The Safeness of Ramadan Fasting Among Patients Who Have Undergone Primary Percutaneous Coronary Intervention: a Cross-sectional Descriptive Study

Shwan O. Amen
  Surgical Speciality Hospital – Cardiac Center

Banan Q. Rasool
  Batas Primary Health Care Center – Ministry of Health, Erbil

Alaa Rashid (✉ alaarashidd@gmail.com)
  Hawler Medical University - College of Medicine

Sara S. Shakir
  Hawler Medical University - College of Medicine

Parez M. Qadr
  Ministry of Health – Kurdistan Regional Government

Asia L. Shawkat
  Ministry of Health – Kurdistan Regional Government

Rangen T. Abdulkarem
  Harir Hospital – Ministry of Health

Salah Hassan Yousif
  Hawler Medical University - College of Medicine

Don Eliseo Lucero Prisno III
  Department of Global Health and Development, London School of Hygiene and Tropical Medicine,
London

Abstract

Background: The rise of Primary Percutaneous Coronary Intervention (PPCI) procedure as an option for treating Coronary Artery Diseases demands addressing a variety of concerns in the recovery period and afterward including fasting the Ramadan month in the countries with the prevailing Muslim population. Therefore this study aims to assess the ability and the safety of fasting among patients who underwent PPCI within two specified periods.

Method: This study was a prospective observational study with a sample size of 200 consecutive patients that have been divided into two groups based on the duration of their last PCI for an attack of Acute Myocardial Infarction (AMI). The patients were admitted to the Causality Department of the Surgical Specialty Hospital-Cardiac Center, Erbil/Iraq. The studied data have been analyzed using the Statistical Package for Social Science version 25 (SPSS), and a P-value of ≤0.05 was considered statistically significant.

Results: The proportion of fasting and non-fasting patients showed a significant association with the duration of their last PCI procedure with a P-value of 0.001 as 14% in Group I (patients with less than 6 weeks duration post-PCI) successfully fasted the month while it was 54% in Group II (Patients with more than 6 weeks duration post PCI).

Among our findings, there were significant associations with P-values of 0.001 between post-PCI symptoms and Ramadan fasting. In regards to NYHA classifications assessment, Group I had a higher proportion of patients classified as Class III and Class IV compared to Group II with a significant P-value of 0.001 with proportions of class III classification in Group I of 14.3% among fasting, 17.1% among non-fasting, and 58.3% among those who could not continue their fasting while in Group II, the proportions showed 3.7% among fasting, 6.7% among non-fasting, and 0% among those who could not continue their fasting.

Conclusion: We discourage fasting among patients who have undergone Percutaneous Coronary Intervention within the first 6 weeks, as well as patients who have NYHA class III and above as they are highly liable for deterioration and can not continue their fasting.

Introduction

Percutaneous Coronary Intervention (PCI) is a nonsurgical, invasive procedure that has been used considerably well for ischemic heart disease to relieve symptoms resulting from the mismatch between myocardial oxygen supply and demand [1]. With the extensive use of PCI and the high occurrence of Coronary Artery Disease (CAD) in the regions of the Middle East and North Africa, there has been a rising concern of whether patients can fast Ramadan again in the year following Primary PCI especially that the previously mentioned regions have the most percentage of Muslims among their populations [1–3].

Ramadan Fasting (RF) is practiced by Muslims all over the world and is considered one of the five Islamic pillars. RF can be described as daytime abstinence of food and drink from dawn to dusk in the 9th month of the Lunar Calendar, and it's a sudden pattern of lifestyle change of sleeping schedule, water intake as well as eating which is usually in the form of two large meals per day. According to the Islamic principle, it's only an obligatory practice for healthy non-traveling adults therefore ill patients can be exempt and excused from fasting, but many still wish to fast the month due to spiritual and cultural costumes despite the advice of their physicians [4–5].

There have been previous studies investigating the physiological effects of fasting and factors that have been considered as risk factors for ischemic heart disease in healthy adults, some showing significant reduction in blood pressure, BMI, waist circumference with improvement in lipid profile while there have been heterogeneous findings on blood sugar thrombogenesis for which efforts have been made to decrease the thrombogenicity and increase the viability of PCI intervention through pharmacological approaches [6–7]. Ramadan Fasting raises the issue of whether patients can strictly comply with these results [8]. Reports have also shown conclusive significant improvement in 10 years coronary heart disease risk that was carried out among patients with at least one cardiovascular risk [9].

Other studies have shown that patients with stable cardiac diseases can safely fast during Ramadan, however, the concern in patients with the PCI procedure is in the aftermath of stent post-PCI medications and the risk of reduced fluid intake which both may highly affect and increase the rate of thrombogenesis [10].

To the best of knowledge, fasting in patients with three months post-PCI period was concluded safely in one study done exploring the safety of Ramadan Fasting in patients following PCI revealing clinical, biochemical, and imaging changes with regards to fasting and non-fasting patients before, during, and after Ramadan with a recommendation of further data collection and analysis reports in other regions of the Muslim populations due to the variable daytime fasting duration, temperature and humidity [10].

The aim of this study, therefore, is to assess the ability and the safety of fasting among patients who undergone primary Percutaneous Coronary Intervention within two specified periods after the procedure as well as to be pioneers in this field of study in our local region.

Methodology

Study population

This is a prospective observational study conducted among 200 consecutive patients that have undergone Primary Percutaneous Coronary Intervention (PPCI) for an attack of acute myocardial infarction (AMI), after their admission to the Causality Department of the Surgical Specialty Hospital-Cardiac Center, Erbil/Iraq.

The participants have been divided into two different groups according to the duration of the last PPCI done for them to assess the safeness of fasting after undergoing of PCI procedure. Group I included 100 consecutive patients who had PPCI within less than 6 weeks before the start of Ramadan 2021 (13-April-2021). Group II included the other 100 patients who had PPCI within the period of more than 6 weeks to 11 months before the start of Ramadan 2021. Medical records, risk factors, and lab analyses have been taken from both groups before the PPCI.

The duration of fasting on the first day of the month of Ramadan was 14 hours and 35 minutes while it was 15 hours and 45 minutes on the last day in the local center in Erbil where the study was conducted. Regarding the weather, the average temperature was 17.4°C and humidity was 57% [11–12].

One month after Ramadan, the studying population has been followed up with a thorough follow-up questionnaire that included have eir ability of fasting during the Ramadan month, their medical state and symptoms, any emergency admission for acute cardiac events, and any recent cardiac intervention.

The persistent symptoms have been evaluated accurately during both fasting/non-fasting days along with the recording of the New York Heart Association (NYHA) classification which is a Functional Classification that provides a simple way of classifying the patients regarding their severity of symptoms. It places patients in one of four categories based on how much they are limited during physical activity; the limitations/symptoms are in regards to normal breathing and varying degrees in shortness of breath and/or angina [13].

Statistical analysis

The studying data have been analyzed using the Statistical Package for Social Science version 25 (SPSS, IBM, Armonk, NY, USA). Quantitative data have been expressed as mean∓Standard Deviation while qualitative data as frequency and percentages (%). Fisher's exact and Chi-square tests have been performed to test for differences in proportions of categorical variables between the two groups and a P-value of ≤0.05was considered statistically significant.

Results

After following up on 200 patients of whom (73.5%) were male and (26.5%) were female of mean age 57.5 ∓ (12.1), among them (34%) fasted successfully during Ramadan in April 2021, while (9%) could not continue to fast, the remaining (50%) had decided that they will not fast and (7%) had passed away on follow up with undisclosed causes. The factors that are known to be common risk factors for cardiovascular diseases, as well as the patients' presentation after their admission to the cardiac center and before the PCI procedure, are shown in Table 1 and Table 2, respectively, and the association between the risk factors and Ramadan Fasting is shown in Table 3. The majority of the patients (78%) were known to have 3 to 5 risk factors, while patients who fasted had mostly less than 2 risk factors of cardiovascular disease with a P-value of 0.002. Figure 1 and Figure 2 show an elaboration of the association between Gender, Fasting, and duration.

Table 1

Demographic and Risk factors of the overall population.

Risk factor	N(%) in male patients	N(%) in female patients
Age (more than 40)	135(72.6%)	51(27.4%)
Previous heart disease	110(72.8%)	41(27.2%)
Hypertension	62(78.5%)	17(21.5%)
Diabetes	72(80.0%)	18(20.0%)
Hyperlipidemia	96(75.0%)	32(25.0%)
Smoking	77(60.6%)	50(39.4%)
Family history	122(73.9%)	43(26.1%)

Table 2

Presentation of the patients with admission to the Cardiac Center before PCI procedure.

Type of MI	N(%)
STEMI	163(81.5%)
NSTEMI	34(17.0%)
No significant change	3(1.5%)

Name of the occluded artery	N(%)
LAD	99(49.5%)
RCA	55(27.5%)
LCX	18(9.0%)
D1	4(2.0%)
OM	6(3.0%)
Double vessel for staged PCI	10(5.0%)
3VD for CABG	8(4.0%)

Table 3

showing association between the risk factors and Ramadan fasting of the overall population.

Risk factor	Fasting	Non-fasting	Could not continue fasting	Dead	*P*-value
Age					
<39	8.8%	8.0%	0.0%	0.0%	0.618
≥40	91.2%	92.0%	100.0%	100.0%	
Gender					
Male	75.0%	64.0%	100.0%	100.0%	0.001
Female	25.0%	36.0%	0.0%	0.0%	
Previous HD					
Yes	35.3%	15.0%	38.9%	38.6%	0.007
No	64.7%	85.0%	61.1%	71.4%	
Smoking					
Yes	42.6%	36.0%	22.2%	28.6%	0.379
No	57.4%	64.0%	77.8%	71.4%	
Hypertension					
Yes	61.8%	59.0%	55.6%	71.4%	0.796
No	38.2%	41.0%	44.4%	28.6%	
Diabetes					
Yes	41.2%	58.0%	55.6%	100.0%	0.001
No	58.8%	42.0%	44.4%	0.0%	
Hyperlipidemia					
Yes	23.5%	48.0%	33.3%	14.3%	0.003
No	76.5%	52.0%	66.7%	85.7%	
Family history					
Yes	14.7%	16.0%	38.9%	14.3%	0.131
No	85.3%	84.%	61.1%	85.7%	

Apart from the (7%) of the participants who passed away, (11.5%) were found to have had acute admissions post-PCI while the other (81.5%) were not, and on comparing the proportions of acute admissions among those who had PCI for less than six weeks, (15.0%) were found to be while it was (8.0%) among those who had PCI more than six weeks and the P-value was 0.095. On following up, (4.0%) were found to have had at least one cardiac intervention of vascularization particularly with PCI and the other (89.0%) did not have any interventions, and apart from the remaining (7%) who were found to have passed away. The proportion of intervention in patients who had PCI in less than six weeks was (6%) while it was (2%) in patients who had PCI in more than six weeks and the P-value was 0.101.

Our sample patients were divided into two equally numbered groups of patients in relation to the duration of their PCI procedure, Group I (patients with less than 6 weeks post-PCI), and Group II (patients with more than 6 weeks post-PCI procedure), and the two groups showed different frequencies of symptoms and NYHA classification during the month of Ramadan as shown in Table 4 and Table 5. The proportion of fasting and non-fasting patients showed a significant association with the duration of post-PCI with a P-value of 0.001 as 14% in Group I successfully fasted the month while it was 54% in Group II as illustrated in Figure 3.

Table 4
shows the association between the risk factors and Ramadan fasting of the overall population.

Post-PCI symptoms	(%) in patients of less than 6 weeks duration	(%) in patients of more than 6 weeks duration
Chest pain	23.0%	24.0%
SOB with exertion	53.0%	26.0%
Palpitation	17.0%	4.0%
Easy fatigability	39.0%	26.0%
*Note: These frequencies are apart from the 4% of patients who passed away in the group of fewer than 6 weeks duration and the 10% of patients of more than 6-week duration group.		

Table 5
NYHA classification of the patients during the month of Ramadan.

Post-PCI NYHA classification	(%) in patients of less than 6 weeks duration	(%) in patients of more than 6 weeks duration
Class I	32.0%	44.0%
Class II	26.0%	40.0%
Class III	21.0%	4.0%
Class IV	17.0%	2.0%
*Note: These frequencies are apart from the 4% of patients who passed away in the group of fewer than 6 weeks' duration and the 10% of patients of more than 6-week duration group.		

Among our findings, there were significant associations with *P*-values of 0.001 between post-PCI symptoms and Ramadan Fasting in Group I (patients with less than 6 weeks of the PCI procedure) with a percentage of 14.3%, 27.1%, and 16.7% for patients who complained of chest pain respectively among fasting, non-fasting, and patients who could not continue to fast during the month. On the contrary, the proportions of those who complained of chest pain in Group II (patients with more than 6 weeks' duration post-PCI) were 25.9% among the fasting patients, 20.0% among non-fasting patients, and 66.7% among those who could not continue to fast during the month. The proportion of those who experienced shortness of breath on exertion in Group I were 50% among fasting patients, 55.7% among non-fasting patients, and 58.3% among those who could not continue to fast while in Group II, the proportions were 18.5% among those who fasted, 46.7% among those who did not and 33.3% among those who could not continue the fast. For the palpitation complaint in Group I, the proportions was 14.3% among the fasting group, 14.3% among non-fasting, and 41.7% among those who could not continue, while in Group II the proportions were 3.7% among fasting, 6.7% among non-fasting, and 0% among those who could not continue to fast. While for easy fatigability in Group I, the proportions were 14.3% among fasting, 40.0% among non-fasting, and 75.0% among those who couldn't continue, while the proportions in Group II were 25.9% among fasting, 40% among non-fasting, and 0% among those who couldn't continue. Figure 4 shows the association of post-PCI symptoms with fasting among Group I.

On relating acute admissions with specific cardiac symptoms among the 12 patients who couldn't continue their Ramadan Fasting in Group I, the proportion of acute admission among those who experienced shortness of breath was 28.6% while it was 100% among those who did not experience shortness of breath with a significant *P*-value of 0.028. However, in cases of easy fatigability, there was 77.8% acute admissions among those who experienced the symptom while it was 0.0% among those who did not experience it with a significant *P*-value of 0.045. This is shown in Table 6.

The relation between NYHA classification and Ramadan Fasting showed a significant *P*-value of 0.001 with proportions of class III classification in Group I of which showed 14.3% among fasting, 17.1% among non-fasting, and 58.3% among those who could not continue their fasting while in Group II, the

proportions showed 3.7% among fasting, 6.7% among non-fasting, and 0% among those who could not continue their fasting.

Table 6
The association between symptoms and admissions among Group I who could not continue their fasting.

Symptoms	Acute Admission	P-value
SOB on exertion		
Yes	28.6%	0.028
No	100%	
Easy fatigability		
Yes	77.8%	0.045
No	0.0%	

Discussion

There is little conclusive data with correspondence of Ramadan Fasting within a short duration post-PCI. To the best of our knowledge, there's data already showing that fasting is only relatively safe after three months' duration of post-PCI [10, 14]. However, studies on attitudes of patients show that patients still fast despite physicians' advice to avoid fasting [15]. In our Group I study sample patients (Patients within six weeks duration post-PCI), all 100 participants were advised against fasting in the following Ramadan, yet 26 patients still intended to fast but only 14 of them completed fasting the whole month making up 54% of the total fasting participants, while comparing to Group II (Patients with more than 6 weeks duration post-PCI), 90% successfully fasted the 30 days. There was also another study on patients with stable heart disease which also showed that 86% could successfully finish the whole month [8].

The symptoms of patients during Ramadan Fasting were assessed and it was found that in Group I, non-fasting patients experienced chest pain in a higher proportion than fasting patients and those who could not continue. Mousavi *et al.* [16] in a study on Ramadan Fasting among patients with coronary artery disease showed that patients who were not complaining of chest pain with an unspecified history of post revascularization, later on, did not experience chest pain during Ramadan Fasting as well. While in our study we specified the time of PCI-procedure being done, we did not have data on the symptomatic status of the patients before Ramadan. However, if patients did originally complain of chest pain before Ramadan in our study of Group I patients, this may have prevented them from fasting which could be an explanation for the higher proportion of chest pain among the non-fasting participants. Chest pain in Group II was found to be significantly higher in proportion among patients who could not continue to fast, and fasting might or might not be the reason for the increased proportion of chest pain while there was

another study that showed that fasting did not affect the symptoms of patients with stable cardiac diseases [16].

The two specific cardiac symptoms (easy fatigability and shortness of breath after exertion) which were important to assess post-PCI were higher in proportion among those who could not continue fasting in Group I while they were higher among non-fasting patients in Group II. Therefore, it's suggestive that it might not be safe for patients to fast with a short duration post-PCI as there was a significantly higher percentage of patients who could not continue fasting in Group I compared to Group II and this is maybe due to new-onset or worsening of these two symptoms. There are already a group of research studies that have shown that fasting did not clinically deteriorate patients with stable cardiac diseases which is corresponding to our findings in Group II [17, 18].

In regards to NYHA classifications assessment, Group I had a higher proportion of patients classified as Class III and Class IV compared to Group II which also agreed with a study that compared NYHA classification on stable and unstable patients with chronic heart failure [19]. The results in Group I showed with significance that the lower the NYHA classification, the higher the proportion of patients who were able to continue their fasting the entire Ramadan with the exclusion of Class IV whom none were from fasting patients as clarified in Figure 5. While in comparison to Abazid et al. [19] no difference was shown in NYHA classification with regards to fasting and non-fasting patients.

Studies reported rates of readmission after PCI within 30 days to be between 3.3%-15.8% influenced highly by the healthcare system [20], while our study of Group I showed a rate of readmission of 15% which is within the common incidence rate of previously studied cohorts which might suggest the indifference effect of fasting on the rate of readmission. Beyond 30-days, Kwok et al. [20] also showed that the readmission rate was 6% at 2 months, 31.5% at 6 months, 18.6-50.4% at 12 months, and 26.3-71% beyond 48 months. In our study, however, the duration of the PCI in Group II was not specified in terms of the exact months and the rate of readmission was 8%. The results of the association between readmission and duration post PCI were statistically insignificant. Regarding the association of symptoms with readmission and cardiac intervention, there was a significant result of the only two patients who had chest pain among fasting patients in Group I were found to have a history of readmission and cardiac re-intervention with a *P*-value of 0.011.

In overall association of the cardiovascular risk factors with fasting in Ramadan, Egypt study [10] showed no significant finding compared to what our data revealed. Our study results showed that there was a significant association between Ramadan Fasting and the risk factors of (gender, previous heart diseases, diabetes, and hyperlipidemia), while there was no significant association between fasting and hypertension, smoking as well as family history. Non-fasting patients had a higher proportion of diabetes (58.0%) than patients who could not continue fasting (55.6%), and patients who completed fasting the whole month (41.2%) with a *P*-value of 0.001 which also corresponded with the results of another study on Ramadan Fasting association with diabetes among hemodialysis patients in which non-fasting patients had a higher proportion than those who fasted as well as those who could not continue fasting

the month [21]. This might be due to the general concern around fasting among diabetic patients because it has already been shown that fasting causes fluctuation in blood sugar levels and leads to more adverse events during Ramadan [22]. In contrast to diabetes, risk factors of male gender and previous heart disease were higher in proportion among patients who could not continue to fast rather than fasting and non-fasting patients, while in hyperlipidemia, proportions were higher in non-fasting patients with a percentage of 48% and a P-value of 0.003 as shown in Table 3.

Limitations

Firstly, we were not able to consider the non-fasting patients as a control group because we did not know the exact reason for their abstinence from fasting. Secondly, the data would have been more conclusive if we had reports of the biochemical and physical status including the vital signs before, during, and after Ramadan as well as the symptomatic status and NYHA classification of the patients periodically after their PCI and at the time of breaking the fast including their type of diet during the non-fasting hours. Two other limitations include the unspecified exact timing of patients who had passed away as fasting might have been the reason for their deterioration, as well as the unascertained causes and reasons behind discontinuing fasting among those who decided to fast the entire month. We also recommend multi-regional studies and a larger number of patient samples regarding the topic at hand.

Conclusion

As a conclusion, we would like to emphasize what has already been suggested in a previous study on the unsafety of Ramadan Fasting within a short duration (6 weeks in our study) after PCI procedure as well as the safety of fasting after a long duration post-PCI. However, we also want to take into consideration that all of the patients with Class I in Group I were able to complete their fasting the entire month without any significant event. And we further recommend more detailed reports before, during, and after Ramadan fasting.

Abbreviations

3VD: Three Vessel Disease, AMI: Acute Myocardial Infarction, BMI: Body Mass Index, CABG: Coronary Artery Bypass Surgery, CAD: Coronary Artery Diseases, D1: First Diagonal, HD: Heart Disease, LAD: Left Anterior Descending artery, LCX: Left Circumflex artery, MI: Myocardial Infarction, NSTEMI: Non-ST Elevation Myocardial Infarction, NYHA: New York Heart Association, OM: Obtuse Marginal, PCI: Percutaneous Coronary Intervention, PPCI: Primary Percutaneous Coronary Intervention, RCA: Right Coronary Artery, RF: Ramadan Fasting, SOB: Shortness of Breath, SPSS: Statistical Package for Social Science, STEMI: ST Elevation Myocardial Infarction

Declarations

Ethics Approval

The study was conducted in accordance with the ethical principles that have their origin in the Declaration of Helsinki. It was carried out with the patient's verbal/written consent. The study protocol, the subject information, and the consent form were reviewed and approved by the Ethics Committee of Hawler Medical University (HMU-MC6-PC7)

Consent for Publication

Not applicable.

Availability of Data and Materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests

The authors declare that they have no competing interests

Author Contributions

S.A., B.R., and S.Y. contributed to the conception and design of the study. A.R. and S.S. were in charge of the data analysis and interpretation as well as the writing of the paper. P.Q., A.S., R.A. contributed to the acquisition of the data and helped in analysis. S.A., B.Q., and D.P. revised the manuscript. All authors read and approved the final manuscript.

Acknowledgments

Not Applicable.

References

1. Ahmad M, Mehta P, Reddivari AKR, Mungee S. Percutaneous Coronary Intervention[Internet]. Treasure Island (FL): StatPearls Publishing; 2021[cited 2021 June 18]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK556123/ (Accessed 13 November 2021).
2. Traina MI, Almahmeed W, Edris A, Tuzcu EM. Coronary heart disease in the Middle East and North Africa: current status and future goals. Current atherosclerosis reports 2017 May 1;19(5):24. Available from: https://pubmed.ncbi.nlm.nih.gov/28378303/ (Accessed 13 November 2021)
3. Kettani H. 2010 world Muslim population.Proceedings of the 8th Hawaii International Conference on Arts and Humanities 2010 Jan:12-16. Available from: https://static1.1.sqspcdn.com/static/f/276285/11250012/1300262558670/kettani-2010-world-

muslim-population.pdf?token=B1HW28Pb8RHom8v38GOw5kgWsC4%3D (Accessed 13 November 2021)

4. Beshyah SA, Fathalla W, Saleh A, Al Kaddour A, Noshi M, Al Hateethi H, et al. Mini-Symposium: Ramadan Fasting and The Medical Patient: An Overview for Clinicians. Ibnosina Journal of Medicine & Biomedical Sciences. 2010 Sep 1;2(5). Available from: https://www.ijmbs.org/article.asp?issn=1947-489X;year=2010;volume=2;issue=5;spage=240;epage=257;aulast=Beshyah;type=0 (Accessed 13 November 2021)

5. Beltaief K, Bouida W, Trabelsi I, Baccouche H, Sassi M, Dridi Z, et al. Metabolic effects of Ramadan fasting in patients at high risk of cardiovascular diseases. International journal of general medicine. 2019 Jul 15;12:247-254. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6643153/ (Accessed 13 November 2021)

6. Sarraf-Zadegan N, Atashi M, Naderi GA, Baghai AM, Asgary S, Fatehifar MR, et al. The effect of fasting in Ramadan on the values and interrelations between biochemical, coagulation and hematological factors. Annals of Saudi medicine 2000 Sep;20(5-6):377-81. Available from: https://pubmed.ncbi.nlm.nih.gov/17264626/ (Accessed 13 November 2021)

7. Camenzind E, Steg PG, Wijns W. A cause for concern. Circulation 2007 Mar 20;115(11):1440-55. Available from: https://www.ahajournals.org/doi/full/10.1161/circulationaha.106.666800 (Accessed 13 November 2021)

8. Chamsi-Pasha H, Ahmed WH. The effect of fasting in Ramadan on patients with heart disease. *Saudi Med J* 2004;25(1):47-51. Available from: https://pubmed.ncbi.nlm.nih.gov/14758379/ (Accessed 13 November 2021)

9. Nematy M, Alinezhad-Namaghi M, Rashed MM, Mozhdehifard M, Sajjadi SS, Akhlaghi S, et al. Effects of Ramadan fasting on cardiovascular risk factors: a prospective observational study. Nutrition Journal 2012 Dec;11(1):1-7. Available from: https://nutritionj.biomedcentral.com/articles/10.1186/1475-2891-11-69 (Accessed 13 November 2021)

10. Amin OA, Alaarag A. The safety of Ramadan fasting following percutaneous coronary intervention. BMC Cardiovascular Disorders 2020 Dec;20(1):1-1. Available from: https://bmccardiovascdisord.biomedcentral.com/articles/10.1186/s12872-020-01784-8 (Accessed 13 November 2021)

11. Timesprayer.com. Erbil prayer times in Ramadan[Internet]. 2021. Available from: https://timesprayer.com/en/hijri-prayer-in-erbil-1442-ramadan.html (Accessed 13 November 2021)

12. Weather2visit.com. Erbil weather in April[Internet]. 2021. Available from: https://www.weather2visit.com/middle-east/iraq/erbil-april.htm (Accessed 13 November 2021)

13. The Criteria Committee of the New York Heart Association.Nomenclature and Criteria for Diagnosis of Diseases of the Heart and Great Vessels .9th ed. Boston: Little, Brown;1994.P. 253–6. Available from: http://vlib.kmu.ac.ir/kmu/handle/kmu/90158 (Accessed 13 November 2021)

14. Alper AT, Akboğa MK, Özcan KS, Tengiz İ, Türk UÖ, Yıldız M, et al. Recommendations for Ramadan fasting to patients with cardiovascular diseases; Turkish Society of Cardiology consensus report. Anatolian Journal of Cardiology 2021 May;25(5):284. Available from: https://pubmed.ncbi.nlm.nih.gov/33960303/ (Accessed 13 November 2021)

15. Mansour AA, Shiaa NR, Ajeel NA. Attitude of patients with diabetes mellitus toward fasting Ramadan in Basrah Iraq. Endocrinol Metab Int J 2018;6(1):00146. Available from: https://medcraveonline.com/EMIJ/attitude-of-patients-with-diabetes-mellitus-toward-fasting-ramadan-in-basrah-iraq.html (Accessed 13 November 2021)

16. Mousavi M, Mirkarimi S, Rahmani G, Hosseinzadeh E, Salahi N. Ramadan fast in patients with coronary artery disease. Iranian Red Crescent Medical Journal 2014 Dec;16(12). Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4341245/ (Accessed 13 November 2021)

17. Salim I, Al Suwaidi J, Ghadban W, Alkilani H, Salam AM. Impact of religious Ramadan fasting on cardiovascular disease: a systematic review of the literature. Current medical research and opinion 2013 Apr 1;29(4):343-54. Available from: https://pubmed.ncbi.nlm.nih.gov/23391328/ (Accessed 13 November 2021)

18. Khafaji HA, Bener A, Osman M, Al Merri A, Al Suwaidi J. The impact of diurnal fasting during Ramadan on the lipid profile, hs-CRP, and serum leptin in stable cardiac patients. Vascular health and risk management 2012;8:7. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3262481/ (Accessed 13 November 2021)

19. Abazid RM, Khalaf HH, Sakr HI, Altorbak NA, Alenzi HS, Awad ZM, Smettei OA, Elsanan MA, Widyan AM, Azazy AS, Chamsi-Pasha HW. Effects of Ramadan fasting on the symptoms of chronic heart failure. Saudi medical journal 2018 Apr;39(4):395. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5938654/ (Accessed 13 November 2021)

20. Kwok CS, Narain A, Pacha HM, Lo TS, Holroyd EW, Alraies MC, et al. Readmissions to Hospital After Percutaneous Coronary Intervention: A Systematic Review and Meta-Analysis of Factors Associated with Readmissions. Cardiovasc Revasc Med 2020 Mar;21(3):375-391. Available from: https://www.sciencedirect.com/science/article/abs/pii/S155383891930315X?via%3Dihub (accessed 15 November 2021)

21. Khazneh E, Qaddumi J, Hamdan Z, Qudaimat F, Sbitany A, Jebrin K, Sawalmeh O, Abuiram Y, Shraim M. The effects of Ramadan fasting on clinical and biochemical markers among hemodialysis patients: A prospective cohort study. PloS one 2019 Jun 24;14(6):e0218745. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6590819/ (accessed 15 November 2021)

22. V RA, Zargar AH. Diabetes control during Ramadan fasting. Cleveland Clinic journal of medicine 2017 May 1;84(5):352-6. Available from: https://pubmed.ncbi.nlm.nih.gov/28530893/ (accessed 15 November 2021)

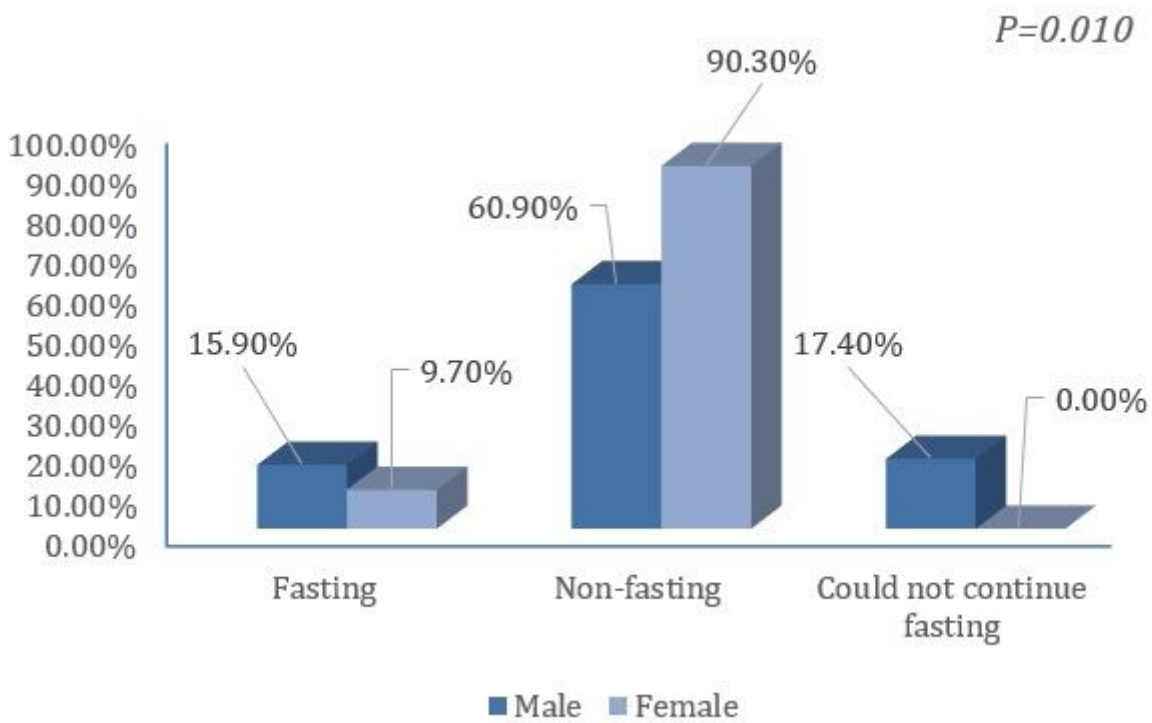# Figures

P=0.010

Figure 1

shows the association between gender and fasting among patients of Group I.
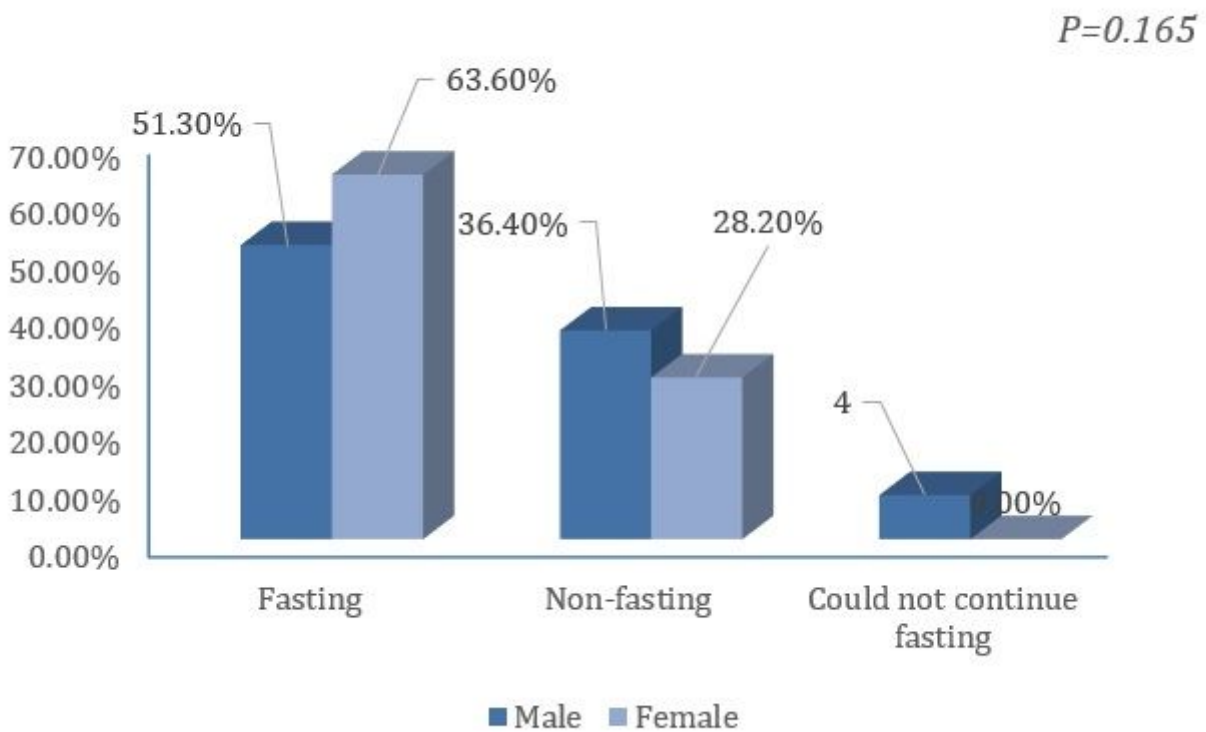

P=0.165

Figure 2

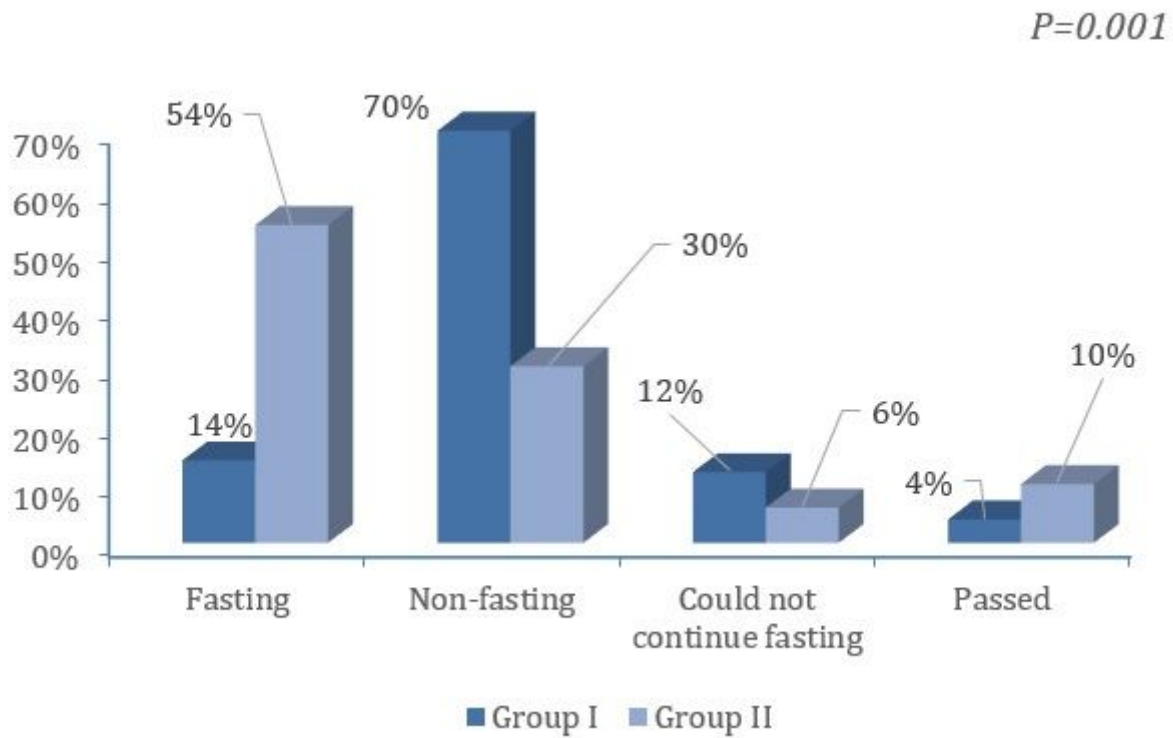shows the association between gender and fasting among patients of Group II.

P=0.001

Figure 3

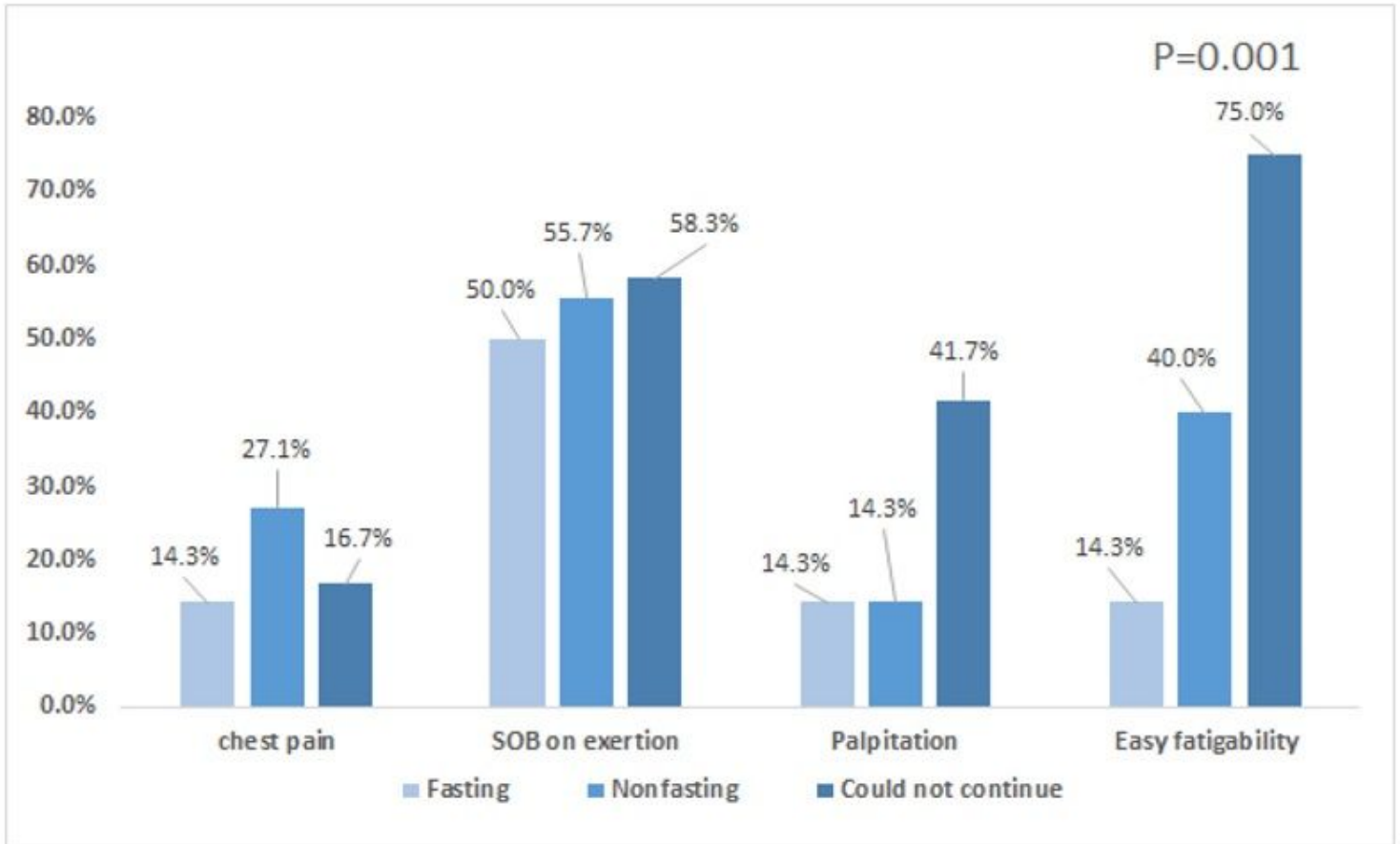shows the association of fasting with different post-PCI durations.

Figure 4

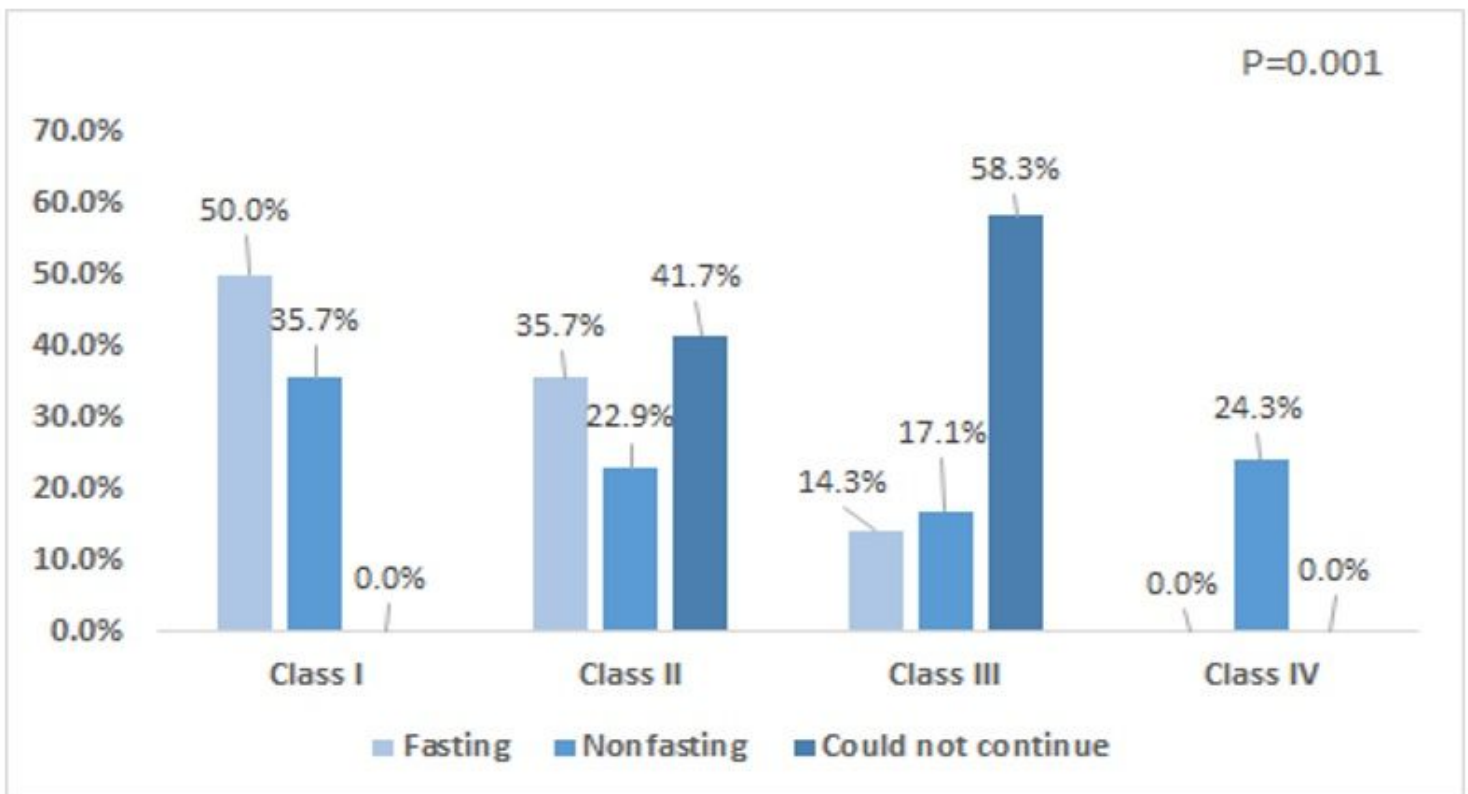shows the association of post-PCI symptoms with fasting in Group I.

Figure 5

shows the association of NYHA-classification with fasting in Group I.