

**EFFECTIVENESS OF PSYCHOSPIRITUAL
ADAPTATION TO CARDIAC REHABILITATION
COMPARED TO STANDARD CARDIAC
REHABILITATION FOR POST CORONARY
ANGIOPLASTY PATIENTS IN HOSPITAL
UNIVERSITI SAINS MALAYSIA**

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UNIVERSITI SAINS MALAYSIA

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BY

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TABLE OF CONTENTS

| | |
|--|--------------|
| ACKNOWLEDGEMENT | ii |
| TABLE OF CONTENTS..... | iii |
| LIST OF TABLES | x |
| LIST OF FIGURES | xii |
| LIST OF ABBREVIATIONS | xiv |
| LIST OF APPENDICES | xv |
| ABSTRAK | xvi |
| ABSTRACT | xviii |
| CHAPTER 1 INTRODUCTION..... | 1 |
| 1.1 Introduction..... | 1 |
| 1.2 Justification..... | 8 |
| 1.3 Objective | 9 |
| 1.3.1 Specific objective..... | 9 |
| 1.3.1(a)Specific objective phase 1 | 9 |
| 1.3.1(b) Specific objective phase 2..... | 9 |
| 1.4 Hypothesis..... | 10 |
| 1.5 Null hypothesis..... | 10 |
| 1.6 Operational definition..... | 10 |
| 1.6.1 Effectiveness | 10 |
| 1.6.2 Psychospiritual..... | 11 |
| 1.6.3 Psychospiritual adaptation..... | 12 |
| 1.6.4 Cardiac rehabilitation..... | 12 |
| 1.6.5 Coronary angioplasty..... | 14 |

| | |
|---|-----------|
| 1.6.6 Anxiety..... | 14 |
| 1.6.7 Depression..... | 15 |
| 1.6.8 Stress biomarkers..... | 16 |
| CHAPTER 2 LITERATURE REVIEW..... | 17 |
| 2.1 Introduction | 17 |
| 2.2. Coronary heart disease (CHD)..... | 18 |
| 2.3 Incidence and prevalence of CHD | 20 |
| 2.4 Management of CHD..... | 21 |
| 2.5 Coronary Angioplasty..... | 22 |
| 2.6 Interconnection CHD and psychological wellbeing..... | 28 |
| 2.7 Cardiac rehabilitation program..... | 32 |
| 2.7.1 Phases of cardiac rehabilitation..... | 34 |
| 2.7.1 (a) Phase one of cardiac rehabilitation..... | 35 |
| 2.7.1 (b) Phase two of cardiac rehabilitation | 36 |
| 2.7.1 (c) The final phase: phase three of cardiac rehabilitation..... | 38 |
| 2.7.2 Cardiac rehabilitation structure | 40 |
| 2.8 Psychospiritual approach in cardiac rehabilitation..... | 43 |
| 2.9 Evaluation of the effectiveness of cardiac rehabilitation programs..... | 49 |
| 2.9.1 Cardiac biomarkers..... | 50 |
| 2.9.2 Pulse rate and blood pressure | 52 |
| 2.9.3 Psychological assessment..... | 53 |
| 2.10 Theoretical framework | 54 |
| 2.11 Conceptual framework | 57 |

| | |
|--|-----------|
| CHAPTER 3 METHODOLOGY..... | 61 |
| 3.1 Research design | 61 |
| 3.2 Study area..... | 61 |
| 3.3 Study populations | 62 |
| 3.3.1 Study populations for pilot study phase..... | 62 |
| 3.3.2 Study populations for interventional study..... | 62 |
| 3.4 Study period and setting..... | 63 |
| 3.5 Phase 1: Developing the CR-PS module using Delphi technique..... | 63 |
| 3.6 Phase 2: Piloting the module..... | 65 |
| 3.7 Phase 3: Intervention phase..... | 66 |
| 3.8 Outcome measured..... | 70 |
| 3.9 Sample size..... | 71 |
| 3.10 Sampling method/randomization..... | 73 |
| 3.11 Subject criteria..... | 74 |
| 3.11.1 Inclusions criteria..... | 74 |
| 3.11.2 Exclusion criteria..... | 74 |
| 3.12 Research tool..... | 75 |
| 3.13 Ethical consideration..... | 76 |
| 3.13.1 Vulnerability of the subject..... | 76 |
| 3.13.2 Conflict of interest..... | 76 |
| 3.13.3 Privacy and confidentiality..... | 77 |
| 3.13.4 Community sensitivities and benefits..... | 77 |
| 3.13.5 Recruitment of subject and informed consent..... | 78 |
| 3.13.6 Potential risk to the subject..... | 78 |
| 3.13.7 Direct and indirect benefits to the subject..... | 79 |

| | |
|---|-----------|
| 3.13.8 Specimen handling..... | 79 |
| 3.13.9 Withdrawal criteria..... | 80 |
| 3.13.10 Data analysis..... | 80 |
| 3.13.11 Incentive for sample..... | 80 |
| CHAPTER 4 RESULT OF MODIFIED DELPHI TECHNIQUE | 82 |
| 4.1 Introduction..... | 82 |
| 4.2. General objective..... | 83 |
| 4.3. Justification..... | 83 |
| 4.4 Method..... | 84 |
| 4.4.1 Stage 1: Selection of the expert panels | 84 |
| 4.4.2 Stage 2: Phase 2: Designing the CR-PS module and questionnaires | 85 |
| 4.4.2 (a) Cut off point for consensus for questionnaires..... | 86 |
| 4.4.3 Stage 3: Modified Delphi technique..... | 87 |
| 4.4.3 (a) Round 1 modified Delphi technique..... | 88 |
| 4.4.3 (b)Round 2 modified Delphi technique..... | 89 |
| 4.5 Analysis..... | 91 |
| 4.6 Result..... | 91 |
| 4.7 Discussion..... | 99 |
| 4.8 Conclusion..... | 100 |

| | |
|--|------------|
| CHAPTER 5 PILOTING THE MODULE..... | 101 |
| 5.1 General objective..... | 101 |
| 5.2 Specific objective..... | 101 |
| 5.3 Subject and sampling methods..... | 101 |
| 5.4 Result for piloting the module..... | 102 |
| 5.5 Discussion..... | 106 |
| 5.6 Conclusion..... | 107 |
| CHAPTER 6 RESULT OF CR-PS INTERVENTIONAL STUDY..... | 108 |
| 6.1 Demographic profile..... | 108 |
| 6.1.1 Gender..... | 110 |
| 6.1.2 Age..... | 111 |
| 6.1.3 Marital status..... | 112 |
| 6.1.4 Race..... | 113 |
| 6.1.5 Education level..... | 113 |
| 6.1.6 Occupation..... | 114 |
| 6.1.7 Income..... | 115 |
| 6.2 Cardiac biomarkers..... | 116 |
| 6.2.1 Serum creatinine kinase..... | 116 |
| 6.2.2 Serum CKMB..... | 118 |
| 6.3 Comparison of systolic blood pressure measurements for the two study groups | 120 |
| 6.4 Comparison of diastolic blood pressure measurements for the two study group..... | 124 |
| 6.5 Comparison of pulse rate for the two study groups..... | 127 |
| 6.6 Comparison of anxiety results for the two study groups..... | 130 |

| | |
|--|------------|
| 6.7 Comparison of depression level for the two study groups..... | 133 |
| 6.8 Comparison of serum cortisol results for the two study groups..... | 136 |
| CHAPTER 7 DISCUSSION..... | 139 |
| 7.1 Variables on patient involvement in the HCR program..... | 139 |
| 7.1.1 Gender..... | 140 |
| 7.1.2 Marital status | 141 |
| 7.1.3 Age..... | 142 |
| 7.1.4 Ethnic groups | 144 |
| 7.1.5 Education level | 144 |
| 7.1.6 Occupation | 145 |
| 7.1.7 Income level | 146 |
| 7.2 The effectiveness of the CR-PS program | 147 |
| 7.2.1 Comparison of the cardiac biomarkers (creatinine kinase and creatinine kinase - MB (CKMB)) level between the intervention and control groups | 147 |
| 7.2.1 (a) Comparison of creatinine kinase level | 147 |
| 7.2.1 (b) Comparison of CKMB level | 149 |
| 7.2.2 Comparison of the Clinical measurement (blood pressure and pulse rate) between the intervention and control groups..... | 150 |
| 7.2.3 Comparison of anxiety and depression level levels between the intervention and control groups..... | 153 |
| 7.2.3 (a) Comparison of anxiety level | 153 |
| 7.2.3 (b) Comparison of depression level | 157 |
| 7.2.4 Comparison of the stress biomarker (Serum Cortisol) levels between the intervention and control groups | 160 |

| | |
|--|------------|
| 7.3 Effectiveness of Psychospiritual adaptation to cardiac rehabilitation..... | 162 |
| CHAPTER 8 CONCLUSION AND FUTURE RECOMMENDATIONS..... | 165 |
| 8.1 Conclusion..... | 165 |
| 8.2 Limitation..... | 166 |
| 8.3 Recommendations for future research | 168 |
| REFERENCES..... | 171 |
| APPENDICES | |
| LIST OF PUBLICATIONS | |

LIST OF TABLES

| | | Page |
|-----------|---|-------------|
| Table 3.1 | Compares between standard cardiac rehabilitation and CR-PS..... | 69 |
| Table 4.1 | The number of expert panels..... | 85 |
| Table 4.2 | Result round 1 and 2 for Module 1- Health education: CHD..... | 92 |
| Table 4.3 | Result round 1 and 2 for Module 1- Health education: Anxiety and depression..... | 93 |
| Table 4.4 | Result round 1 and 2 for Module 1- Health education: Diet..... | 95 |
| Table 4.5 | Result round 1 and 2 for Modul 2: Psychospiritual..... | 96 |
| Table 4.6 | Results round 1 and 2 for Modul 3 Physical rehabilitation..... | 97 |
| Table 5.1 | Systolic and diastolic blood pressure..... | 102 |
| Table 5.2 | The result of the evaluation form..... | 103 |
| Table 6.1 | Demographic profile of study respondents..... | 110 |
| Table 6.2 | Comparison of serum creatinine kinase level for the two study groups..... | 116 |
| Table 6.3 | Comparison of serum CKMB level for the two study groups..... | 118 |
| Table 6.4 | Comparison of systolic blood pressure measurements for the two study groups..... | 121 |
| Table 6.5 | Post-hoc comparison of the pattern of systolic blood pressure measurements between intervention and control group at each time level..... | 122 |
| Table 6.6 | Comparison of diastolic blood pressure measurements for the two study groups..... | 124 |

| | | |
|------------|--|-----|
| Table 6.7 | Post-hoc comparison of the pattern of diastolic blood pressure measurements between intervention and control group at each time level..... | 125 |
| Table 6.8 | Comparison of pulse rate results for the two study groups..... | 127 |
| Table 6.9 | Post-hoc comparison of the pattern of pulse rate between two groups at each time level..... | 128 |
| Table 6.10 | Comparison of anxiety level for the two study groups..... | 130 |
| Table 6.11 | Post-hoc comparison of the pattern of anxiety between two groups at each time level..... | 131 |
| Table 6.12 | Comparison of depression level for the two study groups..... | 133 |
| Table 6.13 | Post-hoc comparison of the pattern of depression between two groups at each time level..... | 134 |
| Table 6.14 | Comparison of serum cortisol results for the two study Groups..... | 136 |
| Table 6.15 | Post-hoc comparison of the pattern of serum cortisol between two groups at each time level..... | 127 |

LIST OF FIGURES

| | Page |
|------------|---|
| Figure 2.1 | Coronary heart disease.....19 |
| Figure 2.2 | Position of brachial and femoral arteries.....24 |
| Figure 2.3 | The process of inserting and inflating the balloon.....25 |
| Figure 2.4 | The process of inserting a stent.....27 |
| Figure 2.5 | Neuman’s model.....56 |
| Figure 2.6 | Conceptual framework.....60 |
| Figure 3.1 | Delphi technique steps.....65 |
| Figure 3.2 | Outcomes measure occasions.....70 |
| Figure 3.3 | Sample size calculation (G*power)73 |
| Figure 3.4 | Study flow.....81 |
| Figure 6.1 | Profile plot for comparison of serum creatinine kinase level between two study groups117 |
| Figure 6.2 | Profile plot for comparison of serum CKMB level between two study groups119 |
| Figure 6.3 | Profile plot for comparison of systolic blood pressure measurements between two study groups123 |
| Figure 6.4 | Profile plot for comparison of diastolic blood pressure measurements between two study groups126 |
| Figure 6.5 | Profile plot for comparison of pattern of pulse rate between two study groups129 |
| Figure 6.6 | Profile plot for comparison of anxiety level between two study groups132 |

| | | |
|------------|---|-----|
| Figure 6.7 | Profile plot for comparison of depression level between two study groups | 135 |
| Figure 6.8 | Profile plot for comparison of serum cortisol level between two study groups | 138 |

LIST OF ABBREVIATIONS

| | |
|-------|--|
| CHD | Coronary heart disease |
| CKMB | Creatinine kinase – myocardial band |
| DBP | Diastolic blood pressure |
| CR-PS | Cardiac rehabilitation with psychospiritual adaptation |
| SBP | Systolic blood pressure |
| SCR | Standard cardiac rehabilitation |

LIST OF APPENDICES

| | |
|------------|--|
| Appendix A | Letter of permission to conduct research at HUSM |
| Appendix B | Approval of Human Research Ethics Committee of Universiti Sains Malaysia |
| Appendix C | Consent for pilot study |
| Appendix D | Patients evaluation form for pilot study |
| Appendix E | Consent for intervention study |
| Appendix F | Block randomization |
| Appendix G | Research tools |
| Appendix H | Hospital Anxiety Depression Scale |
| Appendix I | Letter of permission to use the Malaysian version of HADS |
| Appendix J | Delphi panel appointment letter |
| Appendix K | Modul rehabilitasi kardiak adaptasi psikospiritual (CR-PS) |
| Appendix L | Audio recording of CR-PS module (relaxation technique) |
| Appendix M | Publications and conferences |

**KEBERKESANAN ADAPTASI PSIKOSPIRITUAL DALAM
REHABILITASI KARDIAK BERBANDING REHABILITASI KARDIAK
STANDARD UNTUK PESAKIT PASCA ANGIOPLASTI
DI HOSPITAL UNIVERSITI SAINS MALAYSIA**

ABSTRAK

Kajian terdahulu telah membuktikan tahap kebimbangan dan kemurungan yang tinggi telah dialami oleh pesakit jantung koronari (CHD) selepas prosedur koronari angioplasti. Justeru, keperluan untuk intervensi psikologi menyeluruh dalam program rehabilitasi kardiak, dengan penekanan pada integrasi elemen psikospiritual adalah penting. Oleh itu, kajian ini bertujuan untuk membangunkan program rehabilitasi kardiak dengan modul adaptasi psikospiritual (CR-PS) yang menggabungkan teknik relaksasi ketarasedar Islam. Kajian itu melibatkan 30 pesakit CHD yang dipilih secara rawak untuk kumpulan intervensi (program CR-PS) dan kawalan (pemulihan jantung standard - program SCR). Dalam tempoh tiga bulan, data tentang tekanan darah sistolik/diastolik, kadar nadi, kebimbangan, dan paras kortisol serum dikumpulkan pada tiga selang masa. Penilaian ANOVA berulang menunjukkan pengurangan ketara dalam kumpulan intervensi dan peningkatan dalam kumpulan kawalan. Secara khusus, tekanan darah sistolik menurun daripada 132.47 kepada 121.73 dalam kumpulan intervensi berbanding peningkatan daripada 127.33 kepada 132.00 dalam kumpulan kawalan. Trend yang sama diperhatikan untuk tekanan darah diastolik dan kadar nadi. Tahap kebimbangan menurun daripada 14.60 kepada 10.80 dalam kumpulan intervensi, berbeza dengan perubahan kecil dalam kumpulan kawalan. Tahap serum kortisol menurun dalam kumpulan intervensi (7.40 hingga 5.20) tetapi kekal stabil dalam kumpulan kawalan. Walaupun tiada perbezaan yang signifikan ditemui dalam serum kreatinin kinase, CKMB, dan tahap depresi, kumpulan intervensi menunjukkan

penurunan parameter ini berbanding peningkatan dalam kumpulan kawalan. Secara keseluruhannya, kajian menunjukkan bahawa mengintegrasikan elemen psikospiritual ke dalam program pemulihan kardiak adalah berkesan untuk pesakit CHD, dan modul yang dibangunkan boleh menjadi asas untuk penyesuaian intervensi psikospiritual dalam proses rehabilitasi dalam waktu penyembuhan.

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ABSTRACT

Previous literatures have documented evidence of heightened anxiety and depression experienced by patients with coronary heart disease (CHD) after coronary angioplasty procedures. This underscores the need for comprehensive psychological intervention in cardiac rehabilitation programs, with an emphasis on integrating psychospiritual elements. Consequently, this research aimed to develop a cardiac rehabilitation program with psychospiritual adaptation (CR-PS) module incorporating Islamic mindfulness relaxation techniques. The study involved 30 CHD patients randomly assigned to intervention (CR-PS program) and control (standard cardiac rehabilitation – SCR program) groups. Over a three-month period, data on systolic/diastolic blood pressure, pulse rate, anxiety, and serum cortisol levels were collected at three intervals. Repeated ANOVA assessments revealed significant reductions in the intervention group and increases in the control group across these parameters. Specifically, systolic blood pressure decreased from 132.47 to 121.73 in the intervention group compared to an increase from 127.33 to 132.00 in the control group. Similar trends were observed for diastolic blood pressure and pulse rate. Anxiety levels decreased from 14.60 to 10.80 in the intervention group, contrasting with a minor change in the control group. Serum cortisol levels decreased in the intervention group (7.40 to 5.20) but remained stable in the control group. While no significant differences were found in serum creatinine kinase, CKMB, and depression

levels, the intervention group showed a decline in these parameters compared to an increase in the control group. Overall, the study suggests that integrating psychospiritual elements into cardiac rehabilitation is effective for CHD patients, and the developed module can serve as a basis for the adaptation of psychospiritual interventions in rehabilitation process during recovery period.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Individuals diagnosed with coronary heart disease (CHD) exhibit a significantly elevated risk of developing psychiatric comorbidities, particularly anxiety and depression where epidemiological studies reported 15% to 30% of CHD patients experience anxiety or depression (Dhital et al., 2018; Gu et al., 2016; Fazirah et al., 2007; Eng et al., 2011; Rothenbacher et al., 2007). Moreover, the prevalence of moderate to severe depression in this population ranges from 33% to 64% (Ren et al., 2014; Dhital et al., 2018). These co-occurring psychological conditions pose a substantial threat to CHD patients, potentially exacerbating cardiovascular complications such as myocardial infarction (MI) (Burg et al., 2014; Pogosova, 2014; Dhital et al., 2018). Furthermore, the presence of psychiatric comorbidities can negatively impact treatment adherence and increase mortality rates in CHD patients (Burg et al., 2014; Pogosova, 2014; Dhital et al., 2018).

Patients undergoing coronary angioplasty in Malaysia often experience significant pre-procedural anxiety. This anxiety arises from several factors, including the invasive nature of the procedure, potential complications, and uncertainty about treatment outcomes (Hadi et al., 2022; Noor Hanita et al., 2022). Studies in Malaysia have shown that over 50% of patients undergoing percutaneous coronary intervention (PCI), which includes angioplasty, report moderate to severe anxiety (Noor Hanita et al., 2015).

Despite these anxieties, coronary angioplasty remains a valuable intervention due to its effectiveness in minimizing symptoms and improving long-term prognosis in patients with CHD (Balasi et al., 2016; Hannan et al., 2019). However, unaddressed pre-procedural anxiety can negatively impact patient well-being and potentially contribute to post-procedural complications such as myocardial infarction (Mohamed et al., 2021; Firdaus et al., 2022). Consequently, effective pre-procedural anxiety management strategies are crucial for optimizing patient outcomes following coronary angioplasty.

Anxiety and depression in CHD patients are demonstrably linked to adverse clinical outcomes. Poor treatment adherence, a documented consequence of these mood disorders, disrupts autonomic tone regulation (Rawashdeh et al., 2021). This translates to increased susceptibility to ventricular arrhythmias and heightened platelet activation, ultimately promoting coronary re-stenosis (Li et al., 2022). Indeed, robust evidence showcases a significantly higher burden of repeat coronary revascularization procedures among CHD patients diagnosed with mood disorders compared to their mentally stable counterparts (Jin et al., 2019; Rawstorn et al., 2016). Given these detrimental impacts, prioritizing effective depression management in CHD patients has become paramount (Allabadi et al., 2019). Integrating psychological interventions into cardiac rehabilitation programs has emerged as a critical strategy in this regard (Gulliksson et al., 2011; Hadi et al., 2022; Dhital et al., 2018; Deer et al., 2016; Chang, 2010). Such multi-pronged approaches hold promise for optimizing clinical outcomes and improving quality of life for CHD patients burdened with comorbid mood disorders.

While conventional cardiac rehabilitation programs demonstrably improve physical health and disease knowledge in CHD patients through tailored exercise, education on medications and nutrition, and multidisciplinary support (Hannan et al., 2019; Dibben et al., 2023), their scope often falls short of addressing the broader spectrum of patient needs. Recent research highlights the vital role of psychospiritual health in optimizing personal well-being following a cardiac event (Masoumi et al., 2017; Achttien et al., 2014). Beyond mere knowledge or physical improvement, CHD patients require interventions that foster resilience, promote positive coping mechanisms, and address spiritual concerns (Salloum et al., 2023). Such holistic approaches have been shown to enhance quality of life, reduce emotional distress, and even improve cardiovascular outcomes (Soares & Fonseca, 2020; Cohen et al., 2022). To fully optimize rehabilitation efforts, integrating strategies that nurture psychospiritual well-being alongside conventional components should be a priority.

The significance of psychospiritual well-being for optimal health in various patient populations is well-established (Masoumi et al., 2017; Achttien et al., 2015), however, its integration into cardiac rehabilitation programs remains an under-explored yet promising avenue. Despite pioneering work by Chang et al. (2010), and Kreikebaum et al. (2011), evidence-based implementation in mainstream cardiac rehabilitation is still lagging. Recent studies bolster the case for a more holistic approach. Amaravathi et al. (2018) demonstrated significant improvements in quality of life for CHD patients undergoing combined cardiac rehabilitation with psychotherapy and spiritual care practices. Similarly, a growing body of research, including work by Mons et al. (2015), highlights the efficacy of incorporating appropriate psychological and spiritual interventions in reducing anxiety and

depression among CHD patients. Recognizing the multifaceted nature of recovery, integrating strategies that nurture psychospiritual well-being alongside conventional elements in cardiac rehabilitation has the potential to optimize outcomes and enhance lives for a broader spectrum of patients with heart disease.

The integration of psychospiritual interventions within cardiac rehabilitation programs remains limited, with infrequent inclusion in prevailing paradigms. Nevertheless, extant literature, as exemplified by studies conducted by Chandrasekaran et al., (2019), Amaravathi et al. (2018), Call, Miron & Orcutt (2013), and Delui et al. (2013), underscores the historical utilization of relaxation techniques. Emerging evidence, as illustrated by investigations conducted by Bajpai & Kiran (2021), Pandya (2019), Chang et al. (2010), and Levin et al. (2014), substantiates the advantageous outcomes associated with the implementation of relaxation interventions in patients with CHD, particularly in terms of enhancing their overall quality of life.

Historically employed relaxation techniques encompass diverse modalities, such as music therapy (Bando et al., 2019; Clark, Baker & Taylor, 2016), yoga (Raghuram et al., 2014; Guddeti et al., 2019), cognitive behavior therapy (CBT) (Gullikson et al., 2011), and mindfulness (Lee et al., 2021; Salmoirago-Blotcher et al., 2015; Nijjar et al., 2019). Of particular note, mindfulness practices, currently integral to therapeutic approaches, have demonstrated stimulating effects, especially in improving the patient's psychological problems. This recent evidence underscores the potential of psychospiritual interventions, particularly mindfulness, as a valuable adjunct in cardiac rehabilitation programs, fostering holistic well-being and mental health outcomes in CHD patients.

Mindfulness interventions have gained recognition for their effectiveness in improving levels of anxiety and depression. Previous empirical investigations conducted by Burg & Wolf (2012), Call, Miron Orcutt (2013), Hofmann & Gómez (2019), and Nijjar et al. (2019) have consistently demonstrated the effectiveness of mindfulness-based stress reduction in mitigating psychological problems. Similarly, mindfulness-based cognitive therapy, as elucidated in studies by Lorca et al. (2018), Hofmann & Gomez (2019), Nyklicek et al. (2013), Van Son et al. (2012), and Younge et al. (2015), has exhibited notable potential in diminishing stress, anxiety, and depression levels among patients.

In specific instances, Cho et al. (2016) and Kim et al. (2013) have employed Mindfulness Breathing in their investigations targeting depression and post-traumatic stress disorder patients. Mindful breathing techniques have been observed to enhance emotional regulation and adaptability to the present situation and environment. This heightened awareness of regular breathing not only contributes to emotional control but also fosters physiological balance. Such enhancements in psychophysiological equilibrium may play a pivotal role in reducing the mortality risk among CHD patients, as evident in studies by Ponte Márquez et al. (2018) and Burg et al. (2014).

For individuals diagnosed with CHD, the heightened risk associated with heart events intensifies their spiritual demands. Incorporating spiritual aspects into treatment modalities facilitates patient adaptation by fostering acceptance of their condition. Psychospiritual stability, as indicated by empirical evidence, has been associated with a reduction in symptomatic manifestations of heart disease. Notably, spiritual elements wield significant influence over health-seeking behavior among Malaysians, as

evidenced by the research conducted by Muzaimi et al. (2016). Addressing psychological issues such as anxiety and depression, various religions offer unique sets of spiritual therapies, modified to align with the distinct faiths of their adherents. This recognition underscores the importance of integrating psychospiritual dimensions into comprehensive healthcare approaches for individuals facing cardiovascular challenges.

Spiritual interventions, such as yoga practices, have emerged as promising complementary and integrative approaches for improving health outcomes in various conditions, including CHD. Several studies demonstrate the efficacy of yoga in reducing stress, anxiety, and depression, factors known to negatively impact CHD prognosis (Guddeti et al., 2019; Brown et al., 2019). Building upon this evidence, Rao et al. (2018) investigated the potential of integrating mindfulness practices found in yoga with relaxation therapy to enhance its effectiveness in improving psychological well-being. Their findings suggest that incorporating yoga-based awareness techniques into relaxation therapy holds promise for promoting mental health in patients.

This study proposes to explore the combined effects of psychospiritual interventions on psychological health outcomes in patients undergoing coronary angioplasty procedures. The intervention will integrate established psychological therapies based on mindfulness with religiously relevant relaxation techniques to potentially enhance their effectiveness. This approach takes into account the dominant Muslim population in Kelantan and recognizes the potential influence of religious frameworks on coping mechanisms. Initial focus on Islamic traditions allows for a

targeted investigation with potential benefits for the local community. Should the intervention demonstrate positive outcomes, subsequent studies could explore its adaptability to other religious contexts, paving the way for broader application and personalized healthcare strategies.

Several studies have explored the beneficial impact of Islamic psychospiritual interventions on mental health outcomes in Muslim populations. Practices such as dhikr (mindfulness of God) and Islamic teachings on hope and acceptance (redha) have demonstrated efficacy in reducing anxiety and depression among Muslim patients with various conditions (Sulistyawati et al., 2019 & Abbas et al. et al., 2022). Further, empirical evidence suggests that Islamic relaxation techniques, including Quran recitation and listening, show promise in alleviating anxiety among CHD patients (Setiawan, Chasani & Mardiyono, 2014). Notably, Mahjoob et al. (2014) found that Quran recitation induced feelings of calmness and improved vital organ function. Additionally, Leanne et al., (2023) observed reduced post-operative pain in patients who listened to Quranic verses. Muzaimi (2016) reported increased alpha and theta wave activity, associated with relaxation, during Quran recitation.

Therefore, incorporating these religiously relevant Islamic elements into a cardiac rehabilitation program for the Muslim-majority population of Kelantan could offer a holistic approach to manage CHD effectively and improve well-being. This approach is in line with the growing recognition of the importance of integrating cultural and religious perspectives in personalized healthcare strategies.

1.2 Justification

CHD in Malaysia carries significant psychological and economic burdens. Among CHD patients, high prevalence of anxiety and depression negatively impacts treatment adherence and disease progression (Guddeti et al., 2019; Rao et al., 2018). Moreover, the past experiences of these patients with these mental health conditions can exacerbate physical symptoms and subsequently affect their quality of life (Brown et al., 2019). Consequently, these psychological factors may contribute to increased morbidity and mortality rates in patients with CHD. Such a rise in morbidity and mortality can hinder national development by affecting workforce productivity and increasing healthcare costs, further straining the healthcare system and burdening the wider population.

The growing interest in complementary and integrative healthcare, alongside Malaysia's predominantly Muslim population and Kelantan's specific demographics, suggests a potential need for development of Islamic-based complementary therapeutics for CHD management.

This aligns with increasing study on the benefits of integrating spiritual and mindfulness practices into healthcare interventions (Brown et al, 2019; Rao et al., 2018). While various Islamic spiritual practices like dhikr (mindfulness of God) and Quran recitation have shown promise in reducing anxiety and depression (Sulistyawati et al., 2019), their specific incorporation into a structured cardiac rehabilitation program for CHD patients remains unexplored. This study therefore proposes a novel approach to cardiac rehabilitation by integrating psychological relaxation techniques with Islamic psychospiritual elements.

1.3 Objective:

To develop a cardiac rehabilitation with psychospiritual adaptation (CR-PS) module and evaluate the effectiveness of cardiac rehabilitation with psychospiritual adaptation (CR-PS) as compared to standard cardiac rehabilitation for post angioplasty patients in Hospital University Sains Malaysia.

1.3.1 Specific Objective

1.3.1(a) Specific objective phase 1

To develop a cardiac rehabilitation with psychospiritual adaptation (CR-PS) module for post angioplasty patients

1.3.1(b) Specific objective Phase 2

1. To compare the levels of cardiac biomarkers (creatinine kinase and creatinine kinase – myocardial band (CKMB)) between the intervention and control groups before and after undergoing the a cardiac rehabilitation with psychospiritual adaptation (CR-PS) and standard cardiac rehabilitation program .
2. To compare the clinical measurement (blood pressure and pulse rate) between the intervention and control groups before and after undergoing the CR-PS and standard cardiac rehabilitation program.
3. To compare stress biomarker (serum cortisol) levels between the intervention and control groups before and after undergoing the CR-PS and standard cardiac rehabilitation program.

4. To compare the anxiety and depression levels between the intervention and control groups before and after undergoing the CR-PS and standard cardiac rehabilitation program.

1.4 Hypothesis

There are significant differences in anxiety, depression, clinical measurement and biomarker levels between CHD patients who were attending standard cardiac rehabilitation and CR-PS sessions.

1.5 Null hypothesis

There are no differences in anxiety, depression, clinical measurement and biomarker levels between CHD patients who were attending standard cardiac rehabilitation and CR-PS sessions.

1.6 Operational definition

1.6.1 Effectiveness

The meaning of effect according to the Cambridge dictionary is a noticeable effect. In this study, an evaluation was conducted to look at the impact of the involvement of CHD patients in the CR-PS program. The effectiveness of this CR-PS program was evaluated through changes in clinical measurements involving blood pressure and pulse rate readings. In addition, the effectiveness of this program was also evaluated through laboratory examinations that included cardiac biomarkers, namely cardiac enzymes and CKMB.

Laboratory screening for serum cortisol readings was also performed to evaluate the effectiveness of the program. The effectiveness of this program in aspects of psychology involving anxiety and depression was also assessed using the Hospital Anxiety and Depression Scale (HADS) instrument.

1.6.2 Psychospiritual

Gleig, (2020) defined the term psychospiritual as the integration or combination of psychology and spirituality. It is commonly used to describe therapeutic interventions that include both psychological and spiritual methods (such as meditation, yoga, dream work, breath work) in a holistic, integrated approach to healing and inner growth.

For Martin (2018), psychospiritual is used with the word transpersonal psychology to describe the field of psychological and spiritual study. He also highlighted the study of consciousness as the essence. In addition, psychospiritual well-being is a special experience that integrates meaning in life and emotional health. Psychospiritual well-being includes stress management, self-awareness, trust, creating relationships and connectedness, living a meaningful life, and confidence and empowerment.

Psychospirituality has been used widely covering various fields such as employment, anxiety treatment, addiction recovery, palliative care, counseling practice, and chronic disease treatment. All of them emphasize the positive importance of incorporating spirituality into the field. Spirituality has been found to be beneficial in increasing self-empowerment and helping individuals find meaning and purpose. In

addition, an approach that combines psychological and spiritual components effectively contributes to the patient's quality of life (Mohammadi, 2017 & Rosenfeld et al., 2016)

1.6.3 Psychospiritual Adaptation

Psychospiritual adaptation is a dynamic process of adjusting psychological and spiritual perspectives, beliefs and coping mechanisms to face challenges or significant life transitions, in a way that promotes well-being and maintains a sense of meaning and purpose (Gleig, 2020 & Liu et al., 2023).

Where psychology emphasizes changes in thinking, emotions and behavior in response to challenges (Ogden, 2019). This may include emotion regulation, cognitive restructuring, and the development of coping skills (Brosch & Steg, 2021) While spiritual means an adjustment in religious beliefs, spiritual practices, and a sense of connection with something greater than oneself. This may involve seeking religious support, engaging in devotional practices, or finding meaning through suffering (De Brito Sena et al., 2021).

1.6.4 Cardiac rehabilitation

Wenger et al. (1995) defined a cardiac rehabilitation program as an intensive intervention aimed at the comprehensive evaluation of long-term medical initiatives, exercise prescriptions, modification of risk factors associated with heart disease, counseling, and health education, specifically tailored for patients with CHD. This multifaceted approach underscores the multifactorial nature of CHD management, acknowledging the interplay between medical, lifestyle, and psychological aspects.

The targeted recipients of cardiac rehabilitation programs are typically individuals who have undergone a heart attack, experienced heart failure, or undergone post-coronary angioplasty procedures (Humprey, Guazzi & Nienauer, 2014). As substantiated by contemporary research (Khadanga et al., 2021), a standard cardiac rehabilitation program amalgamates various rehabilitative modalities, encompassing health education, nutritional guidance, psychological support, medication, and physical rehabilitation. This integrative strategy reflects the evolving landscape of cardiac care, acknowledging the importance of a holistic and personalized approach to address the multifaceted needs of CHD patients.

The overarching objective of a cardiac rehabilitation program is to foster a health-conscious lifestyle among individuals with heart-related ailments while mitigating the risks associated with disease severity and the recurrence of cardiac events. This preventive orientation aligns with recent investigations by Myer, Niebauer, and Humphrey (2021), Oliveira et al. (2014), and Ballin et al. (2019), emphasizing the imperative of proactive intervention strategies in minimizing the deleterious impact of CHD and optimizing long-term cardiovascular health outcomes. The convergence of evidence from these studies reinforces the pivotal role of cardiac rehabilitation programs in not only addressing immediate medical concerns but also in cultivating sustained lifestyle modifications conducive to cardiac health.

1.6.5 Coronary angioplasty

Percutaneous coronary intervention (PCI), commonly known as coronary angioplasty, is a minimally invasive procedure used to treat coronary artery stenosis, a prevalent manifestation of CHD. This narrowing arises from the gradual accumulation of atheromatous plaques, primarily composed of cholesterol deposits, within the arterial wall, culminating in atherosclerosis (Khosravi et al., 2019; Libby & Soehnlein, 2021). PCI is performed by interventional cardiologists and offers an alternative to open-heart surgery for revascularization.

The term "post-coronary angioplasty" encompasses patients who have successfully undergone a PCI procedure, regardless of the specific technique employed. These techniques may involve balloon angioplasty alone, which widens the narrowed artery using an inflatable balloon, or stent implantation, where a small expandable mesh tube is positioned to maintain arterial patency (Lownie & Pelz, 2013; Jun et al., 2023). Notably, this study focused on patients experiencing their first PCI, excluding those with prior interventions, and initiated data collection within 24-48 hours post-procedure, capturing a crucial early recovery period.

1.6.6 Anxiety

Anxiety, characterized by tense, restless, or fearful emotions, is a complex psychological phenomenon that can manifest as a normal and sometimes beneficial response, enhancing motivation for individuals. However, when anxiety becomes frequent and uncontrolled, it can profoundly disrupt an individual's daily life and functioning, impacting various aspects such as personality, occupation, and socialization. Importantly, the detrimental psychological effects of anxiety extend

beyond the affected individual to those in their immediate surroundings (Delewi et al., 2017).

Persistent and prolonged anxiety can manifest for no apparent reason or result from traumatic incidents, including heart attacks, and individuals may experience symptoms such as excessive restlessness, chest tightness, shortness of breath, or difficulty breathing (An et al., 2013). This prolonged anxiety can pose significant risks to cardiovascular health and increase the likelihood of CHD (Moser et al., 2011).

1.6.7 Depression

Depression, a prevalent mental health disorder, exhibits global variability, impacting individuals across diverse ages, backgrounds, and lifestyles. The World Health Organization 2017 estimates that more than 264 million people worldwide are affected by depression, positioning it as a leading cause of disability on a global scale (Vos et al., 2017).

Characterized by persistent feelings of sadness, hopelessness, and a diminished interest or pleasure in activities, depression, as defined by the American Psychiatric Association (2020), transcends the normative fluctuations in mood experienced by individuals. This mental health disorder profoundly influences an individual's thoughts, emotions, and physical well-being, impeding their daily functioning. A clinical diagnosis of depression is established when these symptoms persist for more than two weeks, accompanied by a discernible decline in daily functioning that adversely impacts the individual and their immediate social environment (Allabadi et al., 2019).

1.6.8 Stress biomarkers

Two prevalent stress biomarkers commonly employed for assessing and quantifying an individual's psychological state are associated with the physiological systems of the adrenal pituitary hypothalamic axis (HPA) and the sympathetic adrenal medullary axis (SAM) (García-Blanco et al., 2017). Cortisol governs the HPA axis, while catecholamines regulate the SAM axis, and heightened levels of cortisol and catecholamines have been historically linked to elevated stress levels (Hellgren et al., 2016; An et al., 2013). Nevertheless, in the present study, the focus was exclusively on cortisol measurement, which was executed through the utilization of serum cortisol assessments.

Cortisol investigations represent a frequently employed approach among stress biomarkers for discerning levels of stress, anxiety, and depression (Dhama et al., 2019). Various biological matrices, including urine, saliva, and plasma, are amenable to cortisol level determination, with plasma affording greater precision. Notably, cortisol levels exhibit a diurnal rhythm, reaching peak concentrations approximately an hour post-awakening, gradually declining throughout the day, and reaching their nadir at midnight (Wagner-Skacel et al., 2021). According to established norms, serum cortisol levels should range between 155 mmol/l from 8 a.m. to 10 a.m., decreasing to 73.8 mmol/l from 4 p.m. to 6 p.m. This temporal delineation aids in contextualizing and interpreting cortisol measurements with regard to the circadian rhythm of cortisol secretion.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Cardiovascular disease (CVD) remains the world's leading cause of death, claiming an estimated 17.9 million lives in 2019 (Tsao, 2022). CHD represents the leading type of CVD, accounting for one-third of global deaths (Virani et al., 2023). While advancements in medical and surgical interventions have improved CHD management, limitations persist, often focusing on symptom control or revascularization without fully addressing underlying risk factors or functional limitations. In this context, cardiac rehabilitation emerges as a crucial component of holistic CHD care, offering a multifaceted approach beyond standard treatments. Numerous meta-analyses and systematic reviews consistently demonstrate the effectiveness of cardiac rehab in improving exercise capacity, reducing mortality and recurrent events, and enhancing quality of life after cardiac events or procedures (Bianchi et al., 2021; Taylor, Dalal & McDonagh, 2022). By integrating exercise training, education, and psychospiritual support, cardiac rehab empowers individuals to actively manage their condition and optimize their post-event cardiovascular health.

CHD, the leading cause of death globally, affects an estimated 17.9 million individuals (Tsao, 2022), representing over 1.8% of the world's population. This translates to a prevalence of 1,845 per 100,000 people, with Eastern Europe exhibiting particularly high rates (Cheong et al., 2023). While new cases typically start in the fourth decade of life, prevalent cases accumulate progressively with age. Worryingly,

this global burden is projected to rise further, exceeding 2,000 per 100,000 by 2030 due to factors like population aging and rising risk factors (Khan et al., 2020).

2.2 Coronary heart disease (CHD)

The silent threat at the heart of CHD is atherosclerosis, a progressive villain that slowly constricts the vital arteries supplying your heart muscle with life-giving oxygen. This insidious process involves the gradual buildup of fatty deposits, cholesterol, and other substances within the coronary arteries, forming hardened plaques that resemble unsightly lumps on the arterial walls. (Hansson, Libby & Tabas, 2015) leading to progressively narrowing of the artery lumen and constricting blood flow. This oxygen deprivation, known as ischemia, can manifest in various ways, from subtle chest discomfort to debilitating angina and even fatal heart attacks or myocardial infarction (MI) (Kaura et al., 2019; Khosravi et al., 2019). During an MI, the ischemic territory experiences oxygen and nutrient deprivation, potentially leading to irreversible muscle damage or cell death (Hansson et al., 2015). Figure 2.0 shows an image of CHD as described above.

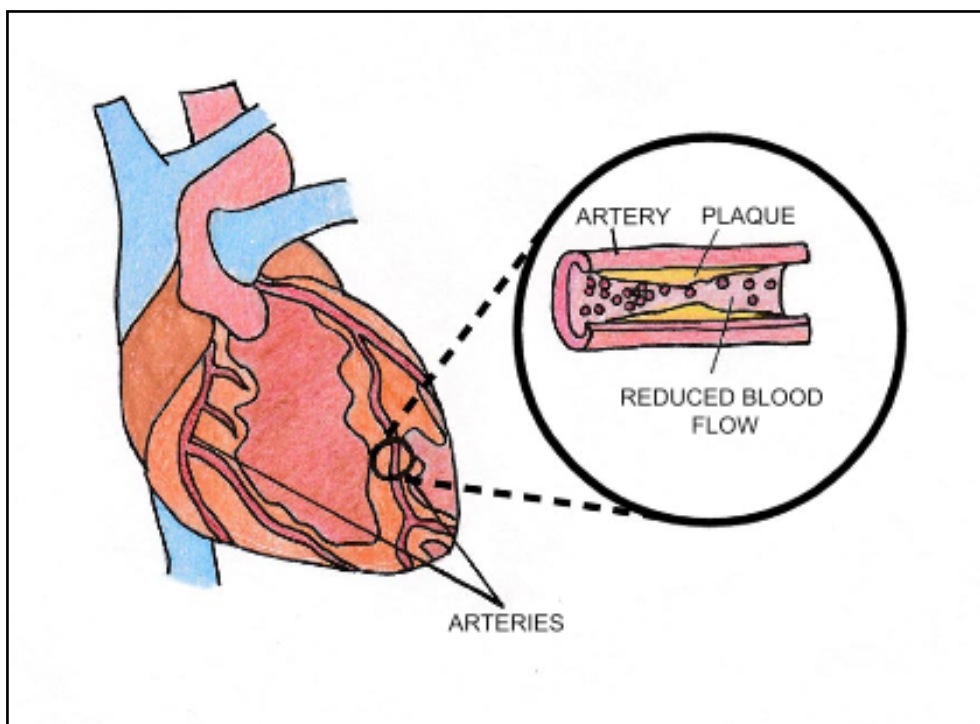


Figure 2.1: Coronary heart disease

CHD pathogenesis unfolds through a complex interplay of chronic inflammation, endothelial dysfunction, and atherogenesis. Proinflammatory cascades triggered by endothelial cell damage, as Khosravi et al. (2019) detail, drive the recruitment of immune cells and subsequent release of pro-inflammatory mediators. This persistent inflammatory response promotes lipid accumulation and plaque formation within arterial walls. Vulnerable plaques susceptible to rupture are further exacerbated by endothelial activation and altered coagulation pathways. As Hansson et al. (2015) explain, endothelial disruption facilitates platelet aggregation and fibrin deposition at the site of plaque rupture, culminating in thrombus formation and complete coronary occlusion. This thrombotic event can manifest as various clinical presentations, including unstable angina, non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI).

Accurate CHD diagnosis relies on a multi-modal approach. While ECGs remain valuable for detecting STEMI, characterized by characteristic ST-segment elevation, NSTEMI often presents with subtle or absent ECG changes. In such cases, as Myint et al. (2014) and Brewster et al. (2020) advocate, cardiac troponin and creatine kinase-MB (CK-MB) levels, specific biomarkers released by injured heart muscle, play a crucial role in definitive diagnosis. Additionally, Burchardt et al. (2016) highlights the utility of cardiac enzyme monitoring in unstable angina, as elevated levels may predict subsequent acute coronary events associated with plaque rupture and thrombosis.

2.3 Incidence and prevalence of CHD

The global prevalence of cardiovascular diseases (CVDs) has witnessed a concerning upward trajectory, driven by factors such as sedentary lifestyles, unhealthy dietary patterns, and an aging population (Khan et al., 2020). Among these debilitating conditions, coronary artery disease (CAD) stands out as the leading cause of death worldwide, claiming over 18 million lives annually and accounting for nearly 30% of global mortality (Tsao, 2022). This translates to approximately 47 million individuals suffering from severe, life-altering CHD every year (Ji et al., 2019).

The impact of CHD extends beyond mortality rates, significantly impacting the quality of life for affected individuals and imposing immense challenges on healthcare systems globally. In the United States alone, over one million people grapple with complications from heart disease annually, with a substantial portion succumbing within a year of CHD diagnosis (Hackshaw et al., 2018; Mozaffariann et al., 2016). Similar grim statistics paint a concerning picture across different regions,

with CHD topping the list of deadly diseases in ASEAN countries like Singapore, Thailand, and the Philippines (Malaysian Department of Statistics, 2021).

Even developed nations haven't escaped this CVD epidemic, with countries like the United States, Japan, the United Kingdom, and Australia reporting similar worrying trends (Malaysian Department of Statistics, 2021). Closer to home, in Malaysia, CHD remains a persistent menace, claiming 18,515 lives in 2020, constituting 17.0% of all medically certified deaths. This represents a worrying rise from 11.6% in 2000, highlighting the urgent need for effective interventions to curb this escalating public health crisis (Wahab, 2015).

2.4 Management of CHD

Numerous therapeutic modalities have been employed in the management of CHD. Initially, pharmaceutical interventions constitute the primary therapeutic approach. However, an alternative method involves the utilization of coronary angioplasty procedures, which afford a swifter and less invasive means of dilating constricted arteries compared to conventional bypass surgery. This approach has been observed to entail a shorter wound healing process, with reduced duration of convalescence (Lownie & Pelz, 2013). The global prevalence of coronary angioplasty is noteworthy, albeit accompanied by a substantial economic burden (Moussa et al., 2013).

Annually, a considerable proportion of the global population, estimated at one million individuals, undergo coronary angioplasty procedures, with the United States accounting for approximately 650,000 cases (Moussa et al., 2013). In Malaysia, a

discerning analysis of hospital admissions data reveals that between 2007 and 2009, 10,602 patients sought coronary angioplasty procedures (Wan Ahmad & Bang, 2016). Intriguingly, statistics from the Universiti Sains Malaysia Hospital demonstrate a rising trend in the number of patients undergoing coronary angioplasty procedures, exemplified by 78 procedures in 2015 and a notable increase to 146 in 2016 (PTCA Registration Book 2015 & PTCA Registration Book 2016). This escalating prevalence suggests an imminent surge in global healthcare expenditures. Consequently, it is imperative for patients undergoing coronary angioplasty to adhere to a structured cardiac rehabilitation program to optimize the monitoring of the healing and recovery process, thereby mitigating the potential escalation of healthcare costs (Musa, Min & Rahim, 2020).

2.5 Coronary angioplasty

Percutaneous coronary intervention (PCI), commonly known as coronary angioplasty, revolutionized the treatment of coronary artery disease (CAD) since its pioneering application by Andreas Gruentzig in 1977 (King & Schlumpf, 1993). This minimally invasive procedure offers a compelling alternative to bypass surgery, allowing for the revascularization of narrowed arteries without extensive incisions.

Technological advancements further refined PCI over the years. The introduction of stents in 1987 provided additional support to the treated artery, reducing the risk of restenosis (King & Schlumpf, 1993). Shortly thereafter, in 2001, drug-eluting stents (DES) emerged, incorporating medications to suppress

inflammation and cell proliferation within the stented segment, significantly improving long-term patency and reducing repeat procedures (Saito et al., 2023).

Coronary angioplasty involves accessing the coronary arteries through a small incision in the femoral or brachial artery (Musa et al 2020). A guidewire and a balloon catheter are then navigated through the arterial system to the stenotic site. The balloon is inflated, compressing the atherosclerotic plaque and widening the lumen of the artery. In some cases, stents are deployed during the procedure to offer additional support and maintain vessel patency (Caneparo, Chabaud & Bolduc, (2021).

PCI effectively alleviates angina pectoris (chest pain) and other ischemic symptoms by improving blood flow to the heart muscle (Ghafari & Carlier, 2021). However, judicious patient selection and appropriate pre- and post-procedural care are crucial for optimal outcomes. Figure 2.1 depicts the position of the brachial and femoral arteries.

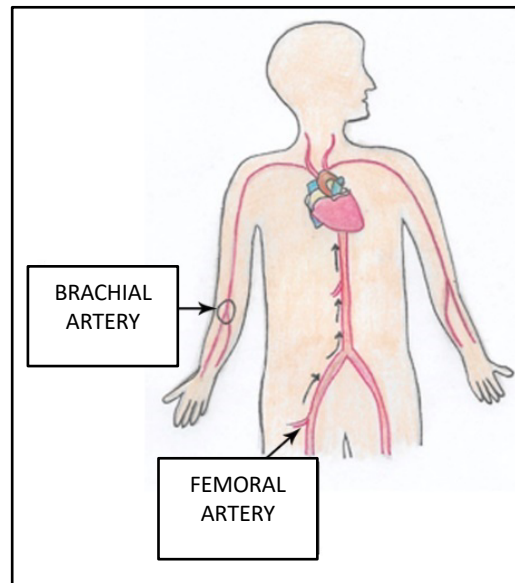


Figure 2.2: Position of brachial and femoral arteries

During percutaneous coronary intervention (PCI), fluoroscopic imaging guides the placement of a catheter into the targeted coronary artery. This real-time visualization allows the interventional cardiologist to navigate the catheter precisely through the vasculature until it reaches the site of stenosis (Ghafari & Carlier, 2021).

To further delineate the extent of the blockage, contrast dye is injected through the catheter. The dye's characteristic X-ray opacity clearly highlights the narrowed segment of the artery, facilitating accurate positioning of the guidewire and subsequent balloon (Ghafari & Carlier, 2021).

The guidewire, a thin, flexible metal shaft, is then maneuvered across the blockage and into the distal segment of the artery. This delicate maneuver serves as a precursor for balloon inflation and subsequent vessel remodeling (Caneparo, Chabaud & Bolduc, (2021).