islam and is conducted by Muslims to perfect their Islam. Fasting is to restrain food, drink, and lust from sunrise to sunset. In the state of fasting, there is a decrease in intake of carbohydrate, protein, and fat from sunrise to sunset.^{1,2} Glucose levels in portal blood decrease so that insulin secretion by β -pancreas cells decreases and an increase in glucagon secretion will activate the enzyme glycogen phosphorylase in the liver.³ This change causes an increase in the release of glycerol and free fatty acids from adipose tissue which will be used as a metabolic source. In a state of prolonged hunger, less than 10% of the body's energy comes from glucose. If there is no other source of glucose, liver and muscle glycogen will be depleted after fasting for about 18 hours. When fasting

continues and adipose reserves are depleted, there will be an increase in protein catabolism to form amino acids that will be used as a substrate for gluconeogenesis.³

Oxidative stress is an imbalance between free radicals and antioxidants in the body. The balance between the amounts of free radicals and antioxidants is an important condition to maintain the body, because free radicals can damage the cell membrane components in the body.^{4,5} One of the markers of oxidative stress is malondialdehyde (MDA). Malondialdehyde is a reactive aldehyde compound consisting of three carbon atoms. MDA is a product of polyunsaturated fatty acid (PUFA) peroxidation and is also formed from arachidonic acid metabolism.^{6,7}

Ramadan fasting can reduce lipid peroxidation as measured by changes in serum MDA levels. Fifin Afriyanti's study in 2013, there was a significant decrease in plasma

MDA level in ayyaumul bidh fasting.⁸ A study by Ibrahim et al about the effects of Ramadan fasting on oxidative stress parameters and cellular damage parameters on healthy objects, found that there was a significant decrease MDA levels in erythrocytes.⁹

We are interested to know the effect of Ramadan fasting on serum MDA level as a marker of oxidative stress and tissue damage.

METHODS

Study design and participants

The design of this study is quasiexperimental with one group pre and post design. The study was conducted at clinical pathology laboratory, Faculty of Medicine UIN Syarif Hidayatullah Jakarta from February to October 2017 with a total sample of 16 preclinical students faculty of medicine UIN Syarif Hidayatullah Jakarta according to inclusion and exclusion criteria. The number of samples in this study using a paired numerical comparative formula.

The subjects were male and female aged 16-25 years who performed Ramadan fasting for 17 consecutive days with exclusion criteria: having a history of metabolic disease or chronic illness, smoking, alcohol consumption, taking antioxidant supplements, vitamins/minerals, or being on medication, and having a vegetarian diet.

Blood samples were taken one day before Ramadan fasting and 17th day of Ramadan after Ramadan fasting for 17 consecutive days.

Blood sampling and assays

Six milliliters blood from cubital vein was extracted using a tube without anticoagulant and left for 30 minutes until it is clotted then centrifuged at 6000 rpm for 15 minutes. Blood serum were stored at -20°C until assayed MDA simultaneously.¹⁰⁻¹³ Serum MDA levels was assayed using

the hiobarbituric acid (TBA) test method, which can be measured spectrophotometrically at 515-553 nm.⁶

Statistical analysis

The normality of data distribution was calculated using the Shapiro-Wilk test. The analysis is continued with Wilcoxon test. Statistical analysis was performed using IBM SPSS ver 22.¹⁵

ETHICAL APPROVAL

The study was approved by ethics committee of the Faculty of Medicine and Health Sciences, UIN Syarif Hidayatullah Jakarta with protocol number Un.01/F10/KP.01.1/KE.SP/08.12.004/2017.

RESULTS

Characteristics subject

From the 16 subjects included in this study, the mean age of the study subjects was 19.8±1.05 years and 13 subjects (81.25%) were female. The subject of this study has a difference in age between 1-4 years. Age is one of the factors that influence serum MDA levels. Serum MDA levels increase is directly proportional to age, so in this study the age range is limited.^{16-18,8}

Laboratory results

The mean value serum MDA levels before Ramadan fasting was 0.90 ± 0.54 nmol/mL. Ibrahim et al study found that the mean serum MDA levels was 1.41 ± 0.13 nmol/mL.⁹ In another study conducted by Hatice et al., the mean value of serum MDA levels in healthy subjects was 1.52 ± 0.51 nmol/mL and Bhutia et al got 0.93 ± 0.39 nmol/mL.^{22,23} This is in contrast to Irianti's study in 2012 in Indonesia that obtained mean value serum MDA levels in healthy subjects was 0.28±0.09 nmol/mL. The difference in serum MDA level can be caused by differences in diet, physical activity, age, consumption of supplements, exposure to sources of free radicals in subjects.^{8,14,16-21}

Table 1. Serum MDA levels after ramadan fasting

Variable	Minimum level	Maximum level	Median
Serum MDA levels after Ramadan fasting	0.03	2.75	0.43
Difference in serum MDA levels	-2.15*	1.27	0.26

DISCUSSION

Based on table 1, there was a change in serum MDA levels on the 17th day of Ramadan fasting. A median value serum MDA levels after Ramadan fasting was 0.43 nmol/mL. This study is different from Ibrahim et al study who obtained serum MDA levels on the 14th and 28th day of Ramadan fasting were 1.34 ± 0.13 nmol /mL and 1.31 ± 0.15

nmol/mL.⁹ This can be caused by differences in diet, physical activity, and exposure to sources of free radicals in research subjects during Ramadan fasting.^{8,14,16-21}

The difference in serum MDA levels between before and after Ramadan fasting has a median value of 0.26 nmol/mL. Data analysis of differences in serum MDA levels before and after Ramadan fasting with the Wilcoxon test is shown in Table 2.

Table 2. Serum MDA levels before and after Ramadan fasting

Variable	Increase	Decrease	Stable	p
Serum MDA levels after Ramadan fasting against serum MDA levels before Ramadan fasting	4 sample	12 sample	0 sample	0.179

Based on the Wilcoxon test, there were 4 samples with increased serum MDA levels after Ramadan fasting and 12 samples with decreased serum MDA levels after Ramadan fasting but not significant ($p > 0.05$). The decrease in serum MDA levels that occurs is probably due to the retraction of polyunsaturated fats and the source of free radicals that occur during fasting, while the increase in serum MDA level after fasting is likely due to a high-fat diet at dawn or breaking fast, low consumption of vegetables and fruit, and free radical sources exposure.

The results of this study differ from the studies of Ibrahim et al., which found that there was a significant decrease in erythrocyte malondialdehyde (MDA), serum glucose, triglycerides, vitamin C, and total plasma carotenoids on the 28th day of Ramadan fasting. This is possible because in this study using serum and samples taken on the 17th day of Ramadan fasting, while in the study of Ibrahim et al using erythrocyte samples and samples taken on the 28th day of Ramadan fasting.⁹

The absence of recording and evaluation of dietary patterns, activity levels, and health complaints of subjects during Ramadan fasting is a limitation in this study.

CONCLUSION

Ramadan fasting decreases serum MDA levels, but the decrease that occurs on the 17th day of Ramadan fasting is not significant ($p > 0.05$). There was an increase in serum MDA levels in 4 subjects (25%) after Ramadan fasting. Further study needed to investigate various results in MDA levels after fasting.

CONFLICT OF INTEREST

None declared.

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