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# Are the birth month and season predictors of coronary artery disease?

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**Abstract**

The month and season of birth have been found to be associated with cardiovascular mortality, but the mechanisms are not fully explained. We planned a study to examine the relationship between SYNTAX score, which shows the severity of coronary artery disease (CAD), and the month and season of birth. 346 patients who underwent coronary angiography between October 2019 and January 2020 were evaluated. Birth month, birth seasons and demographic data of patients were recorded. SYNTAX scores were calculated from patients' coronary angiographies. Patients with birth months September, October, November and December had the lowest SYNTAX score (6.42±8.78, 5.61±8.42, 8.93±12.07, 6.35±8.02, respectively). SYNTAX score of patients who were born in October was statistically significantly lower compared to other months (p= 0.005). Coronary artery disease was highest in those born in June (%81.2) and July (%82.6). The presence of CAD in patients born in fall was 46.5% (p <0.001) and the mean of SYNTAX was 7.08 ± 10.03, which was significantly lower compared to other seasons (p = 0.003). There was a correlation between the month and season of birth and the severity of CAD. Being born in the fall season, and especially in October, can be a protective factor for CAD. Compared to other months, being born in June and July is more risky for CAD. The correlation between the month and season of birth and psychiatric diseases, and also seasonal variation in maternal vitamin D exposure may be the main trigger of CAD.

**Keywords:** Birth month, birth season, coronary artery disease, SYNTAX score

## Introduction

Although it is possible that birth month and birth season might cause acute effects and diseases in the first years of our lives, might they also be foreshadow of diseases in the future? Due to the variety of seasonal effects and accompanying risk factors, it is difficult to understand the relation between diseases and birth month and birth season. The relation between diseases and birth season has been researched. Three different hypotheses are attempted to be explained [1]. According to the first hypothesis, newborn anthropometric measurements are an example. Seasonal effects on fetal life or infant time do not continue lifelong. The effect is present in early life time and disappears in adolescence [2]. In studies conducted on hypermetropia and corneal curvature, it is explained that they are only affected by seasonal exposure in fetal life or infancy.

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Later, there is very little change in continuing exposure specifities. The effect in early life stays as a lifelong mark [3]. A third relation is explained by future diseases and the relation with past seasonal exposure. Here, the disease is not developed during the exposure time. Explaining such a relation is difficult. Well known diseases of this kind are schizophrenia and multiple sclerosis [4,5].

A study identified increased cardiovascular disease risk in babies born in winter (January-March) and spring (April-June) and this was attributed to increased infections of mothers. It has been presented that individuals born in fall (September-December) have been protected against cardiovascular conditions [6]. Another study found that those born in fall (September-December) lived longer than those born in spring (April-June). It has been demonstrated that birth month is correlated with cardiovascular disease and those born in months that are low risk group for those diseases, lived longer [7].

These studies provide new information about the effect of the month and season of birth on the cardiovascular system; however, the mechanisms are unclear.

The SYNTAX score is an angiographic grading tool for determining the severity of CAD. It is the sum of the scores calculated for each lesion detected in coronary angiography.

Our study is the first study in the literature evaluating the relationship between SYNTAX score and the month and season of birth. It was planned to elucidate the mechanism of the relationship between the presence and severity of CAD and the month and season of birth and to minimize confounding factors.

## Material and Methods

A total of 815 patients who underwent coronary angiography were evaluated. Patients who previously underwent coronary artery bypass surgery and percutaneous intervention as well as patients whose birth date certainty is suspicious were excluded from the study. In total 346 patients were included in the study. Patients' birth date (day-month-year), demographic data, body mass index (BMI), application diagnosis, fasting blood glucose and lipid profiles were recorded. Patients with 50% stenosis in at least one major epicardial artery on coronary angiography were defined as CAD.

Coronary angiography recordings of the patients were analyzed and the SYNTAX score was calculated using a computer program with a series of consecutive, interactive questions. In the SYNTAX score, which includes 12 basic questions, the first three questions include dominance, the total number of lesions and the vascular segment containing the lesions. SYNTAX scoring system prepared by using angiographic features such as number of lesions, plaque structure, thrombus content, functional significance and location of the lesion provides important data in determining the severity of CAD. The scores for each lesion were calculated separately and the total SYNTAX score was obtained by summing all these lesion scores. SYNTAX score ranges were accepted as following: Syntax score 0-22 low, 23-32 medium, 33 and above, high [8]. This prospective study was completed with the permission of the Chair of Yıldırım Beyazıt University Yenimahalle Training and Research Hospital Clinical Research Ethics Committee (2019/69).

## Statistical Analysis

Statistical analysis of the study was performed using the Statistical Package for Social Sciences" version 20 (IBM Corp., Armonk, NY, USA) Programme. Kolmogorov Smirnov Test was performed to test whether quantitative measuring ensured normal distribution assumption. Descriptive statistics of parametric quantitative data was calculated as mean ± standard deviation, non-parametric ones were calculated as median (minimum-maximum); categorical data were given as percentage (%). Comparison of categorical measuring between groups was done with the Chi square test. T test for independent groups was used if assumptions of comparison between quantitative measuring were ensured. Mann Whitney U test was done of if the assumptions were violated. For the comparison of more than two groups, One-Way ANOVA was computed. Limit of significance was accepted as $p<0,05$.

## Results

The mean age of the 346 patients included in the study was 61.38 ± 10.74 years, and 56.4% were male. Of the patients, 222 (64.2%) were hypertensive, 113 (32.87%) were diabetic, and 193 patients (56%) had a smoking history. The number of patients born in January was the highest with 50, and those born in June were the lowest with 16 patients (Table 1).

**Table 1**. Demographic Data According to Birth Month and Birth Season

| Birth mont | N | Age (mean) | Sex Woman (%) | HT (%) | DM (%) | Smoker and Ex-Smoker (%) | BMI |
|---|---|---|---|---|---|---|---|
| **January** | 50 | 59.68±10.01 | 32.00 | 60.0 | 36.0 | 66.0 | 26.96±2.42 |
| **February** | 42 | 59.66±10.54 | 45.2 | 64.3 | 28.6 | 64.3 | 27.75±2.80 |
| **March** | 40 | 61.97±9.05 | 47.5 | 75.0 | 30.0 | 57.5 | 27.55±2.93 |
| **April** | 31 | 61.51±12.05 | 54.8 | 64.5 | 35.2 | 48.7 | 27.27±2.89 |
| **May** | 32 | 59.18±11.89 | 40.6 | 53.1 | 24.4 | 62.5 | 26.85±2.18 |
| **June** | 16 | 62.18±12.79 | 31.2 | 62.5 | 40.0 | 75.0 | 27.18±2.50 |
| **July** | 23 | 66.30±12.57 | 43.5 | 65.2 | 42.2 | 43.5 | 26.89±2.12 |
| **August** | 21 | 61.33±11,33 | 47.6 | 61.9 | 23.3 | 42.9 | 27.98±2.73 |
| **September** | 20 | 60.85±9,86 | 30.0 | 50.0 | 35 | 65.0 | 27.46±2.82 |
| **October** | 21 | 62.80±10,47 | 52.4 | 76.2 | 28.1 | 52.9 | 27.34±3.02 |
| **November** | 30 | 60.90±10.16 | 46.7 | 63.3 | 36.7 | 56.7 | 27.61±3.20 |
| **December** | 20 | 60.30±7.92 | 55.0 | 75.0 | 35.0 | 45.0 | 27.98±4.20 |
| **Season of Birth** | | | | | | | |
| **Spring** | 105 | 60.86±10.99 | 46.6 | 64.88 | 36.1 | 54.3 | 27.18±2.71 |
| **Summer** | 60 | 63.86±11.86 | 41.7 | 65.0 | 29.7 | 51.7 | 27.37±2.43 |
| **Fall** | 71 | 61.46±10.07 | 43.7 | 63.4 | 31.5 | 53.5 | 27.50±3.00 |
| **Winter** | 110 | 59.63±9.82 | 41.8 | 63.6 | 34.2 | 61.8 | 27.40±2.95 |

Of the patients, 41 (11.8%) ST elevation myocardial infarction (STEMI), 93 (26.9%) non-ST elevation myocardial infarction (NSTEMI), 69 (19.9%) unstable angina pectoris (USAP), 143 (%) 41.3) presented with the diagnosis of stable angina pectoris (SAP). When the patients are evaluated in terms of risk factors according to the month of birth, hypertension (p=0.69), presence of diabetes (p= 0.71), lipid profile (total cholesterol p= 0.88, LDL p=0.89, HDL p= 0.99, triglyceride p= 0.29), BMI (p= 0.87) and smoking (p= 0.14), there was no difference between groups in terms of birth months.

Those born in September, October, November, and December had the lowest SYNTAX score on coronary angiography (6.42 ± 8.78, 5.61 ± 8.42, 8.93 ± 12.07, 6.35 ± 8.02 respectively) (Figure 1). The mean SYNTAX score of those born in January, March, June and July were found to be comparatively higher (14.80±14.06, 13.73±12.72, 15.06±11.65, 16.28±12.71) (Table 2). SYNTAX score was statistically significantly lower in those born in October compared to other months (p= 0.005).

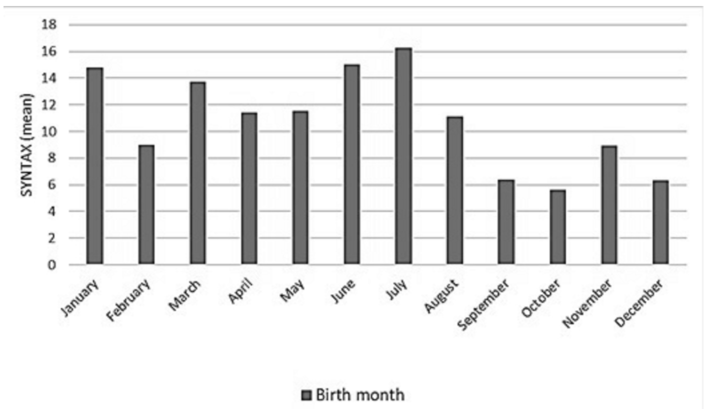


**Figure 1**. Association between birth month and SYNTAX score

Risk of significant stenosis in at least one epicardial artery in coronary angiography was highest in patients born in June 81.2% and July 82.6%. The diagnosis of STEMI was highest in July (21.7%) and lowest in October (4.8%).

The presence of CAD was in patients born in the lowest fall season compared to other seasons (46.5%). STEMI ratio was 9.9% and mean SYNTAX score (7.08 ± 10.03) was statistically significantly lower than other seasons (p= 0.003). The mean ejection fraction (EF) was 55.80% (Figure 2).

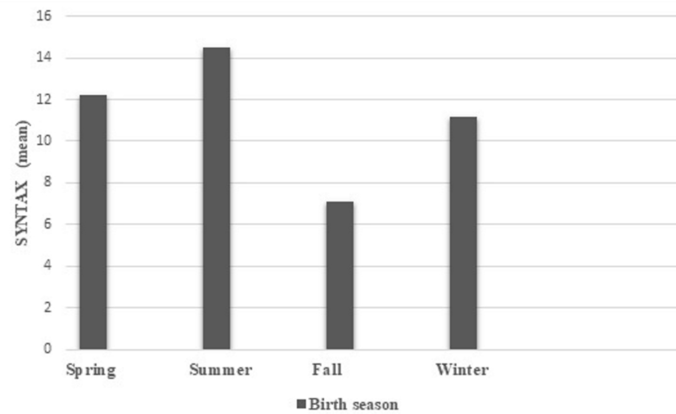


**Figure 2**. Association between birth season and SYNTAX score

In our study, since patients who underwent percutaneous and surgical revascularization were excluded from the study, the relative rate of normal coronary artery was found to be high. However, the normal coronary detection rate (53.5%) is significantly higher in those born in fall season (p <0.001).

**Table 2.** Coronary Angiography Data According to Birth Month and Birth Season

| Birth month | NCA n (%) | SYNTAX score n (%) | | | STEMI (%) | SYNTAX score | |
|---|---|---|---|---|---|---|---|
| | | 0-22 | 23-32 | >32 | | mean | median |
| **January** | 16 (32.0) | 17(34.0) | 9 (18.0) | 8(16.0) | 20.0 | 14.80±14.06 | 12.0 |
| **February** | 18(42.9) | 16(38.1) | 7(16.7) | 1(2.4) | 16.7 | 9.01±10.87 | 5.0 |
| **March** | 9(22.5) | 21(52.5) | 4(10) | 6(15) | 12.5 | 13.73±12.72 | 11.5 |
| **April** | 7(22.6) | 18(58.1) | 3(9.7) | 3(9.7) | 6.5 | 11.45±10.81 | 10.0 |
| **May** | 9(28.1) | 16(50.0) | 6(18.8) | 1(3.1) | 9.4 | 11.53±10.76 | 11.0 |
| **June** | 3(18.7) | 6(37.5) | 6(37.5) | 1(6.3) | 6.2 | 15.06±11.65 | 18.0 |
| **July** | 4(17.4) | 11(47.8) | 3(13.0) | 5(21.7) | 21.7 | 16.28±12.71 | 14.0 |
| **August** | 9(42.9) | 8(38.1) | 3(14.3) | 1(4.8) | 9.5 | 11.11±12.18 | 8.0 |
| **September** | 11(55.0) | 6(30.0) | 2(10.0) | 1(5.0) | 15.0 | 6.42±8.78 | 0 |
| **October** | 11(52.4) | 9(42.9) | 0(0) | 1(4.7) | 4.8 | 5.61±8.42 | 0 |
| **November** | 16(53.3) | 10(33.3) | 2(6.7) | 2(6.7) | 10.0 | 8.93±12.07 | 0 |
| **December** | 8(40.0) | 10(50.0) | 1(5.0) | 1(5.0) | 5.0 | 6.35±8.02 | 3.0 |
| **Season of Birth** | | | | | | | |
| **Spring (n:105)** | 25(23.8) | 57(54.3) | 13(12.4) | 10(9.5) | 9.5 | 12.20±11.47 | 10.0 |
| **Summer (n:60)** | 16(26.7) | 24(40.0) | 14(23.3) | 6(10.0) | 11.7 | 14.49±12.20 | 13.5 |
| **Fall (n:71)** | 38(53.5) | 27(38.0) | 3(4.2) | 3(4.2) | 9.9 | 7.08±10.03 | 0 |
| **Winter (n:110)** | 42(38.2) | 42(38.2) | 17(15.5) | 9(8.2) | 15.5 | 11.16±12.50 | 6.0 |

Coronary artery disease presence was 61.8% for those born in winter season, STEMI rate was 15.5% and the highest compared to other seasons. The mean SYNTAX score was 11.16 ± 12.50, and mean EF was 54.87%. Coronary artery disease presence in those born in spring season was highest 75.2%, STEMI rate was 9.9%, and mean SYNTAX score was 12.20±11.47, the mean EF was 53.77%.

Coronary artery disease presence for those born in summer season was 73.3%, STEMI rate 11.7%. The mean SYNTAX score was 14.49±12.20 the highest, mean EF was the lowest with 50.28% (p= 0.02).

**Discussion**

In our study, individuals born in January, March, June, July, that is, in winter and summer, had high SYNTAX score and STEMI diagnosis rates. In addition, the presence and severity of CAD was significantly lower in individuals born in fall compared to other seasons. The month and season in which we were born can be predictive in terms of the severity of CAD.

Tell me your month of birth so I can tell you your cardiac risk. ”Although this is not entirely possible, there are studies in the literature that indicate a significant relationship between the month and season of birth and cardiovascular diseases [9-13]. There are very few data on the severity of CAD by month of birth and season in the literature [11,12].

A study investigating sudden and rapid cardiac death rates according to birth months, reported that those born in the first half of the year are significantly higher than those in the second half. Individuals born in the fourth quarter are the fewest [10].

In the study of Zhang et al., compared with women born in November, it was found that there was an increase in cardiovascular disease deaths among those born from March to July, and that women born in the spring and summer had higher cardiovascular disease mortality than women born in the fall, regardless of familial and socioeconomic factors [13].

In previous studies examining the relationship between the month and season of birth and cardiovascular disease, familial and socioeconomic factors, total calorie intake, infections, climatic temperature and air pollution, sunlight exposure and maternal vitamin D levels were discussed as the cause of these relationships, but clear explanatory results were not obtained on this issue [14-19].

According to the pineal gland and melatonin hypothesis in this regard, sunlight affects the pineal gland seasonally in infancy, and melatonin release varies depending on the month of birth. Melatonin has been shown to have an effect on ischemic heart disease, hypertension and lipid metabolism [20]. Melatonin production rates of patients with coronary heart disease are low [21]. There are no clear data evaluating melatonin levels by the month of birth. Being born in winter and autumn may be protective for CAD due to higher dark exposure.

Vitamin D is important for bone homeostasis and calcium metabolism. Recent research has shown the additional beneficial effects of Vitamin D on the cardiovascular system [22]. Epidemiologic data has shown that Vitamin D plasma levels are inversely proportional with cardiac damage after acute myocardial damage [23]. As determined in our study, the other hypothesis that being born in autumn is protective against cardiovascular diseases seems to be maternal vitamin D exposure. This can be explained by the fact that the baby spends its last trimester in the mother's womb during the summer months when vitamin D exposure is the most intense.

Some studies suggest that the birth season may be effective in the later development of various psychiatric disorders such as depression, schizophrenia, bipolar disorder, suicide, obsessive-compulsive disorder, eating disorder [24-29].

In the study of Fountoulakis et al., although there was a higher level of depression in spring-born patients and higher levels of anxiety in summer-born patients, no statistically significant relationship was found [30]. In a different study evaluating the relationship between the birth season and psychiatric disease, the rate of psychiatric disease diagnosis was lower in autumn-born children compared to other seasons [24].

There is epidemiological evidence that high levels of depressive symptoms are associated with an increased risk of myocardial infarction and a higher mortality rate following an acute cardiac event [31]. From this point of view, the relationship between the month and season of birth and CAD is likely to be associated with underlying psychological disorders. In order to clarify this, there is a need for large-scale further studies evaluating the relationship between birth month, birth season and CAD in which personality and psychiatric assessment scales are used.

In our study, the effect of the month and season of birth on CAD was observed in a consistent manner with previous studies. The correlation between the month and season of birth and the severity of CAD is important because it is evaluated with quantitative data such as the SYNTAX score. Accordingly, it may be considered to include the month and season of birth while performing CAD risk assessment.

**Limitations**

In our society, it is known that in rural regions children born in the last months of the year are often officially registered in January of the following year. This is relevant to the high number of patients born in January. Therefore, the accuracy of January data is not definite. In addition, as the study was designed retrospectively, personality assessment analysis could not be applied to the patients.

**Conclusion**

It seems that being born in the last quarter of the year, in fall, specifically in October, is a protective factor for CAD. Although several genetic factors and environmental exposures right from the moment of birth on are embedded in the etiology of diseases, the birth month and season could be an important risk factor for the existence and severity of CAD. Although our birth month and season seems to be a decisive factor for CAD risk in advanced age; it should not be forgotten that it is more important to pursue a healthy diet, doing exercise and leading a positive, extrovert and stress free life.

**There is no conflict of interest**
*The authors declare that they have no competing interests.*

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**Ethical approval**
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