



Systematic Review

The Benefits of Fasting to Improve Health Conditions and to Prevent Cardiovascular Disease**Wahyu Sukma Samudera, Gracia Victoria Fernandez, Rahmatul Fitriyah, Hidayat Arifin, Shenda Maulina Wulandari, and Roby Aji Permana**

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ABSTRACT

Introduction: Fasting is defined as the voluntary abstinence from eating for variable time intervals and it has been associated with potential beneficial impacts on human health. The study was to review the benefits of fasting on cardiovascular health in humans with or without cardiovascular disease.

Methods: The databases search was done using the keywords 'fasting' and 'cardiovascular system' using Scopus, Science Direct and ProQuest, limited to between 2013 and 2019 for publication year. A total of 3.619 articles were obtained and 15 articles involving experimental and non-experimental studies were used as the reference material.

Results: The findings showed that in people who are healthy, fasting can reduce the inflammatory markers (IL-1 & IL-6, TNF- α), the oxidative stress marker (Malondialdehyde), body weight, abdominal circumference, fasting blood glucose, LDL, triglyceride and blood pressure. In people at risk or with cardiovascular disease, fasting can reduce body weight, body mass index, abdominal circumference, fat percentage, blood pressure, triglyceride, the biomarker of inflammation (serum amyloid A), the biomarker of oxidative stress (protein carbonyl), the biomarker of endothelial dysfunction (asymmetric dimethylarginine) and increase the vascular endothelial growth factor.

Conclusion: Based on these findings, fasting can improve the health condition of people at risk or with cardiovascular disease by improving the risk factors such as blood pressure, overweight and endothelial dysfunction. In people who are healthy, fasting can be used for the prevention of cardiovascular disease by helping to maintain their weight, blood pressure, LDL and triglyceride within the normal limits.

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INTRODUCTION

Cardiovascular disease remains a major cause of disability and premature death globally. It is estimated that there are around 17,3 million deaths every year worldwide. It is predicted that there will be an increase to around 27,3 million by 2030 (Elbashir, Awaisu, Sa, Hajj, & Rainkie, 2019). Patients with cardiovascular disease requires a high level of involvement from the patient related to control and management of cardiovascular disease (Elbashir et al., 2019). Moreover, a healthy lifestyle is important to control and/or prevent cardiovascular

disease. Some research has shown the health improving effect of calorie restriction and intermittent fasting on the cardiovascular system. It also can reduce the risk of cardiovascular disease (Elbashir et al., 2019).

Fasting is a plan that is consciously carried out by the individuals to withhold some or all food and drinks over a certain period of time (Faris, Jahrami, Obaideen, & Madkour, 2019). Fasting comes in various types and time frames based on what has been determined or the method that has been made by someone (Trepanowski et al., 2017). One of the

fasting types that is often done is fasting based on religious teachings, in which the fasting practices carried out by someone is on the basis of their faith (Trepanowski et al., 2017). Some examples of fasting on the basis of belief are when Jews fast for 6 days in a year, where Greek Orthodox Christians fast for 180 - 200 days each year and when the Muslims do Ramadan fasting for 28 - 30 days every year (Faris et al., 2019). Another type of fasting is fasting that is not based on religion. This method of fasting is done by the individual by limiting their calorie intake by 25% of their total intake per day or around 500 kcal (Horne, Muhlestein, & Anderson, 2018).

Fasting has several benefits for human health and it has become known as a safe method to use to reduce the risk of disease (Trepanowski et al., 2017). Most individuals use the fasting method to lose weight (Kul, Savas, & Ozturk, 2013). Losing weight is one of the ways to improve one's overall health condition. Some of the benefits include improving systolic and diastolic blood pressure and improving the body's insulin levels, total cholesterol and the inflammatory markers in the body (Ganesan, Habboush, & Sultan, 2018).

Several studies have shown the benefits of fasting on one's health. One of the studies by (Faris et al., 2019) showed that Ramadan fasting is effectively proven to encourage the loss of weight, a decrease in blood sugar levels and in LDL cholesterol in healthy individuals. Other studies (Salahuddin, Ah, Sr, & Km, 2014) have shown that fasting can be used as an additional therapy to reduce body weight and blood pressure in middle-aged individuals with hypertension. Other studies have also showed that fasting can reduce weight characterized by a decrease in waist circumference and that it can also reduce blood pressure without causing hypotension complications (Id, Grundler, Bergouignan, Drinda, & Michalsen, 2019).

This study aimed to know the benefits of fasting related to improving the present health conditions and preventing diseases of the cardiovascular system in individuals with and without cardiovascular disease.

MATERIALS AND METHODS

Research Design

This study used a systematic review to find out the benefits of fasting on the health of the cardiovascular system.

Search strategy

This research reviews the benefits of fasting through the process of electronic database searching which limited the search years to between 2013 and 2019 using the Scopus, Science Direct, and ProQuest databases using the following keywords: Fasting and cardiovascular health.

Inclusion and exclusion criteria

The inclusion criteria of the research in this systematic review were 1) experimental and non-

experimental studies, 2) research conducted between 2013 and 2019 and 3) research samples or respondents who have or do not have cardiovascular disease. Meanwhile, the exclusion criteria in this systematic review was 1) research samples or respondents accompanied by diseases other than cardiovascular and 2) research samples or respondents that are pregnant.

Article search process

The research articles were obtained from 3 databases, namely Scopus, Science Direct, and ProQuest and 3,619 research articles were initially obtained. A detailed process of the mechanism for selecting the research articles can be seen in Table 1.

RESULTS

The results of the review of the 15 journal articles used in the study were related to the benefits of fasting on cardiovascular health in individuals with and without cardiovascular disease. Based on Table 1, the researcher found some benefits of fasting in terms of improving the human health condition. They were a decrease in the inflammatory markers such as IL-1, IL-6, TNF- α , malondialdehyde (MDA), serum amyloid A, carbonyl protein, a reduction in LDL levels, endothelial dysfunction (Asymmetric Dimethylarginine), lowered blood pressure, a loss in weight, body mass index, and waist circumference and an increase in the Vascular Endothelial Growth Factor (VEGF). There were different types of fasting observed in this study: Ramadhan (Faris et al., 2019) and alternate day fasting (Horne et al., 2018).

Ramadhan fasting is an annual routine agenda for Muslims which lasts for 28 - 30 days (Faris et al., 2019). Alternate day fasting is when someone restricts their calorie intake by 20-25% of their total calorie intake per day or by approximately 500 kcal per day (Horne et al., 2018).

Figure 1 explains the flow of the study selection; 6 out of 15 articles revealed that fasting could reduce body weight. This is aligned with the introductory part of this study elaborating that fasting methods were used to reduce body weight in some studies. Moreover, 3 articles stated that fasting had the therapeutic side effect of reducing blood pressure and LDL level. Seven studies observed that the subjects undertook religious fasting or Ramadhan fasting which lasts for 28 - 30 days while the rest of the studies observed subjects using intermittent type of fasting including alternate day fasting. In normal healthy humans without a cardiovascular risk, fasting could help to decrease the inflammation biomarker (IL-1, IL-6, TNF- α) (Faris et al., 2019), oxidative stress (malondialdehyde) (Faris et al., 2019), body weight (Kul et al., 2013), waist circumference (Sayedda et al., 2013), fasting blood glucose (Kul et al., 2013),

Table 1. Benefit of fasting on human health

Article writer	Impact of fasting on human health
Trepanowski et al (Trepanowski et al., 2017)	Increased HDL
Akaberi et al (Akaberi, Golshan, Moojdekanlo, & Hashemian, 2014)	Improved HDL, LDL/HDL ratio, TG/HDL ratio
Kul et al (Kul et al., 2013)	Decreased body weight, fasting blood glucose and LDL at people healthy
Faris et al (Faris et al., 2019)	Decreased biomarkers of inflammation (IL-1, IL-6, TNF- α) and decreased oxidative stress malondialdehyde (MDA).
Salahuddin et al (Salahuddin et al., 2014)	Can be used as complementary treatment for reducing blood pressure and body weight in people with hypertension
Mazurak et al (Mazurak & Gu, 2013)	Decreased body weight and cortisol diurnal profil
Iso et al (Iso et al., 2014)	Decreased trygliceride
Asadi et al (Asadi et al., 2015)	Decreased biomarkers of inflammation (serum Amyloid A and protein carbonyl)
Radhakishun et al (Radhakishun, Blokhuis, Vliet, & Rosenstiel, 2014)	Decreased percentage of fat
Horne et al (Horne et al., 2018)	Improved body weight and lower prevalence of cardiovascular disease
Sayedda et al (Sayedda, Kamal, & Ahmed, 2013)	Decreased body weight, waist circumference and mean blood pressure (healthy)
Wei et al (Wei et al., 2017)	Decreased body weight, waist circumference, body mass index, body fat and systole blood pressure (Risk)
Id et al (Id et al., 2019)	Decreased body weight marked by a decrease in waist circumference, and decreased blood pressure without hypotension complications
Ganesha (Ganesan et al., 2018)	Decreased body weight, LDL and trygliceride
Youse et al (Youse et al., 2014)	Increased Vascular Endothelial Growth factor (VEGF) and a decrease in the biomarker of endothelial dysfunction (asymmetric Dimethylarginine)

LDL (Kul et al., 2013), trygliceride(Ganesan et al., 2018) and blood pressure(Id et al., 2019). In humans with a risk of or with cardiovascular disease, fasting could help to decrease their body weight (Salahuddin et al., 2014), body mass index(Wei et al., 2017), body fat percentage(Wei et al., 2017), blood pressure(Salahuddin et al., 2014), triglyceride(Iso et al., 2014), the biomarker of inflammation (serum amyloid A)(Asadi et al., 2015), the biomarker of oxidative stress (protein carbonyl)(Asadi et al., 2015) and the biomarker of endothelial dysfunction (asymmetric dimethylarginine)(Youse et al., 2014)

while increasing the vascular endothelial growth factor (VEGF)(Youse et al., 2014).

DISCUSSION

This study indicates that fasting has several benefits related to cardiovascular maintenance, both for people with cardiovascular risk and for healthy people.

Fasting Benefits for Body Weight Maintaining

Based on the research meta-analysis of 21 studies, a total 830 participants were analyzed (531 participants were men and 299 participants were women). The results showed a significant decrease in body weight in the male participants (Kul et al., 2013). Another study stated that Ramadhan fasting could reduce body weight in middle age adults with hypertension (Salahuddin et al., 2014). Being overweight is triggered by a high fat intake and a low level of physical activity. Prevention and management in the context of being overweight can be done by maintaining the balance of diet and physical activity. One of the management efforts used to reduce body weight is fasting (Kul et al., 2013). Fasting is categorized as a dietary approach to restricting the daily calorie intake in both the short and long term (Ganesan et al., 2018). Both diet management types, using the Ramadhan and alternate day fasting methods, can be done to limit the daily calorie intake. Therefore it would help in preventing over-intake and eventually in maintaining the ideal body weight.

Fasting Benefits in Blood Pressure

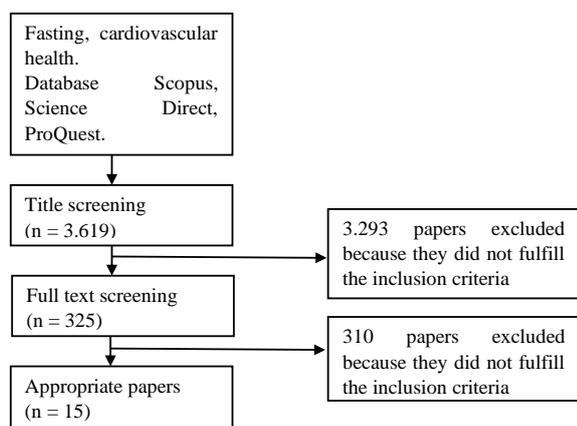


Figure 1. Flowchart of the research benefits of fasting to improve health conditions and disease prevention in relation to the cardiovascular system

A study (Salahuddin et al., 2014) revealed that Ramadhan fasting could be used as a non-pharmacological therapy to support anti-hypertension therapy in reducing blood pressure in a person with hypertension. This was proven by the result of the study, which showed a total of 15 hypertensive patients experienced a decrease in their systolic and diastolic blood pressure after fasting (Salahuddin et al., 2014). Another study stated that fasting was safe to be practiced to decrease blood pressure by not overly reducing it below the normal level. According to the study by (Sayedda et al., 2013), a routine of 5 days spent fasting every month continually performed over 3 months in a row helped in the systolic reduction. Fasting triggers the hunger sensation which produces a protective effect by preventing catecholamine release and minimizing blood flow in the veins. This mechanism results in reducing the sympathetic nerve impulse and causing a reduction in blood pressure and thus the arterial and cardiac output (Salahuddin et al., 2014). Thus, fasting is categorized as a non-pharmacological method for additional therapy to control blood pressure in hypertensive patients. Furthermore, it has been proven to be a safe way to diet without initiating hypotension complications.

The use of fasting towards LDL levels in the body

Fasting is one of the several ways to control the LDL level in the body. The results of the meta-analysis included 13 studies representing 740 healthy participants (500 men and 240 women). It showed that fasting is proven to be an effective way to decrease the LDL level in the body (Kul et al., 2013). This result proved that the respondents who carried out Ramadhan fasting experienced weight loss and a decrease in some of the biochemical parameters such as LDL level compared to before Ramadhan. Fasting shifts the dietary habits of people. For instance, someone who did Ramadhan fasting ate just twice in a day; once before dawn and the remainder after sunrise. During Ramadhan fasting, a Muslim changes their lifestyle as well, such as their physical activities and dietary habits. The reduction of LDL level occurring as an effect of Ramadhan fasting is the thing that is related to weight loss during fasting. It is basic proof that the use of fasting could be used for the prevention of disorders or diseases in the cardiovascular system.

The use of fasting towards the vascular wall

Fasting is useful in relation to vascular wall function or endotel. The use of fasting can be seen from the previous results of the research. A total of 21 individuals who did fasting experienced an increase in the Vascular Endothelial Growth Factor (VEGF) and a decrease in asymmetric dimethylarginine (ADMA) level. These are the markers that relate to dysfunctions of the vascular wall (endotel) (Youse et al., 2014). The dysfunction of the vascular wall (endotel) is a systemic disorder that has become one of the factors tied into the pathogenesis of

atherosclerosis. Endotel dysfunction causes a decrease in the vasodilation ability of the vascular wall. It is caused by the imbalance between vasodilation and vasoconstriction as one of the symptoms of endotel dysfunction (Youse et al., 2014). Some research has showed that fasting can increase the nitric oxide level in the cardiovascular system which could influence the vascular wall. Nitric oxide possesses links with the vascular endothelial growth factor and asymmetric dimethylarginine. Vascular endothelial growth factor increases the nitric oxides used to maintain the elasticity of the endotel that causes endotel dysfunction endotel (Youse et al., 2014). Meanwhile, asymmetric dimethylarginine decreased the production of nitric oxide that could cause endotel dysfunction (Youse et al., 2014). It showed that fasting contributed to maintaining the elasticity of vascular wall and thus it prevented endotel dysfunction. Both are the main factors of high blood pressure or hypertension.

CONCLUSION

Fasting is a safe pharmacological treatment that can be safely done. It has some advantages such as helping to reduce weight, controlling or reducing blood pressure without causing hypotension complications, preventing endotel dysfunction and decreasing the LDL level. Several advantages can be gained by a healthy individual without cardiovascular disease such as the prevention of cardiovascular disease. It can also help an individual with a high risk of or with cardiovascular disease. Fasting can be used to repair one's health condition by repairing the risk factors such blood pressure, being overweight and endotel dysfunction.

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