ACCESSING OF SOME RISK FACTORS OF RHEUMATOID ARTHRITIS USING LOGISTIC REGRESSION

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ABSTRACT

When the immune system attacks the synovium, rheumatoid arthritis develops (the lining of the membrane that surrounds the joints). The resulting inflammation thickens the synovium, which can eventually destroy the joint's cartilage and bone. The purpose of this study is to identify the significant risk factors for Rheumatoid Arthritis in 240 patients at Ahmadu Bello University Teaching Hospital (ABUTH), Zaria. Obesity, Gender, Smoking, Age, Alcoholism, and Family History were the selected risk factors for this study, and they were analyzed using logistic regression analysis and descriptive statistics. Alcoholism and age have a significant association with Rheumatoid Arthritis and Age has a positive effect on developing the disease while Alcoholism has a negative effect on developing the disease, according to the statistical analysis. However, there is no link between Rheumatoid Arthritis and gender, obesity, smoking, or family history. Based on the study's findings, it is critical for future clinical research to critically evaluate the lifestyle of patients developing Rheumatoid Arthritis.

Keywords: Rheumatoid Arthritis, Smoking, Juvenile RA, Risk, Disability

INTRODUCTION

Rheumatoid Arthritis (RA) is a chronic, symmetrical, inflammatory autoimmune disease that begins in the small joints and progresses to the skin, eyes, heart, kidneys, and lungs. Joint bone and cartilage are frequently destroyed, and tendons and ligaments become weak (Lee *et al.* 2017). All of this joint damage results in deformities and bone erosion, which are usually excruciatingly painful for the patient. Morning stiffness of the affected joints for more than 30 minutes, fatigue, fever, weight loss, tender, swollen joints, and Rheumatoid nodules under the skin are all common symptoms of RA. This disease usually appears between the ages of 35 and 60, with periods of remission and exacerbation. It can also affect young children under the age of 16, which is known as Juvenile RA (JRA), which is similar to RA except that the Rheumatoid factor is not present (Chaudhari *et al.* 2016).

Based on the global burden of the disease 2010 Study, the global prevalence of RA has been estimated to be 0.24 percent (Cross *et al.* 2014). Estimates of RA prevalence in the United States and Northern Europe are typically higher, ranging from 0.5 to 1 percent (Myasoedova *et al.* 2010; Hunter *et al.* 2017). The annual incidence of RA in the United States or Northern European countries has been estimated to be around 40 per 100,000 people (Eriksson *et al.* 2013; Puente *et al.* 1989). The majority of RA epidemiology studies have been conducted in the United States or northern European populations. As a result, epidemiologic estimates of RA and risk factor identification are largely based on these populations. The incidence and prevalence of RA are much higher in some populations, such as Pima Native Americans, where rates are up to ten times higher than in the majority of population groups (Crowson *et al.* 2011).

Rheumatoid Arthritis (RA) is an auto-immune disease in which the body misidentifies and attacks certain parts of its system as pathogens. Ahmad *et al.* (2018) used a Stepwise binary logistic regression to examine the variables associated with Rheumatoid Arthritis in the study subjects. The findings revealed that there is no screening test suitable for diagnosing RA disease and that females are more susceptible to this disease than males. Intriago *et al.* (2019) compared the clinical characteristics of men and women with Rheumatoid Arthritis (RA) to determine gender differences. A comparative cross-sectional analysis was conducted on a group of 50 men and 50 women with RA from a rheumatology center in Guayaquil, Ecuador. According to the findings of the study, men consumed more tobacco and alcohol than women. Women have a 3.6 percent lifetime risk of developing RA, while men have a 1.7 percent lifetime risk (Abhishek *et al.* 2017). Dar *et al.* (2018) conducted a cross-sectional study on Rheumatoid Arthritis using the Clalit Health Services database. Data were gathered from the start of a computerized database used to assess the relationship between obesity and Rheumatoid Arthritis (RA). Patients with RA were compared to population-based controls who were age and gender-matched (by a ratio of 1:5). Medical records were used to obtain body measurements and smoking status. To compare the study groups and assess the relationship between Obesity and RA, chi-square, t-tests, and logistic regression models were used. In comparison, the proportion of obese subjects among RA patients was higher. Smoking and obesity were found to be associated with RA in the multivariate regression model, whereas the male gender was found to be inversely related to RA. Obesity was found to be significantly associated with RA.

Sánchez-Campamá *et al.* (2021) investigated the link between smoking and the onset of Rheumatoid Arthritis. A case-control study was conducted that included all patients with a new diagnosis of RA who were registered in the database between 01/01/2008 and 31/12/2018 and matched them to up to 1:5 controls based on age, gender, and general practitioner. The primary care staff classified smoking as never, ex-, or current. The conditional logistic regression method was used to calculate the odds ratios and 95% confidence intervals for the association between current and ex-smokers and RA. The analysis found that never smokers, current smokers, and ex-smokers had an increased risk of RA, with an adjusted OR of 1.28(95 percent CI 1.20-1.37) and OR 1.19(1.12-1.26), respectively. It was determined that there was a link between smoking and the risk of developing RA. Kronzer *et al.* (2021)

investigated the relationship between a family history of rheumatic, autoimmune, and non-autoimmune disease and the risk of Rheumatoid Arthritis. The case-control study found 821 RA cases in the Mayo Clinic Biobank and matched three controls to each case based on age, gender, recruitment year, and other factors. Logistic regression was used to calculate odds ratios (ORs) and 95 percent confidence intervals for RA risk based on the presence of Family History for each comorbidity, after adjusting for BMI, race, and smoking. A family history of several conditions, including rheumatic autoimmune disease, pulmonary fibrosis, inflammatory bowel disease, hyper/hypothyroidism, and obstructive sleep, was linked to the development of RA. Analyses of 143 cases of incident RA were similar, and an association with a family history of autism was also suggested. A family history of several autoimmune and non-autoimmune comorbidities was linked to an increased risk of RA, opening up the possibility of identifying new populations at risk for RA.

METHODOLOGY

This study covers 240 Rheumatoid Arthritis patients from Ahmadu Bello University Teaching Hospital, Zaria. Information on the selected Risk factors was obtained from the hospital medical record. Statistical analyses were conducted using SPSS. Descriptive statistics were obtained for all patients. Binary logistic regression has been applied to determine if there is a significant association between Rheumatoid Arthritis and the risk factors and to determine which risk factor increases the likelihood of developing Rheumatoid Arthritis. For a response variable Y with two measurement levels (dichotomous) and explanatory variable X, let: $\pi(x) = p(Y = 1|X = x) = 1 - p(Y = 0|X = x)$, then the logistic regression model has linear form for logit of this probability

$$\text{Logit}[\pi(x)] = log\left(\frac{\pi(x)}{1-\pi(x)}\right) = \alpha + \beta x, \tag{1}$$

where the odds $= \frac{\pi(x)}{1-\pi(x)}$

The odds $= \exp(\alpha + \beta x)$, and the logarithm of the odds is called logit, so

$$\text{Logit}[\pi(x)] = log\left(\frac{\pi(x)}{1-\pi(x)}\right) = log[\exp(\alpha + \beta x)] = \alpha + \beta x \tag{2}$$

The logit has a linear approximation relationship, and the logit is the logarithm of the odds.
The parameter β is determined by the rate of increase or decrease of the S-shaped curve of π (x). The sign of β indicates whether the curve ascends (β > 0) or descends (β < 0), and the rate of change increases as |β| increases.

RESULT AND CONCLUSION

Table1: The significance of the Risk factors

Risk factors		B	S.E.	Wald	df	Sig.	Exp(B)
Gender	(Female/male)	0.188	0.367	0.263	1	0.608	1.207
	Age	0.023	0.008	8.033	1	0.005	1.023
	Obesity	-0.292	0.305	0.916	1	0.339	0.747
	Smoking	-0.470	0.344	1.870	1	0.171	0.625
	Alcohol	-0.965	0.361	7.146	1	0.008	0.381
	Family- History	0.093	0.273	0.115	1	0.735	1.097
	Constant	1.093	0.912	1.438	1	0.230	2.984

The fitted Regression equation form would be:

$$\ln\left(\frac{p}{1-p}\right) = 1.093 + 0.023\text{age} + 0.188\text{gender} - 0.470\text{smoking} - 0.965\text{alcohol} + 0.093\text{familyhistory} \tag{3}$$

Taking alcohol have a negative effect while age has a positive effect on the likelihood of developing Rheumatoid Arthritis. On the other hand, obesity, smoking, and family history do not affect having Rheumatoid Arthritis. From the result in Table 1, age and alcohol are statistically significant while obesity, smoking, and family history are not statistically significant.

Table 2. Descriptive statistics for the Risk Factors of Rheumatoid Arthritis

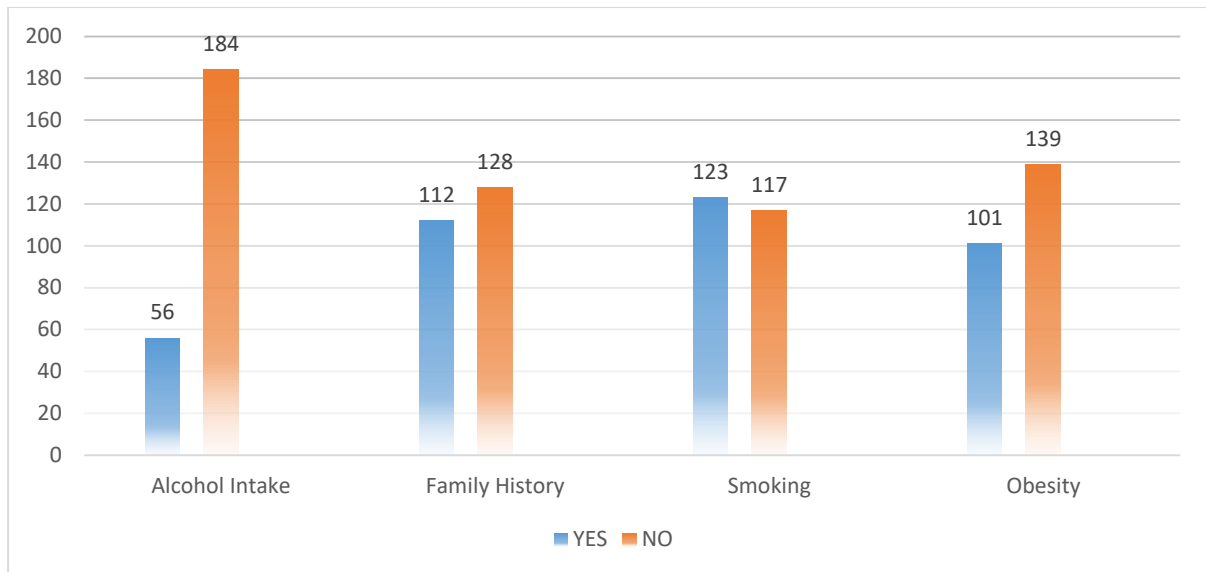| RISK FACTORS	YES	NO
Alcohol intake	56	184
Family History	112	128
Smoking	123	117
Obesity	101	139

Fig. 1: Risk factors of Rheumatoid Arthritis

From Fig. 1 and Table 2, 56 patients take alcohol and 184 patients don't, 112 patients have a family history of Rheumatoid Arthritis while 128 don't have. 123 patients are smokers and 117 don't smoke, 101 patients are obese, and 139 are not.

Table 3: The number of Male and Females reported for Rheumatoid Arthritis patients

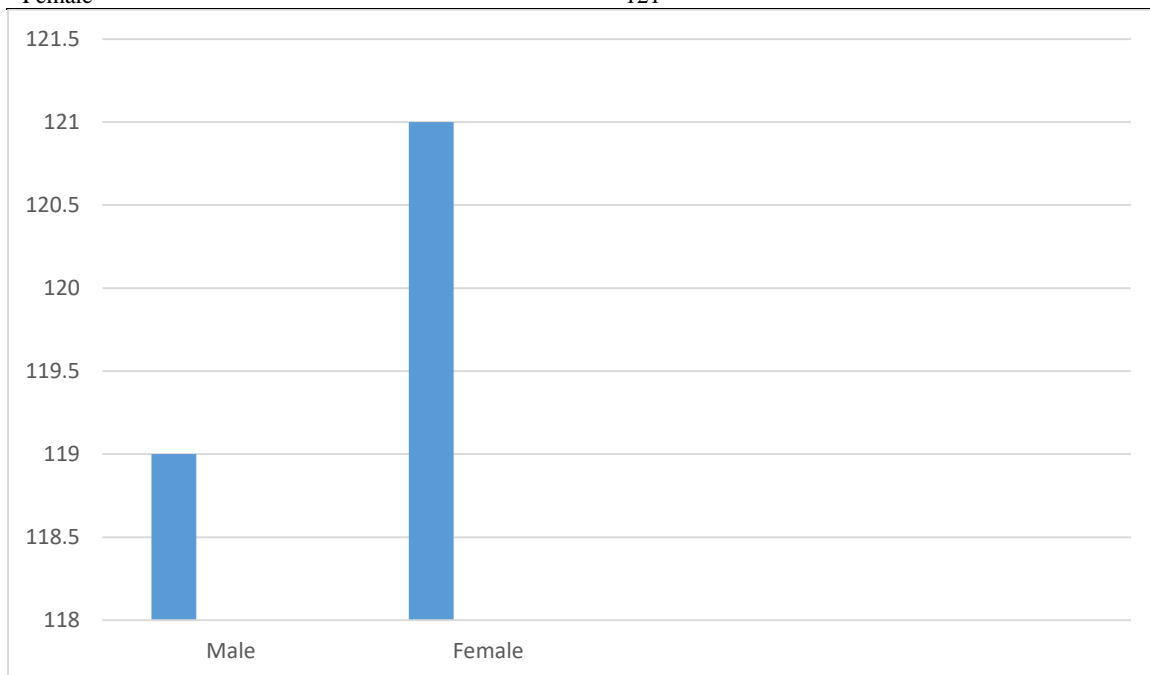| Gender	No. of patient
Male	119
Female	121

Fig. 2: Number of Male and Female Rheumatoid Arthritis patients

Table 4: The age range of Rheumatoid Arthritis patients

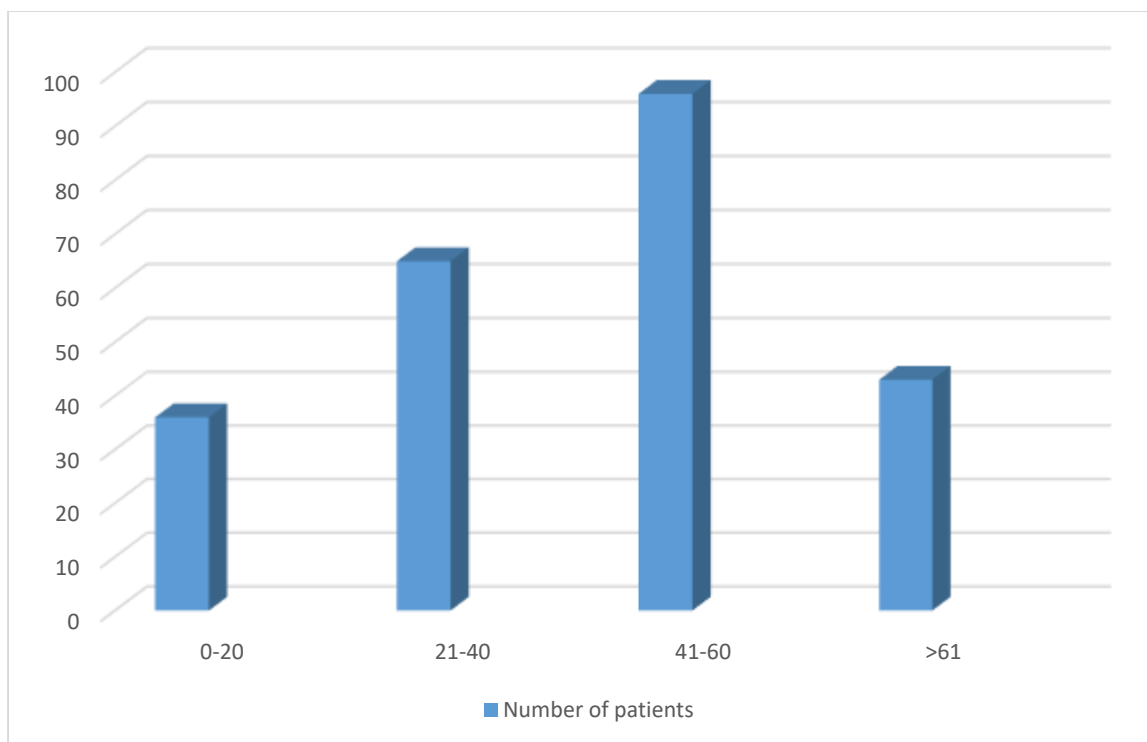| Age range	Number of Patients
0-20	36
21-40	65
41-60	96
>61	43

Fig. 3: Age group of Rheumatoid Arthritis patients

Fig. 3 and Table 4 shows that patients between the range of 41 to 60 years are more likely to develop Rheumatoid Arthritis, while those that fall between the range of 0 to 20 are less likely to develop Rheumatoid Arthritis.

CONCLUSION
We can conclude that older people are more likely to develop RA than younger ones, this is because there is a positive significant relationship between age and RA. So, it means the older (higher age) the patients, the more risk they are of developing the disease. Moreover, alcohol intake can develop the risk of developing RA even though, it is negatively related to the disease.

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