Research Article

The Impact of Ramadan Fasting on Health Parameters among Elementary School Teachers in Medan

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Abstract

Ramadan fasting, a globally significant religious practice, involves abstaining from food and drink from dawn to sunset for 29 to 30 days. While previous studies have linked fasting to various health outcomes, the results remain inconsistent. This study examines the effects of Ramadan fasting on several health indicators among elementary school teachers in Medan, focusing on body weight, glucose levels, uric acid levels, cholesterol levels, and blood pressure. Using a prospective cohort design, the study involved teachers from diverse backgrounds at Perguruan Islam Cendekia in Medan, North Sumatra. Baseline health measurements were recorded before Ramadan, with follow-up assessments conducted during and after fasting. Dietary patterns, physical activity, and other relevant factors were evaluated through validated questionnaires and interviews. Statistical analyses, including paired t-tests and Wilcoxon tests, were performed using IBM SPSS Statistics 20. Among the 20 participants, significant changes in health parameters were observed after Ramadan fasting. These included reductions in blood glucose (p = 0.034) and cholesterol levels (p = 0.014), along with an increase in uric acid levels (p = 0.009). However, no significant changes were found in BMI (p = 0.344) or mean arterial pressure (p = 0.345). These findings highlight both the benefits and potential challenges of fasting on physiological health. Ramadan fasting has a multifaceted impact on the health of elementary school teachers in Medan across different health indicators. Tailored interventions are recommended to support well-being during fasting periods.
***Keywords**: elementary school teachers, health parameters, Ramadan fasting.*

Pengaruh Puasa Ramadan terhadap Parameter Kesehatan pada Guru Sekolah Dasar di Medan

Abstrak

Puasa Ramadan merupakan praktik keagamaan berupa abstinensi dari makanan dan minuman sejak fajar hingga matahari terbenam selama 29 hingga 30 hari. Penelitian terdahulu telah menunjukkan bahwa puasa memiliki kaitan dengan parameter kesehatan, meskipun hasilnya bervariasi. Penelitian ini bertujuan untuk mengetahui dampak puasa Ramadan di kalangan guru sekolah dasar di Medan terhadap indikator kesehatan mencakup berat badan, tinggi badan, kadar glukosa, asam urat, kolesterol, dan tekanan darah. Penelitian kohort prospektif ini melibatkan guru dari berbagai latar belakang di Perguruan Islam Cendekia, Medan, Sumatra Utara, sebagai subjek penelitian. Pengukuran dilakukan sebelum, selama, dan setelah puasa Ramadan. Data pola makan, aktivitas fisik, dan faktor lainnya dikumpulkan melalui kuesioner terstandar dan wawancara. Analisis statistik menggunakan IBM SPSS Statistics 20 dengan uji paired t-test dan Wilcoxon test. Dari 20 subjek, terdapat penurunan bermakna pada glukosa darah (p=0,003) dan kolesterol total (p=0,014), serta peningkatan bermakna pada asam urat (p=0,009) setelah puasa Ramadan. Namun, tidak terdapat perubahan bermakna pada body mass index (p=0,344) dan mean arterial pressure (p=0,345). Studi ini menekankan manfaat dan tantangan potensial dari puasa terhadap kesehatan fisiologis. Puasa Ramadan memiliki dampak yang beragam terhadap kesehatan guru sekolah dasar di Medan untuk berbagai indikator kesehatan. Intervensi khusus diperlukan untuk mendukung kesejahteraan selama berpuasa.
***Kata kunci:** guru sekolah dasar, parameter kesehatan, puasa Ramadan.*

Introduction

Fasting during Ramadan is a significant religious practice observed by millions worldwide, involving abstinence from food and drink from dawn to sunset for approximately 29 to 30 days. This period of fasting is characterised not only by its spiritual significance but also by its potential implications on various health parameters.[1] Among the diverse groups observing Ramadan, elementary school teachers represent a unique cohort due to their professional responsibilities and societal contributions, making them an important demographic to study in Medan, Indonesia. The effects of fasting on health parameters have been a subject of extensive research.[2,3]

The decision to study elementary school teachers during Ramadan fasting is rooted in several key considerations.[4] Firstly, elementary school teachers represent a cohort with regular daily routines and responsibilities that fasting may impact. Their occupational demands, including teaching schedules, physical activities, and stress levels, could interact with fasting practices and potentially influence health outcomes. Moreover, exploring diverse health parameters—body weight, height, glucose, uric acid, cholesterol, and blood pressure—provides a comprehensive understanding of the physiological changes associated with Ramadan fasting.[2,3] These parameters are interconnected and integral to assessing overall health, metabolic function, and cardiovascular risk.

A systematic review underscores the complexity of the relationship between fasting and health parameters.[3] Numerous studies have reported alterations in metabolic profiles during Ramadan, with variations observed in body weight due to changes in meal timings, caloric intake, and dietary composition.[2,5] Additionally, fluctuations in glucose, uric acid, cholesterol, and blood pressure levels have been documented during fasting periods, suggesting potential short-term impacts on metabolic health.[2] However, conflicting findings exist within the current literature. While some studies highlight beneficial effects such as improved lipid profiles and weight management, others indicate transient changes or negligible effects on certain health parameters.[3,4] Variability in study populations, methodologies, and duration of fasting could contribute to these discrepancies, warranting further investigation.

This prospective cohort study examines the impact of Ramadan fasting on various health parameters among elementary school teachers in Medan. By evaluating physiological adaptations before, during, and after the fasting period, the study aims to provide a comprehensive understanding of its effects. The findings are expected to offer valuable insights that can inform targeted health recommendations and interventions during this period.

Methods

Participants

Participants in this study were recruited through convenience sampling. The eligible participants were teachers or staff members actively teaching at Perguruan Islam Cendekia in Medan, North Sumatra, who were observing Ramadan fasting and intended to fast for at least 20 days in the upcoming Ramadan 2023. Those who were pregnant, diagnosed with renal failure, hepatic impairment, diabetes mellitus, hypertension, hyperlipidemia, thyroid disorders, cardiovascular diseases, or using weight-reducing agents were excluded. They agreed to participate in the study and completed a structured questionnaire to collect demographic and health-related information. The questionnaire included birth date, gender, occupation, body weight, height, history of cardiovascular disease and diabetes (including family history and medications), and smoking habits.

Additional data collected in the questionnaire included participants' blood pressure, blood glucose, cholesterol, and uric acid levels. Information on fasting habits, including the number of fasting days, dietary intake during suhoor, iftar, post-iftar, and physical activity during Ramadan, was also gathered. A total of 65 teachers or staff members participated in the study; however, only 20 completed all the required data.

Research Instrument and Data Collection

The study design used in this research was a prospective cohort. It was conducted at the Perguruan Islam Cendekia in Medan, North Sumatra, during the fasting month of Ramadan in 2023. The Department of Clinical Pathology research team measured participants' weight, height, blood sugar levels, cholesterol levels, uric acid levels, and blood pressure. Weight was measured using scales, while height was measured with tape. Blood sugar, cholesterol, and uric acid levels were determined using GCU Easy Touch® devices (Taiwan). Blood pressure measurements were conducted using a digital sphygmomanometer.

Data Analysis

The IBM SPSS Statistics 20 for Windows program analyzed the research data. Data on weight, height, blood sugar levels, cholesterol levels, uric acid levels, and blood pressure were assessed for normality. Subsequently, for each dataset with a normal distribution, the paired t-test was applied, utilizing mean (SD) as the result. Variables that were assessed using the paired t-test were body mass index (BMI), total cholesterol, and mean arterial pressure (MAP). Meanwhile, the Wilcoxon test was utilized with median (min-max), which was reported as the result for data that was not normally distributed.

Results

This study examined 20 elementary school teachers, with participants having a mean age of 36 ± 15 years. The majority were female (n = 19), with an average BMI of 26.37 ± 6.24. Initial screening results showed a mean (SD) glucose level of 123.45 (54.28) mg/dL, total cholesterol of 224.2 (29.9) mg/dL, uric acid of 5.26 (1.68) mg/dL, and MAP of 90.93 (11.97) mmHg.

Among the reported comorbidities, one participant had cardiovascular disease, one had diabetes mellitus, five had gastrointestinal disease, and three had allergic respiratory disease. Regarding family history, four participants reported a family history of cardiovascular disease, while six had a family history of diabetes mellitus. Participants were also asked about their fasting habits, with 12 individuals fasting for 12–20 days and five fasting for 22–30 days.

Additional data included details on food and drink consumption at specific times—such as suhoor, breaking fast, and the period between the two—as well as information about participants' daily activities. Demographic data for the subjects are presented in Table 1.

The participants were divided into pre-intervention and post-intervention groups. Pre-intervention measurements were taken before fasting, while post-intervention measurements were recorded after the fasting period. Table 2 presents an overview of the average BMI values, which showed a slight decrease from 26.38 ± 6.24 kg/m² in the pre-fasting group to 26.12 ± 5.97 kg/m² in the post-fasting group, with a mean difference (95% CI) of 0.26 (-0.29–0.82). Similarly, total cholesterol levels declined from 224.2 ± 29.9 mg/dL to 201.75 ± 42.82 mg/dL, with a mean difference of 22.45 (5.04–38.86). Glucose levels also showed a significant reduction, with the pre-fasting median (min-max) recorded at 111 (77–311) mg/dL and the post-fasting median at 87.50 (3.5–8.9) mg/dL.

Table 1. Characteristics of the Subjects (n=20)

Characteristics	n
Age (years)*	36 (15)
BMI (kg/m2)*	26.37 (6.24)
Glucose (mg/dL)*	123.45 (54.28)
Total cholesterol (mg/dL)*	224.2 (29.9)
Uric acid (mg/dL)*	5.26 (1.68)
MAP (mmHg)*	90.93 (11.97)
Gender	
Male	1
Female	19
Comorbidities	
Cardiovascular disease	1
Family history of cardiovascular disease	
Yes	4
Unsure	2
No	14
Diabetes mellitus	1
Family history of diabetes mellitus	6
Gastrointestinal disease	5
Typhoid	1
Allergic respiratory disease	3
Smoker	1
Ramadan Fasting	
Accumulated days	
12-21 days	12
22-30 days	5
No answer	3
Consumptions at suhoor	
Rice	16
Fruits	2
Fish	3
Vegetables	7
Mineral Water	4
Consumptions when breaking the fast	
Rice	13
Dates	2
Fish	1
Fried chicken	1
Vegetable	1
Fried snacks	5
Cake	1
Mineral water	2
Juice	1
Fruit soup	1
Milk	1
Consumptions between breaking the fast and suhoor	
Rice	5
Fried snack	2
Fruits	1
Sweet snack/drink	5
Meatball	1
Meat skewer	1
Nothing	5
Activity during Ramadan	
Teaching	11
Working (not specified)	6
Sleeping	1
Preparing food for suhoor	1

*mean (SD)

significant reduction, with the pre-fasting median (min-max) recorded at 111 (77–311) mg/dL and the post-fasting median at 87.50 (3.5–8.9) mg/dL

Table 2. Health Parameters on Pre- and Post-Fasting Conditions

Parameter	Pre-Fasting	Post-Fasting	Mean Difference (CI 95%)	z	p
BMI (kg/m2)	26.38 (6.24)[a]	26.12 (5.97)[a]	0.26 (-0.29–0.82)	N/A	0.344
Total cholesterol (mg/dL)	224.20 (29.91)[a]	201.75 (42.82)[a]	22.45 (5.04–38.86)	N/A	0.014
MAP (mmHg)	90.93 (11.97) [a]	92.43 (11.00)[a]	-1.50 (-4.7–1.74)	N/A	0.345
Glucose	111 (77–311)[b]	87.50 (3.58.9) [b]	N/A	-2.923	0.003
Uric Acid	4.56 (69–93)[b]	5.85 (3–9.8)[b]	N/A	-2.616	0.009

a) Mean (Standard Deviation)
b) Median (Min-Max)

In contrast to the three variables that showed a decrease, uric acid and MAP exhibited an increase in their average values. Specifically, the median uric acid level rose from 4.56 (69–293) mg/dL in the pre-fasting group to 5.85 (3–9.8) mg/dL in the post-fasting group. Similarly, the mean MAP value increased from 90.93 ± 11.97 mmHg to 92.43 ± 11.00 mmHg, with a mean difference of -1.50 (-4.7–1.74). However, only three out of the five parameters—glucose, total cholesterol, and uric acid—were statistically significant ($p < 0.005$).

Discussion

Body Mass Index

The BMI serves as an anthropometric metric commonly utilized to elucidate height/weight characteristics and is associated with an individual's level of fatness. Various studies have extensively examined the impact of fasting during Ramadan on BMI. The outcomes may vary among individuals, resulting in either weight gain or weight loss, contingent upon the ratio of energy intake to expenditure. According to a meta-analysis conducted by Fernando et al,[6] a significant positive correlation was observed between the initial BMI and weight loss during fasting. Ramadan fasting led to notable reductions in weight, fat mass (both as a percentage of total weight and in absolute terms), and fat-free mass. This study revealed that individuals with higher initial BMI experienced greater weight loss. Notably, individuals who were overweight or obese exhibited a significant reduction in fat mass, a phenomenon not observed in those with a normal weight. This suggests that fasting during Ramadan may be more effective in weight loss for individuals with a higher BMI.

In another study by Illahika et al,[7] intriguing results were obtained. For participants with normal weight, overweight, and obesity, there was an increase in BMI during the second week for obese participants and a decrease in BMI during the third week for normal and overweight participants. Similar results were reported by Majid et al,[8] showing an increase in BMI during the second week and a decrease in BMI during the fourth week. Our findings indicated a positive correlation between decreasing BMI and the post-fasting state, although this correlation was not significant ($p>0.05$). Therefore, it can be concluded that while previous studies have noted a decrease in BMI, some of these observations did not achieve statistical significance.[8]

Glucose

Fasting among elementary school teachers in Medan has been correlated with a significant decline in blood glucose levels. Ramadan fasting has been found to have an impact on glucose levels. Several studies have investigated the association between fasting during Ramadan and glucose control in different populations. One study found that fasting during Ramadan led to a slow fall in glucose levels during fasting hours, followed by a rapid rise after the sunset meal.[9] Another study observed an increase in hyperglycemic episodes and glucose variability after Ramadan compared to before and during Ramadan.[10] Additionally, Ramadan fasting was associated with a significant decrease in fasting blood glucose levels and HbA1c levels in patients with type 2 diabetes mellitus.[11] These findings suggest that fasting during Ramadan can affect glucose metabolism and insulin sensitivity, leading to changes in glucose levels.

Total Cholesterol

Fasting among elementary school teachers in Medan has been correlated with a significant

decline in total blood cholesterol. Ramadan fasting has been found to have an association with total cholesterol levels. Several studies have shown that fasting during Ramadan can lead to a decrease in total cholesterol levels.[12,13] However, the exact mechanism behind this association is not fully understood. It is suggested that the changes in dietary intake and lifestyle during Ramadan fasting may contribute to reducing total cholesterol levels.[14] Additionally, the alteration in lipid profile during Ramadan fasting, such as an increase in high-density lipoprotein (HDL) cholesterol and a decrease in low-density lipoprotein (LDL) cholesterol, may also play a role in reducing total cholesterol levels.[15]

Uric Acid

Fasting among elementary school teachers in Medan has shown a notable association with increased uric acid levels. During fasting, alterations in dietary habits, particularly reduced intake of purine-rich foods, lead to decreased excretion and increased production of uric acid. Several studies have highlighted that fasting practices can result in a rise in uric acid due to decreased renal clearance caused by dehydration and reduced urine output. Furthermore, it is also emphasized that the body's reliance on endogenous protein breakdown for energy during fasting exacerbates this phenomenon. This metabolic shift elevates uric acid levels due to increased purine catabolism.[16–18]

The impact of fasting-induced changes on uric acid levels has been extensively documented among diverse populations. In addition to dietary modifications, it is also demonstrated that fluctuations in insulin levels during fasting contribute to reduced renal excretion of uric acid, compounding its accumulation.[18,19] Consequently, fasting practices among elementary school teachers in Medan pose a potential risk for elevated uric acid levels, necessitating monitoring and dietary adjustments during fasting periods to mitigate potential health implications.[16]

Mean Arterial Pressure

Fasting among elementary school teachers in Medan was not correlated with a significant elevation in MAP. Previous studies on the effects of Ramadan fasting on MAP have yielded varied results. One study involving diabetic patients with a history of cardiovascular events observed a non-significant decrease in blood pressure following Ramadan, possibly due to metabolic changes. Similarly, a study focusing on hypertensive patients found no notable changes in blood pressure during Ramadan, regardless of medication timing.[20] Additionally, research on stable ischemic heart disease patients fasting during Ramadan found no significant alterations in blood pressure levels before and after fasting.[21] These findings suggest that fasting during Ramadan may not significantly impact MAP in specific patient groups.

During fasting, MAP levels exhibit dynamic changes driven by various physiological adaptations. Initially, sympathetic nervous system activity increases to maintain blood glucose levels through vasoconstriction and elevated heart rate, leading to a rise in MAP. As fasting progresses, insulin levels decrease, prompting the utilization of alternative fuel sources like ketones and a subsequent decrease in sympathetic activity. This transition, coupled with the body's entry into autophagy, contributes to a reduction in MAP.[22–23]

Additionally, hydration status plays a crucial role. Dehydration commonly occurs during fasting, decreasing blood volume and triggering compensatory mechanisms to maintain blood pressure. However, despite these mechanisms, dehydration-induced haemoconcentration and reduced circulating blood volume can decrease MAP. Therefore, the fluctuating levels of MAP during fasting reflect a complex interplay of hormonal changes, metabolic adaptations, and fluid balance dynamics, highlighting the body's sophisticated mechanisms to maintain homeostasis during nutrient deprivation.[24]

Several investigations have noted the association between fasting and blood pressure changes across diverse populations. Additionally, alterations in circadian rhythm and sleep patterns during fasting have been linked to fluctuations in MAP.[27] These findings emphasize the multifactorial nature of MAP level changes during fasting among elementary school teachers in Medan, warranting attention to hydration, dietary composition, and stress management during fasting periods to mitigate potential cardiovascular risks.

This study has several limitations that affect the interpretation of its findings. The small sample size (20 participants) limits generalizability, and variations in fasting adherence (12–21 days) may have influenced the results. Additionally, only specific health indicators—BMI, glucose levels, cholesterol, uric acid, and blood pressure—were measured, without assessing other metabolic factors like liver and kidney function or metabolic

hormones. Another major limitation is the lack of detailed dietary intake assessment, including daily energy consumption, which is crucial for understanding metabolic changes. Without precise data on food intake, interpreting health parameter changes remains challenging. Future research should address these gaps by including a larger sample, comprehensive metabolic assessments, and detailed dietary analysis to better understand the effects of Ramadan fasting on health

Conclusion

This study examined the impact of Ramadan fasting on various health parameters among elementary school teachers in Medan. While BMI did not show a significant change, glucose and total cholesterol levels exhibited notable reductions, consistent with previous research. In contrast, uric acid levels increased significantly, likely due to dietary and metabolic shifts during fasting, while mean arterial pressure remained relatively unchanged. These findings emphasize the complex interplay between fasting, dietary habits, hydration, and metabolism. Further research is necessary to better understand these physiological changes and develop tailored health interventions to optimize fasting outcomes.

Conflict of Interest

We declare that there is no conflict of interest relevant to this article.

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