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Stock Market Volatility and Trading Volume in MINT Markets: Evidence From COVID-19 Pandemic Period

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ABSTRACT

This study aims to examine the relationship between stock market return volatility and trading volume. The countries of Mexico, Indonesia, Nigeria and Turkey are analyzed within the scope of the COVID-19 pandemic period, from March 11, 2020 to April 28, 2022. EGARCH(1,1) model estimations reveal asymmetrical effects on the returns by including contemporaneous and lagged trading volumes. While the model estimation results show that there is an asymmetric effect in return volatility for the Turkish and Indonesian stock markets, there does not appear to be an asymmetric effect on volatility for the Mexican and Nigerian stock markets. The results support the validity of the mixture of distribution hypothesis for Turkey and Indonesia, and provide useful findings for portfolio managers, researchers and investors.

Keywords: COVID-19, EGARCH, MINT Countries, Stock Returns Volatility, Trading Volume

JEL Classification: G15, C58

MINT Piyasalarında Hisse Senedi Piyasa Oynaklığı ve İşlem Hacmi: COVID-19 Pandemi Döneminden Bulgular

ÖZ

Çalışmada hisse senedi getiri oynaklığı ve işlem hacmi arasındaki ilişki araştırılmıştır. Yükselen piyasalar kapsamında MINT ülkeleri 11.03.2020 – 28.04.2022 COVID-19 pandemi dönemi kapsamında analiz edilmiştir. İşlem hacminin eş zamanlı ve bir dönem geçmiş dönemi dahil edilerek getiriler üzerindeki asimetrik ilişkileri ortaya koymak için EGARCH(1,1) model tahminleri yapılmıştır. Türkiye ve Endonezya için yapılan model tahmini sonuçları getiri oynaklığında asimetrik bir etkinin olduğunu gösterirken; Meksika ve Nijerya model tahmin sonuçlarında oynaklık üzerinde asimetrik bir etkinin olduğu görülmemektedir. Türkiye ve Endonezya sonuçları Karışık Dağılımlar Hipotezinin geçerliliğini desteklemektedir. Çalışmanın sonuçları portföy yönetimi, araştırmacılar, risk yönetimi ve yatırımcılar için faydalı bulgular sunmaktadır.

Anahtar Kelimeler: COVID-19, EGARCH, MINT Ülkeleri, Hisse Senedi Getiri Oynaklığı, İşlem Hacmi

JEL Sınıflandırması: G15, C58

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1. INTRODUCTION

High stock market volatility negatively affects normal market functioning. With this in mind, it is important to accurately analyze market volatility, which impacts macroeconomics and financials (Bhowmik and Wang, 2020). To do this, it is necessary to ascertain the volatility and return processes of different financial markets (Do et al., 2020). The relationship between returns, trading volume and return volatility in the stock markets has been studied extensively. Changes in trading volume may cause information flow in financial markets, which in turn could lead to price or return volatility (Kao, Chuang and Ku, 2020).

The relationship between return volatility and trading volume in financial markets was evaluated within the scope of the sequential information arrival hypothesis proposed by Copeland (1976) and the mixture of distributions hypothesis proposed by Clark (1973). The sequential information arrival hypothesis suggests that investors will react differently to new information in the market, and that a new market equilibrium will be formed over time, not instantaneously (Darrat, Zhong and Cheng, 2007). According to the hypothesis, new information in the market is distributed sequentially to investors in the market. On this point, there is criticism of the hypothesis; investors who have knowledge take positions in the market and organize their portfolios accordingly. The diffusion of information in the market between different investors is related to the number of transactions. With the entrance of new information to the market, trading volume and price movements increase (Kao, Chuang and Ku, 2020). It is assumed that volume will be the highest when investors are informed about the market and when all investors agree on the information (Karpoff, 1987). The mixture of distribution hypothesis argues that information entering the market requires concurrent changes in trading volume and volatility in order to reach the new market equilibrium (Darrat, Zhong and Cheng, 2007).

Emerging markets can be risky due to political, economic and currency risks. Emerging market investors need to be aware of these risks and make investment decisions with the knowledge that fluctuations may occur (Tu and Xhang, 2012). Ongoing changes in emerging market volatility structure may lead to an increase in the cost of capital (Umar et al., 2021).

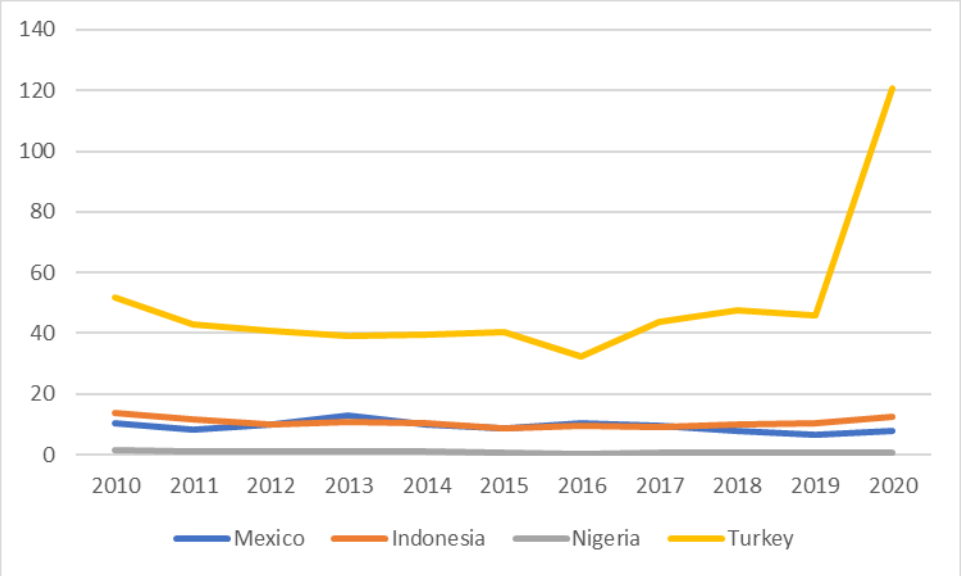

Figure 1: Stock traded (% GDP)

Source: World Bank

Market capitalization is the value of stock for all listed domestic companies multiplied by the number of outstanding shares. The market value effect can be interpreted as an investment strategy. This value is used as a macro indicator for country analysis and is considered a market development indicator. Figure 1 shows the ratios of market value to gross domestic product for Mexico, Indonesia, Nigeria and Turkey (MINT) between 2010 and 2020. While the highest ratio is seen in Turkey, the lowest ratio belongs to Nigeria. Although there are decreases in the initial year rates, there are significant increases in all countries in 2020, especially during the COVID-19 pandemic.

Jim O'Neill, who coined the term "BRIC" to refer to the countries of Brazil, Russia, India and China, also introduced the concept of "MINT" in 2013 for Mexico, Indonesia, Nigeria and Turkey. O'Neill identified these countries as having potential for rapid growth, and emphasized that one of their important features is a large population. Due to Mexico, Indonesia and Turkey's geographical locations, adjacent to other Eastern and Western countries, there is a high potential for good neighborly relations supporting economic development in those countries.

The mixture of distributions and the sequential information arrival hypotheses are approaches that deal with the relationship between stock returns and trading volume. This study examines the relationship between return volatility and trade volume for MINT countries within the scope of these hypotheses. In this context, the effect of contemporaneous and lagged trading volume variables on return volatility during the COVID-19 pandemic period are examined. High volatility in emerging markets may result in different results for different periods. This study is important in terms of understanding emerging market volatility and the fact that volatility can be used as an investment target by investors. Analyzing the link between return volatility and trading volume in MINT stock markets during the pandemic period provides important findings for investors and researchers.

2. LITERATURE REVIEW

There are previous studies examining the relationship between stock prices and trading volume in different countries during different periods (Tai, 2007; Azevedo et al., 2014). Analyzing the volatility dynamics of financial markets correctly is important. In financial literature, generalized autoregressive conditional heteroskedasticity (GARCH) type modes are widely preferred (Kuhe et al., 2019; Do et al., 2020; Yıldırım and Çelik, 2020; Vo and Tran, 2020; Aydın et al., 2021; Özdemir et al., 2021; Fakhfekh, Jeribi and Salem, 2021). Researchers prefer different GARCH type models in studies examining the relationship between stock return volatility and trading volume in countries at different levels of development. Wang, Wang and Liu (2005) examined the relationship between prices and trading volumes for 22 stocks in China from January 2, 1995 to December 31, 2002. They concluded that the trading volumes included in the GARCH models significantly reduced conditional variance persistence for stocks. Mubarık and Javid (2009) examined the relationship between stock returns, trading volume and volatility. Their study covering July 1998 to October 2008 showed significant interaction between trading volume and return volatility in the GARCH – M model results. Chocholatá (2011) investigated the relationship between stock return volatility and trading volume using the threshold GARCH (TGARCH) model. The author dealt with the European economies of Austria, Belgium, England, Germany, France, the Netherlands, Spain and Switzerland, and the Asian economies of Hong Kong, India, Indonesia, Japan and Taiwan. Different volatility findings were obtained for European and Asian stock market returns, and the author also concluded that trading volume was generally a weak variable for information flow in the market. Darwish (2012) examined the relationship between stock returns and trading volume for

Pakistan based on weekly data from January 2000 to August 2010. According to the Granger causality results, there was a bidirectional relationship between stock returns and trading volume, and the coefficients in the GARCH(1,1) model were positive and significant. Kalu and Chinwe (2014) analyzed the relationship between stock prices and trading volume for Nigeria from January 3, 2000 to June 21, 2011. They used the GARCH model to investigate the effect of trading volume on stock return volatility. According to their results, they found that the Nigerian stock market exhibited strong volatility persistence, with past volatility explaining current volatility. Naik, Gupta and Padhi (2018) examined the relationship between stock price and the trading volume for South Africa from July 6, 2006 to August 31, 2016 using the EGARCH(1,1) model. The model results revealed that the mixture of distributions hypothesis is valid for South Africa. Mushinada and Veluri (2020) showed that asymmetric volatility was explained by overconfidence bias from April 2004 to September 2008, the result of an EGARCH model estimation for the Indian stock market.

Chen (2012) investigated the relationship between stock returns and trading volume from February 1973 to October 2008 for the S&P 500. The author showed that in the simultaneous correlation relationship, there is a negative relationship between returns and volume in a bear market, and a positive relationship in a bull market. Christiana, Setiana and Mamduch (2016) examined the relationship between Indonesia's stock returns and trading volume between 2010 and 2014. As a result of the two-stage Markov switching model estimation, a positive relationship was found between returns and trading volume simultaneously, with no asymmetric effect. Chan, Cheng and Ma (2018) applied the vector autoregressive model (VAR) and the Granger causality approach to examine the relationship between volatility, trading volume and turnover between the Shanghai, Hong Kong and Shenzhen stock markets. The results showed causality between turnover to market volatility and trading volume, and also support the sequential information arrival hypothesis. Rakshit and Neog (2021) examined the impact of the COVID-19 pandemic on stock returns and volatility for Brazil, Chile, India, Mexico and Russia. As a result of the EGARCH model estimation, they saw an asymmetric effect in the volatility of all stock returns. Huang et al. (2022) investigated the relationship between returns and trading volume for the Chinese stock market from January 2000 to December 2020 using the VAR and Granger causality approaches. They concluded that there is bidirectional causality between returns and trading volume growth.

3. DATA AND METHODOLOGY

This study aims to analyze the relationship between returns and trading volume for MINT stock markets from March 11, 2020 to April 28, 2022, which includes the COVID-19 pandemic period. In this context, daily data are used for analysis. Closing prices and trading volumes from the S&P/BMW IPC for Mexico, the JAKARTA COMPOSITE for Indonesia, the NSE 30 for Nigeria and the BIST 100 for Turkey were used in the analysis. The data were taken from Yahoo! Finance and Investing.com. The return series was obtained as follows:

$$r_t = 100 \times (lnP_t - lnP_{t-1}) \quad (1)$$

P_t represents the closing price at time t, and P_{t-1} is the closing price at time t-1 in equation (1). A similar transformation is applied for the trading volume as in equation (2).

$$V_t = 100 \times (lnP_t - lnP_{t-1}) \quad (2)$$

The GARCH model positively limits conditional volatility. In other words, even if the coefficients are negative, σ_t^2 will be positive because $\ln(\sigma_t^2)$ is modelled, so the assumption of non-negativeness will be provided in the model (Brooks, 2014). The GARCH model reveals the symmetrical response of volatility to negative and positive shocks. However, the EGARCH model reveals that negative shocks may be greater than positive shocks of the same size (Ahmed, Zhao and Habiba, 2022). A study conducted for Asian countries revealed that the EGARCH model outperformed GARCH and TGARCH models (Vidanage, Carmignani and Singh, 2017). Similarly, a study conducted in Nigeria concluded that the EGARCH model provides good results (Adenomon, Maijaama and John, 2022). The EGARCH model introduced by Nelson (1991) is a preferred model for showing volatility asymmetries in stock returns. The EGARCH(1,1) model is specified in equation (3).

$$\ln(\sigma_t^2) = \omega + \beta \ln(\sigma_{t-1}^2) + \gamma \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left[\frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} \right] \quad (3)$$

In equations (4) and (5), the contemporaneous trading volume variable added to the EGARCH(1,1) model and the lagged trading volume variable are given, respectively. The $\boldsymbol{\gamma}$ coefficient should be negative and statistically significant in EGARCH models (Temiz Dinç and Akdoğan, 2019).

$$\ln(\sigma_t^2) = \omega + \beta \ln(\sigma_{t-1}^2) + \gamma \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left[\frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} \right] + \mu volume_t \quad (4)$$

$$ln(\sigma_t^2) = \omega + \beta\, ln(\sigma_{t-1}^2) + \gamma \frac{\varepsilon_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left[\frac{|\varepsilon_{t-1}|}{\sqrt{\sigma_{t-1}^2}} \right] + \theta volume_{t-1} \quad (5)$$

In equations (4) and (5), the coefficients showing the contemporaneous and lagged trading volumes are shown as μ and θ, respectively. Thus, it will be revealed whether trading volume affects volatility. If the coefficient of μ is positive and statistically significant, the mixture of distribution hypothesis is valid; if the θ coefficient is positive and statistically significant, it supports the sequential information arrival hypothesis (Naik and Padhi, 2015).

4. FINDINGS

Table 1 reports the descriptive statistics of countries' stock returns and trading volumes. According to the results, it is concluded that the stock market with the highest average return is Turkey, and the stock market with the highest average trading volume is Indonesia. While the Turkish stock market has the highest standard deviation return value, the Mexican stock market has the highest value in terms of trading volume. According to the skewness value, Mexico and Turkey are left-skewed for returns, while Indonesia and Nigeria are right-skewed. The skewness values obtained for trading volume show that the other series, except Mexico, are skewed to the right. The kurtosis values show that all series have leptokurtic distributions. Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root test results are provided in Table 1. The table results show that the null hypothesis was rejected because the test statistical values of the series were lower than the critical value (-3.43). Therefore, all series do not have a unit root at the 1% significance level and are stationary.

Prior to the EGARCH model estimates for the stock markets, the appropriate mean equation was determined according to the Akaike information criterion. Accordingly, ARMA(3,3) for the S&P/BMW IPC, ARMA(4,2) for the JAKARTA COMPOSITE, and AR(2)

for the NSE 30 and the BIST 100 were chosen as appropriate mean equations. After this stage, EGARCH model estimates revealed asymmetric effects, and the effects of the contemporaneous and lagged trading volume variables on the returns were analyzed. The Q test statistic for the autocorrelation test and the Lagrange Multiplier (LM) test statistic for the ARCH effect was calculated for the models. The null hypothesis was that there is no autocorrelation in the autocorrelation test; the null hypothesis states no ARCH effect in the LM test.

Table 1: Descriptive Statistics and Unit Root Test Results

	Mexico		Indonesia		Nigeria		**Turkey**	
	Return	**Volume**	**Return**	**Volume**	**Return**	**Volume**	**Return**	**Volume**
Mean	0.057	-0.012	0.065	0.275	0.115	-0.130	0.164	0.101
Maximum	4.181	245.311	9.704	87.052	5.915	208.719	5.810	482.916
Minimum	-5.489	-291.316	-5.341	-103.872	-4.464	-247.223	-10.307	-456.655
Standard deviation	1.205	58.750	1.243	18.834	0.912	48.949	1.683	38.495
Skewness	-0.296	-0.069	0.294	-0.191	0.986	0.094	-1.729	0.639
Kurtosis	5.151	7.225	12.677	5.585	11.856	5.505	11.629	84.825
ADF	-24.297*	-16.492*	-17.446*	-23.144*	-20.340*	-17.063*	-14.085*	-14.013*
PP	-24.664*	-134.833*	-23.258*	-46.832*	-20.750*	-61.033*	-24.742*	-70.376*

Note: * significance at the 1% level. The critical values of the ADF and PP unit root tests are taken as -3.43 at the 1% level. Series expressed as price and volume are included in the analysis as return series.

The EGARCH(1,1) model estimation without trading volume results for MINT stock markets are provided in Table 2. Although γ is negative, as expected, in the estimates for Mexico, it is not statistically significant. According to the estimation results of the EGARCH(1,1) model for Indonesia, except for the γ coefficient, the other coefficients are significant. Since the γ coefficient is not significant in the estimation results of the model for Nigeria, an asymmetry effect cannot be mentioned. The estimation results of the model for Turkey show that the γ coefficient is statistically significant and negative at the 1% significance level. This result indicates the existence of volatility asymmetry. Mushinada and Veluri (2020), as well as Rakshit and Neog (2021), who conclude that there is volatility asymmetry, also obtained findings similar to this study. The autocorrelation and LM test results for MINT show that the null hypothesis cannot be rejected. According to the results, it is concluded that there is no autocorrelation and there is no ARCH effect.

Table 2: EGARCH(1,1) Model without Trading Volume Results

Coefficient	Mexico	Indonesia	Nigeria	**Turkey**
ω	-0.068**	-0.096***	-0.304***	-0.033
α	0.085**	0.114**	0.382***	0.251***
γ	-0.004	-0.019	0.057	-0.112**
β	0.979***	0.972***	0.928***	0.797***
Persistence	0.979	0.972	0.928	0.797
Q(20)	16.021 (0.312)	13.245 (0.507)	11.758 (0.859)	14.801 (0.676)
LM(6)	1.398 (0.966)	5.344 (0.501)	2.967 (0.813)	1.325 (0.970)
LM(20)	12.622 (0.893)	16.349 (0.695)	19.668 (0.479)	8.138 (0.991)

Note: ***,**,* significance at the 1%, 5%, 10% level, respectively. Values in parentheses indicate probability values.

EGARCH(1,1) models were estimated by adding the contemporaneous trading volume variable for MINT. These estimation results reveal that the trading volume variables are significant at the 1% level. As a result of the EGARCH(1,1) model estimation for Mexico, the trading volume variable is positive and significant at the 1% significance level. The results for Indonesia also show that trading volume has a significant effect on volatility at the 1% significance level. In addition, all coefficients are significant for the EGARCH(1,1) model results. In these results, the γ coefficient obtained is negative. Although the trading volume for Nigeria is positive and significant, a meaningful interpretation could not be made because the γ coefficient is not significant. The trading volume variable is significant at the 1% level for Turkey. These results are similar to Naik, Gupta and Padhi (2018). Table 3 shows that there is no autocorrelation and there is no ARCH effect for MINT.

Table 3: EGARCH(1,1) Model with Trading Volume Results

Coefficient	Mexico	Indonesia	Nigeria	**Turkey**
ω	-0.042*	-0.089***	-0.259***	-0.051
α	0.051	0.094**	0.336***	0.256***
γ	-0.006	-0.088***	0.009	-0.118**
β	0.990***	0.969***	0.961***	0.801***
μ	0.006***	0.015***	0.011***	0.006***
Persistence	0.990	0.969	0.961	0.801
Q(20)	15.324 (0.356)	15.322 (0.357)	12.676 (0.810)	12.690 (0.810)
LM(6)	1.015 (0.985)	4.167 (0.654)	3.861 (0.695)	2.661 (0.850)
LM(20)	12.088 (0.913)	12.858 (0.883)	18.544 (0.552)	14.821 (0.787)

Note: $^{***},^{**},^{*}$ significance at the 1%, 5%, 10% level, respectively. Values in parentheses indicate probability values.

Table 4 reports the estimation results of the EGARCH(1,1) model with the lagged trading volume variable. The lagged trading volume variable coefficient is significant at the 1% level for Indonesia. Although the lagged trading volume variable for Mexico and Nigeria is found to be positive as a result of the model estimations, it is not significant. These results are similar to Chocholatá (2011), Ejem, Ogbonna and Ezirim (2018). The results for Turkey show that the lagged trading volume is not significant. Compared to the model estimates with contemporaneous trading volume for MINT, the volatility persistence decreased, as shown in Table 4. All models assume no autocorrelation and the LM test results show that there is no ARCH effect.

Table 4: EGARCH(1,1) Model with Lagged Trading Volume Results

Coefficient	Mexico	Indonesia	Nigeria	**Turkey**
ω	-0.067**	-0.085***	-0.263***	-0.036
α	0.084**	0.094**	0.334***	0.248***
γ	-0.005	-0.055**	0.037	-0.111**
β	0.979***	0.974***	0.941***	0.801***
θ	0.885	0.009**	0.003	0.001
Persistence	0.979	0.974	0.941	0.801
Q(20)	15.917 (0.318)	14.611 (0.405)	10.899 (0.899)	15.335 (0.639)
LM(6)	1.444 (0.963)	4.743 (0.577)	2.196 (0.901)	1.578 (0.954)
LM(20)	12.661 (0.892)	14.765 (0.790)	12.625 (0.893)	9.592 (0.975)

Note: $^{***},^{**},^{*}$ significance at the 1%, 5%, 10% level, respectively. Values in parentheses indicate probability values.

5. CONCLUSION

The relationship between return volatility and trading volume for MINT countries was investigated from March 11, 2020 to April 28, 2022. The objective was to reveal whether there was an asymmetric effect on financial market return volatility during the pandemic using EGARCH models. In addition, the effects of contemporaneous and lagged trading volume on return volatility in these model estimations were also examined. Autocorrelation and ARCH effect tests were performed for all models. While an asymmetric effect was observed in Indonesia and Turkey's stock return volatility during the COVID-19 pandemic, the asymmetric effect was insignificant in Nigeria and Mexico.

The EGARCH model provided meaningful results for Indonesia; with the addition of contemporaneous and lagged trading volume variables, the persistence degree of volatility was higher. These results show that the persistence of volatility depends on trading volume. In addition, the validity of the mixture of distributions hypothesis, which argues that trading volume has an effect on Indonesian stock market volatility, is suggested. At the same time, the sequential information arrival hypothesis is also valid, since lagged trading volume had a positive and significant effect on return volatility for Indonesia. This indicates that lagged trading volume has important effects on the purchasing behavior of investors. EGARCH model results show an asymmetric effect on volatility in Turkey. Similar to the results obtained for Indonesia, an increase in volatility persistence with the addition of the contemporaneous trading volume variable was observed for Turkey. The results also reveal findings that support the mixture of distributions hypothesis for Turkey. The results for Indonesia and Turkey reveal that negative market shocks had a higher impact on volatility than positive shocks during the pandemic period. Based on EGARCH model estimations, no effect on volatility asymmetry was found for Mexico or Nigeria. Trading volume did not affect volatility for Mexico and Nigeria. Similarly, the effect of lagged trading volume on volatility was insignificant.

This study presents findings that ascertain the impact of volatility and asymmetric effects during the COVID-19 pandemic period for portfolio managers, policymakers and researchers, as well as investors trading in emerging markets. The asymmetric effect on the markets was obtained as a result of this analysis. In order to prevent the spread of bad news, which increases volatility, market policies should be regulated so that investors can access accurate market information. The volatility in daily returns for MINT countries was persistent. This result shows that investors react quickly to market information because the model estimations were realized in a short time. Monitoring changes in trading volume in MINT stock markets can also help investors make decisions.

Declaration of Research and Publication Ethics

This study has been carried out in accordance with the rules of scientific research and publication ethics.

Authors' Contribution

This study is prepared by a single author.

Declaration of Conflict of Interest

There is no conflict of interest.

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