*Arşiv Kaynak Tarama Dergisi*
**Archives Medical Review Journal**

# Causes for increased incidence of heart disease Among African American Community.

## Kalp Hastalığı İnsidansının Afrikalı-Amerikalılar Arasında Artmasının Nedenleri

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**ABSTRACT**
Cardiovascular disease is a worldwide phenomenon. While it is found in men and women almost equally, it is found in almost disproportionately high rates in African-Americans. African-Americans compromise a smaller portion of the population yet, they have higher risk of suffering from heart disease than most minority groups. The increased probability of suffering for heart disease is based on commonly known factors such as stress, lifestyle choice, and biochemistry levels. But the possibility of developing cardiovascular disease also relies on less thought of factors such as direct environment, socioeconomic status, and even perceived racism. This review sought to understand why African- Americans have such a high prevalence of heart disease, and even heart attack and death. We hope that in the future researchers can find more effective ways to minimize both traditional and non-traditional risk factors, which cause elevated frequency of heart disease in African-Americans. By minimizing the risk factors, improvements can be made to overall health and hopefully decreased incidence of heart disease.
**Keywords:** African Americans, cardiovascular disease, genetics, environment, stress, biochemistry levels

**ÖZET**
Kardiyovasküler hastalıklar dünya çapında önemli bir olgudur. Erkeklerde ve kadınlarda neredeyse eşit olarak bulunurken, Afrikalı-Amerikalılarda orantısız olarak yüksek oranlarda bulunur. Afrikalı-Amerikalılar, nüfusun daha küçük bir bölümünü oluşturuyor olsa da, çoğu azınlık grubundan daha yüksek kalp rahatsızlığı riski taşırlar. Kalp rahatsızlığının artma olasılığı, stres, yaşam tarzı seçimi ve biyokimya seviyeleri gibi yaygın olarak bilinen faktörlere dayanmaktadır. Ayrıca, kardiyovasküler hastalığın ilerleme olasılığı, doğrudan çevre, sosyoekonomik durum ve ırkçılık gibi faktörlere de bağlıdır. Bu derlemede, Afrikalı-Amerikalıların neden bu kadar yüksek yaygınlıkta bir kalp hastalığı, kalp krizi ve ölüm oranına sahip oldukları anlamaya çalışıldı. Gelecekte araştırmacıların, Afrikalı-Amerikalılarda kalp hastalığının sıklığının artmasına neden olan hem geleneksel hem de geleneksel olmayan risk faktörlerini en aza indirgemek için daha etkili yollar bulabileceğini umuyoruz. Risk faktörleri en aza indirilerek, genel sağlık için iyileştirmeler yapılabilir ve kalp rahatsızlığına yakalanma riski azaltılabilir.
**Anahtar Kelimeler:** Afrikalı Amerikalılar, kardiyovasküler hastalık, genetik, çevre, stres, biyokimya seviyeleri

## Introduction

Cardiovascular disease is the leading cause of death in both men and women in the US, causing over 600,00 death annually. While heart disease affects both men and women, men are more likely to be affected. Heart disease affects 6% of women over the age of 20 and between 7-9% of males over the age of 20. Men account for the majority of sudden onset of cardiac incidents. In men there is a 50% chance of developing heart disease and dying without any symptoms of a heart attack. Clues that men are suffering from heart disease or experiencing a heart attack are chest pain, shortness of breath, or feeling lightheaded. In women, there is a chance that no symptoms will show, but the most common signs of a heart attack are chest pain, pain in the jaw, or pain in the upper back, and even nausea. This variety of symptoms can make it difficult for women to differentiate between those of a heart attack or another type of ailment. Cardiovascular disease is influenced by a number of factors such as HDL and LDL levels, genetics, lifestyle, and comorbidity with other diseases [1,2]. Cholesterol is a leading factor in developing heart disease. Cholesterol levels are maintained by high-density lipoprotein (HDL) as well as low-density lipoprotein (LDL). HDL functions to absorbs extra cholesterol and return it to the liver to be separated and removed from the body. LDL can collect in


2020;29(2):108-115
doi:10.17827/aktd.648758

arteries causing them to tighten which could cause heart disease and eventually heart attack[3]. Cholesterol can be maintained by losing weight, eating fewer fatty foods, minimizing alcohol consumption, taking cholesterol medications, or a combination of the above-mentioned treatments [4]. Weight, more specifically BMI, shows correlation between increased BMI and causes increased risk of heart disease[5]. This is because increased weight causes an increase adipose tissue build up in the body. This build up can cause compression on the internal organs, specifically the heart and can trigger a heart attack. Several studies have been performed to determine not only how to reduce these risk factors, but also if a group of people was more likely to suffer from these risk factors than others.

Studies have shown that there is a relationship between the quantity of risk factors someone has with the likelihood that they will develop CVD[6]. Studies have concluded that African-Americans are most likely to suffer from more risk factors of cardiovascular disease than other ethnic groups such as obesity, high blood pressure, stroke, diabetes, and more. This increase in risk factors intensifies the likelihood of developing cardiovascular disease [7,8]. African-Americans despite being a smaller subsection of the population account for as many cardiac related deaths as their Caucasian counterparts. This is in part because of inheritable traits and behavior. Researchers found that African-Americans have greater incidence of FKBP5 and galectin-3, which increases cortisol levels and inflammation respectively, and correlates with the proliferation of heart disease [9-11]. The increased occurrence of these genes is shown to cause higher rates of heart disease. While there are several physiological and genetic components of heart disease that cannot be controlled, there are also several external factors that cannot be controlled. Dynamics such as abnormal stress levels, the environment, and the quality of care received which all contribute to the prevalence of cardiovascular disease in African-Americans[12-14]. Researchers performed studies monitoring the connection between these factors and heart disease. They found that adverse situations such as environment and stress impair the likelihood of avoiding heart disease. The researchers also discovered that African-Americans are more likely to live in these unpleasant communities but also suffer from uncharacteristically high stress levels. When discussing how to reduce chances of developing heart attacks providers tends to focus only having the patient make lifestyle changes. Lifestyle changes such as having the patient exercise more, eat a more nutritious diet, and limit stressors, but as important as these changes are, they only solve part of the problem[5,15]. To truly help patients reduce the possibility of developing heart disease, more research should be done determining the relationship of all potential risks and heart disease.

The relationship between traditional risk factors and non-traditional risk factors on the frequency of heart disease are often not explored. But both are important in understanding the prevalence of heart disease in the African-American community. Exploring the relationship of traditional and non-traditional risk factors and heart disease can also be used to combat heart disease in future generations. Discovering this correlation can change not only improve cardiovascular health in African-Americans, but also improve the overall health of African-Americans. This review seeks to explain why African-Americans have higher incidence of cardiovascular disease.

## Relationship between environment and increased incidence of heart disease in African-Americans

Studies have shown how crucial neighborhoods are in developing a person's health. These neighborhoods can determine not only how accessible doctors are, but also education levels and even income. It has been discovered that African-Americans are most likely to live in poorer neighborhoods, which contributes to lower socioeconomic status, lower levels of education, and lower senses of community[7]. These factors were determined to be important because people living in worse neighborhoods had higher incidents of cardiovascular disease and heart attack. Having a lower socioeconomic status can contribute to the inability to see the doctor because of lack of insurance which can lead to other health problems[8]. These lower income environments are more likely to be in unsafe areas[1]. This lack of affordable housing causes people to find homes wherever they can. This usually means finding homes in less than desirable neighborhoods[16]. Some of these affordable neighborhoods are segregated, which causes an increase of cardiovascular disease[12]. These segregated neighborhoods relate to socioeconomic status. Studies have shown that lower-income communities are more likely to be filled with minorities, while more affluent communities are filled with

most Caucasians. Researchers studied the relationship between these segregated neighborhoods and heart disease and discovered that people that lived in the lower income communities were more likely to develop heart disease than those that live in better neighborhoods. This helps us explain why African-Americans with lower socioeconomic status are more likely to develop heart disease compare to African-Americans living in better communities with higher socioeconomic statuses[11]. While lower socioeconomic status causes increased incidence of heart disease, it is not the only factor that affects the development of heart disease.

Education is another factor that affects the progression of heart disease. Studies have shown that lower levels of education can cause a lack of understanding of disease and health overall. This decreased health knowledge causes negative effects to one's health[8]. This lower health literacy causes a decrease in positive health outcomes because patients are unable recognize other potential deadly symptoms of a heart attack besides chest pain[17]. Not being able to identify warning signs and other health aspects leads to delay in ambulance calls, ER visits, and more. While education levels and income level all contribute to environment and indirectly health, community, the inhabitants of a neighborhood, are also a factor in the advancement of heart disease[1].This sense of community is influenced by numerous details. One idea is that members of the community view themselves as individuals instead of as part of the community. Lower sense of community could also be contributed to the fact that some African-Americans live in unsafe neighborhoods and possibly don't want to interact with their neighbors[18]. This decreased sense of community causes a lack of social cohesion which causes a surge in heart disease[11]. Social cohesion is important in minimizing certain mental health disorders which possibly could lead to heart disease[19]. Higher social cohesion can be caused by living in better neighborhoods or even having better relationship with neighbors. Environment is an important component in the progression of heart disease, but it is not one of the most well-known factors of heart disease.

## How increased stress in African-Americans effects incidence of heart disease

Stress is commonly associated with increased levels of cardiac disease. Increased stress levels cause increased incidence of cardiovascular disease[9]. Stress can be influenced by financial issues, mental health, genetics, and elevated biochemistry levels[1, 10,20]. These factors alone cause negative effects on health, but a combination of these factors causes dire consequences. Studies show that African-Americans have a greater likelihood at living at or below the poverty line than other minority groups, which causes higher levels of stress[7]. These higher levels of correlate with higher probabilities of contracting heart disease[13]. Minimizing this type of stress is difficult to change because it also correlates with education level which can be challenging to change. While finances play a role in stress level, mental health also plays a decisive role in stress levels. Patients with post-traumatic stress disorder, PTSD, report higher levels of stress and the prevalence of PTSD is especially high in African-Americans[18]. PTSD can be treated with therapy and medication but often patients are unable to receive the care they need [12]. When patients' live-in low-income communities, they have decreased access to doctors[8]. .But when patients have access to a doctor, there is a greater need for help than the physicians can accommodate[21]. While these external factors are essential aspects in determining cardiovascular disease, internal aspects such as genetics and hormones have an equal importance in the development of heart disease.

Internal factors can often not be controlled, one such factor is genetics. Certain genes are more prevalent in certain situations. One of these genes is FKBP5, which functions as glucocorticoid promoter[10]. This purpose of a glucocorticoid promotor ensures that cortisol will be produced more which then causes the stress levels in the body to rise. Rising cortisol levels can be helpful such as in fight or flight situations because they can help produce glucose. This glucose can be used by the body to help activate the muscles to move faster. Continually high stress levels can be damaging to the body. The increased stress levels escalate the chance of developing heart disease[9]. Stress can also be triggered by secretion of certain hormones. Over production of hormones such as cortisol and aldosterone have adverse effects on health. This stress causes a release of cortisol which has negative long-term effects. Overproduction of cortisol causes hypertension and narrower arteries which can lead to atherosclerosis and eventually a heart attack[6,22]. This is why reducing stress levels is necessary when attempting to diminish one's chances of heart disease[2]. Aldosterone is hormone in the body correlated with blood pressure [20].The more aldosterone the body produces the higher one's blood pressure. Stress has adverse effects on health, though it is not the only

negative cause of heart disease. There are several less researched influences on heart disease and one of these influences is racism.

## How perceived racism and accessibility to care impact cardiovascular disease

Of all the possible influences on heart disease quality of care and racism are probably the least suspected causes. It is not as researched as environment, stress, or genetics, but is still an important component in the prevalence of heart disease. Accessibility to physicians is critical to quality of care. Some physicians do not take patients without insurance which is detrimental to patients from low income backgrounds. Some physicians may also have their offices far away from these low-income communities making it harder for patients who need to see a doctor. This inaccessibility can impede physicians for diagnosing diseases and treatment in a timely manner. Accessibility to care is influenced by socioeconomic status and education level[8]. Patients with lower socioeconomic status may have to delay going to the doctor because of other expenses. Since many low-income patients cannot afford going to the doctor, they often do not recognize potential warning signs of heart disease which could lead to stroke or even cardiac arrest[19]. This delay paired with low-health literacy is a recipe for disaster. When researchers asked a group African-Americans if there were any health literacy courses, they could participate in many said no [17]. It was discovered that several clinics and doctors' offices that had cardiac health sessions with tips on how to recognize symptoms of coronary heart failure, how to make lifestyle changes to avoid heart disease, and more. But since many of these participants did not have practitioners to alert them of these information sessions, the sessions were not very helpful to many of the people who really needed them[6]. To make better strides in not only these sessions, but also accessibility to doctors, there must be more feasible ways for patients to see physicians and improve their health education. Some such ways are having these information sessions in more accessible places such as churches and other public places. To enhance the quality of care of patients, there should be revisions to provider accessibility including improving the obtainability of care and decreasing the negative perceptions that African-Americans have on providers.

Quality of care is not only comprised accessibility to physicians, but also how the physician perceives and treats patients[23]. Thus, explaining how racial bias and discrimination are key elements in the diminished quality of care are that African-Americans receive. One study found inconclusive results about implicit bias and treatment of patients. The study did reveal that Black patients were less likely to be admitted to the hospital, even with serious illness, have fewer chances at certain surgeries and receive delayed labs. Racial bias affects the decision-making process. It was discovered that this bias sometimes inhibits physicians from making certain recommendations to their patients. This is especially seen in coronary heart disease. This implicit discrimination affects more than the patient's short-term health, it produces more negative effects. Racism was shown to cause an increase in blood pressure, even hours after the situation has passed. One can infer from this data that a lifestyle of dealing with racism causes consistent long-term increases in blood pressure which could lead to heart disease or stroke[8]. When physicians ignore their patient's concerns and even health, it causes patients to distrust future physicians[7]. This distrust eventually leads to patients being noncompliant with the physician's demands, even if the physician has helpful information or the information is essential in preventing illness. Patients will dismiss this information because they have lost trust in healthcare providers. This distrust can cause serious health issues and even death. While accessibility to care and perceived racism are two external factors that contribute to heart disease, some of the most important elements of heart disease are determined by internal factors.

## How Genetics contributes to heart disease in African-Americans

Heart disease is influenced by not only external factors such as stress or lifestyle, but also internal factors such as biochemistry levels and genetics. Genes such as LGALS3, FKBP5, and SCN5A are essential in determining not only the severity of heart disease, but also the prevalence of heart disease[6, 24, 25]. SCN5A is key in encoding for sodium, specifically for the cardiac sodium channel[26]. The SCN5A gene specifically instigates and transmits action potentials, this correlates to deciding the cardiac impulses and conduction[27]. This conduction is best seen by QT interval on an EKG. Proper cardiac signaling allows for a normal reading, reduced mutations, and a lower rate of developing heart disease. However, when the SCN5A mutates this cause either an increase or decrease in the expression of the SCN5A gene. When the gene is

overexpressed, this causes an increase of sodium interacting with the heart cells which causes a longer QT segment. A longer QT segment translates to increased risk of electrical heart diseases. A decrease in SCN5A causes a decrease in sodium influx, which leads to defective sodium being produced. This defective sodium can also cause an electrical heart disease. Any situation where the SCN5A gene is not at optimal functional is a situation where electrical disease can develop and cause serious health problems. SCN5A defects are also shown to cause hypokalemia which occurs more often in African-Americans[28]. Hypokalemia can lead to increased heart arrhythmias and even death[29]. While the SCN5A gene is one of the leading genes contributing to increased heart disease in African- Americans it is not the only gene of importance.

FKBP5 is important in secreting cortisol[10]. Cortisol is typically secreted in stressful situations but can also be used reduce inflammation and lower blood pressure[9]. Inflammation can lead to atherosclerosis which is a common indicator of heart disease[6]. Repeated FKBP5 expression causes a buildup of cortisol which can cause a decrease effect and response from the body. This can lead to increased inflammation, higher blood pressure, and eventually heart disease [30]. FKBP5 is an important for more than cortisol production, it is also used as an important marker for kidney disease. FKBP5 is not the only gene important in controlling inflammation and heart disease. LGALS3 is another gene associated with inflammation and coronary heart failure. LGALS3 encodes for galectin-3[22]. Galectin-3 levels have shown to positively associate with heart disease. Galectin-3 is vital in determining fibrosis and inflammation. Increased galectin-3 levels increase the probability heart failure and heart diseases[31]. African-Americans have higher cellular galectin-3 levels but have fewer alleles that correlate to galectin-3. This shows that cellular galectin-3 quantities have a larger impact on the body than the alleles coding for galectin-3. These increased galectin-3 levels show that some aspects of heart disease are not readily controlled. One aspect of heart disease that is deemed easier to control is lifestyle.

## How the comorbidity of other diseases causes an increased risk of heart disease

Cardiovascular disease is influenced by multiple factors including diseases. Multiple diseases transpiring in the same person is defined as comorbidity. Comorbidity is not only the occurrence of multiple ailments but is also the interaction of these illnesses which can cause dire consequences in that person, consequences such as heart disease, stroke, and even death. These comorbidities can cause the diseases to rapidly progress or cause another ailment to occur in the person. Some examples of common comorbidities are diabetes, hypertension, and obesity[7]. While these diseases are harmful enough on their own, when paired together they can have disastrous effects on a person's health and wellbeing. African-Americans have the highest rate of comorbidity, which can explain why African-Americans have among the highest rate of heart disease[8]. One reason for this could be because obesity is also very prevalent in African-Americans. Obesity is common in over ten percent of the world's population and is defined as having a BMI over 30 and becoming more prevalent as the years pass[5,32]. BMI was previously thought to be the best indicator of chronic heart disease; however, studies have shown that measuring the waist circumstance is more accurate[15]. Obesity is also defined as having excess adipose tissue deposits in the body and this fat can accumulate all over the body. But when it accumulates around the waist and hips it is truly cause for concern. While obesity can be corrected with surgery, diet and exercise are other healthier methods[17].Diet is important to countering obesity and reducing the risk of heart disease. Eating less processed food and more fruits and vegetables is a way to lower your weight.

Hypertension is extremely high blood pressure, which is typical seen with obesity, diabetes and even renal failure [23]. Failure to resolve hypertension leads to stroke or heart attack. Hypertension can be caused by inflammation of the arteries or atherosclerosis, which causes the heart to overexert itself until it is too late[6]. Researchers found that African-Americans have lower levels of arterial elasticity than others. Hypertension can also be caused by abnormally high stress levels which is regulated by cortisol. Inability to modify hypertension leads to increased risk stroke. While there are numerous types of stroke researchers found a strong connection between hypertension and hemorrhagic stroke[33]. Researchers have also discovered that African Americans have higher rates of hemorrhagic strokes than any other group of people[34]. This explains the higher rates of stroke and stroke-related deaths in African-Americans[35].Hypertension is a prominent risk

factor of heart disease and heart failure, but it can be treated[16]. Hypertension can be corrected by medication, reduction in stress, diet, or exercise, but it is usually remedied by a combination of these methods. More research is being conducted on better tactics to eliminate hypertension including using immunosuppressants[36]. While it is clear there are numerous factors affecting comorbidity of diseases especially hypertension and obesity, supplemental research is needed to find better treatments to reduce the eventual progression of coronary heart disease. Although minimizing comorbidity of diseases is commonly associated with lessening the proliferation of heart disease, generally there is a focus on controlling certain serums in the blood. Specifically, controlling HDL and LDL levels which are shown to regulate cholesterol levels as well as whether or not someone will have heart disease.

## How biochemistry levels can have damaging effects on the heart

Cholesterol is commonly thought to be the central origin of heart disease. While increased cholesterol levels does increase risk of inflammation in the blood vessels, monitoring high-density lipoprotein levels, HDL, and low-density lipoprotein levels, are more efficient ways to determine whether or not someone will develop heart disease. HDL is important in helping the body recycle excess cholesterol by returning it back to the liver. LDL helps transport cholesterol to the rest of the body. But LDL can only transport so much cholesterol. When LDL has surpassed its optimal activity, LDL begins to accumulate in the arteries. A high LDL is correlated with a heightened risk of heart disease and is a sign that there is too much cholesterol in the body [37]. This accumulation can lead to inflammation which is a precursor to atherosclerosis[38]. Atherosclerosis is one of the main causes of heart attack. Atherosclerosis is a disease caused by too much LDL and other debris depositing in the arteries[3]. This debris causes the blood vessels to narrow, making it harder for blood to pass through. When the blood vessels have amassed too much plaque they can burst. This rupture can cause stroke, heart attack, or even death[22]. This is especially damaging in African-Americans who are known for having extremely high LDL levels[1]. While diet contributes to this increase in LDL, genetics also play a role. African-Americans have exceptionally high galectin-3 rates[6]. Galectin-3 is important in inflammation and fibrosis. This surge in galectin-3 levels is known to enhance chances of developing heart disease. To reduce the prospect of developing atherosclerosis and ultimately heart disease, it is recommended to exercise, eat healthier food, and lose weight[2,24]. LDL levels are indicative of the likelihood of maturation of heart disease, but the immune system also plays a key role in this development.

The immune system is crucial in defending the body from foreign antigens and preventing illness. The immune system is less commonly known for aiding in the proliferation of heart disease by secreting lymphocytes and other cytokines necessary for prevention heart disease[40]. The immune system is important in reducing inflammation, but when it is unable to do so atherosclerosis can occur[6].This atherosclerosis is a key component in the advancement of coronary heart disease. Researchers discovered that monocytes are the cause of this spread to atherosclerosis. Higher plasma monocyte levels are shown to occur with increased inflammation which has shown to cause heart disease[39]. While inflammation is one internal cause of heart disease, arguably the most important cause is blood pressure levels. If there is constantly high blood pressure this could also mean that the kidneys are not functioning properly. Blood pressure can be regulated by the renin-angiotensin system, which is activated by a drop in blood pressure[3,40]. This signals that aldosterone needs to be secreted to help regulate this drop in blood pressure. Aldosterone is not just secreted when blood pressure is too low, it is also secreted when BMI is too high. This increased blood pressure can progress into hypertension and ultimately heart disease or failure.

## Concluding Remarks

Cardiovascular disease is an illness affected by many complex factors. Cardiovascular disease is affected by traditional risk factors such as diet, exercise, and high blood pressure, but also influenced by non-traditional factors such as environment, genetics, and stress[1,2]. Understanding the role traditional and untraditional factors play in heart disease can help healthcare providers offer better treatment for their patients. Most treatments focus on only minimizing the traditional risk factors, while ignoring the more intricate non-traditional factors. In future reviews, ways to decrease the non-traditional factors should be explored. By decreasing some of the controllable non-traditional risk factors and traditional risk factors, this would not only decrease the likelihood of heart disease in African Americans, but also improve the overall health of

African Americans. African Americans have a higher prevalence of heart disease and even heart death. Prevention can also be aided with neighborhood focus groups and increased medical education in African American communities[11,17].

This article made an effort to explain why African-Americans have had higher incidence of cardiovascular disease, despite making up a smaller amount of the population. It was discovered that African-Americans have increased expression of certain genes such as SCN5A and FKBP5, which are crucial in determining heart disease[6, 41]. African-Americans also have an increased risk of comorbidity. This review hopes that, in the future, researchers can find more effective ways to minimize both the traditional and non-traditional risk factors involved in the elevated frequency of heart disease in African-Americans. By minimizing the risk factors improvements can be made to overall health and hopefully decreased incidence of heart disease.

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**Geliş tarihi/ Received:** 19.11.2019
**Kabul tarihi/Accepted**: 02.03.2020