



## CLIMATE VARIABILITY, INCIDENCES AND MITIGATION STRATEGIES AMONG POULTRY FARMERS IN ABIA STATE, NIGERIA

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### ABSTRACT

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This paper investigated climate variability, incidences and mitigation strategies among poultry farmers in Abia State, Nigeria. It specifically analysed the trend of climate variables over the period of 30 years, the perception of poultry farmers as regards the impact of climate variability on poultry production in the study area, and examined the different mitigation strategies adopted by these farmers. A multi-stage sampling technique was employed in choosing the required sample of 120 poultry farmers. Data were collected with validated structured questionnaire, and analyzed using descriptive statistics. The result showed a high inter-annual variability in the volume of rainfall from 1983 to 2012 with insignificant correlation (0.0781) between rainfall volume and time. Also, the result showed reduction in number of rainy days and sunshine duration between 1983 and 2012 with correlation coefficients of 0.146 and 0.132 respectively. Temperature had significant positive relationship with time with correlation coefficient 0.638. High mortality rate, disease outbreak, smallness of egg size, poor quality of egg shell, heat stress and reduced feed intake actually impacted on poultry production in the study area. Climate variability was therefore found to have affected poultry production in the study area and this has serious environmental and food policies implication. The respondents identified the use of climate resilient breeds, closeness to hatchery, feed improvement, mixed farming, use of artificial cooling system and stocking less during harsh season as major mitigation strategies to climate variability. It is therefore recommended that the government should come up with appropriate policy that will assist the poultry farmer to be more resilient and able to cope with effect of climate variability. Policies should also be formulated to reduce the emission and accumulation of green-house gases in our environment.

**Contribution/Originality:** This study is one of very few studies which have investigated climate variability, incidences and mitigation strategies among poultry farmers in Nigeria. The paper's primary contribution is finding that mortality rate, disease, egg size, quality of egg shell, heat stress and feed intake impacted on poultry production in Nigeria.

## 1. INTRODUCTION

Climate variation is one factor that has caused a lot of havoc in the world and its devastation has taken its toll particularly in the developing countries. It is an issue that has taken a global scale and dimension. Literature and related studies show that many factors are responsible for climate variation across the globe and this include land use (Agriculture), deforestation, bush burning, fossil fuel combustion and many others. Krishna (2011) as cited in Alade and Ademola (2013) stated that the change in the atmospheric composition is attributed to the emissions of green-house gases (GHG) such as Carbon dioxide (CO<sub>2</sub>), Methane (NH<sub>4</sub>), Nitrogen oxide (N<sub>2</sub>O) and other gases.

Incidentally, agriculture is responsible for 14 percent of global Green House Gases (GHG) emissions and livestock plays a considerable role in climate variation in terms of their contribution to GHG emissions aside from the emission by the burning of fossil fuel (Steinfeld *et al.*, 2006; Krishna, 2011). These studies also explained that animal slaughtering, and transport of processed and refrigerated products, through land use, and the use of inputs for the production of feed release a considerable amount of harmful gases into the atmosphere. These emissions according to the report are influenced indirectly by intensification of feed production, which requires energy input for the production of mineral fertilizer and the subsequent use of this fertilizer in the feed production process. Also, poultry processing facilities use energy to heat water and produce steam for process applications and cleaning, and for the operation of mechanical and electrical equipment, refrigeration and air compressors. In poultry abattoirs, fossil fuel is mainly used for process heat, while electricity is used for the operation of machinery and for refrigeration, ventilation, lighting and the production of compressed air (Dawkins and Layton, 2012).

In as much as agriculture contributes to global warming, it is also clear that climate variation in different parts of the world in turn adversely affects water availability, agriculture, forestry, fisheries and animal husbandry. It is a phenomenon that will continue to impact on the society except a drastic and urgent step is taken to reduce its effect. It is on this premiss that the paper suggests that mitigation to climate variability is the only way out.

Most literature consulted showed scarcity of research on effect of climate variability on poultry production in the study area. Bulk of the study was on climate variability on crop production. There is therefore insufficient information available to farmers, researchers and policy makers in this region. Against this background, the paper was set to:

- (i) assess the trend of climate variables in Abia State over the period of 30 years
- (ii) examine the incidences of climate variability among poultry farmers in the study area, and
- (iii) identify the different mitigation strategies adopted by poultry farmers.

## 2. MATERIALS AND METHODS

A multi-stage sampling technique was employed for selecting the required sample size. In the first stage, 10 out of 27 LGAs that make up the study area were randomly selected. In the second stage, 1 community each was randomly selected from 10 selected LGAs giving a total of 10 communities. The third stage involved the selection of 2 villages from each of the ten communities selected; this gave a total of 20 villages. In the last stage, 6 poultry farmers were randomly selected from each of the selected village, giving a total of 120 poultry farmers. The sampling frame was the list of 460 poultry farmers in the selected villages. Data were collected from both primary and secondary sources. Primary data were collected using validated structured questionnaire administered through personal interview to the selected poultry farmers. Secondary data came from National Root Crop Research

Institute Umudike. Data collected were analyzed using line graph and descriptive statistics such as mean and percentages.

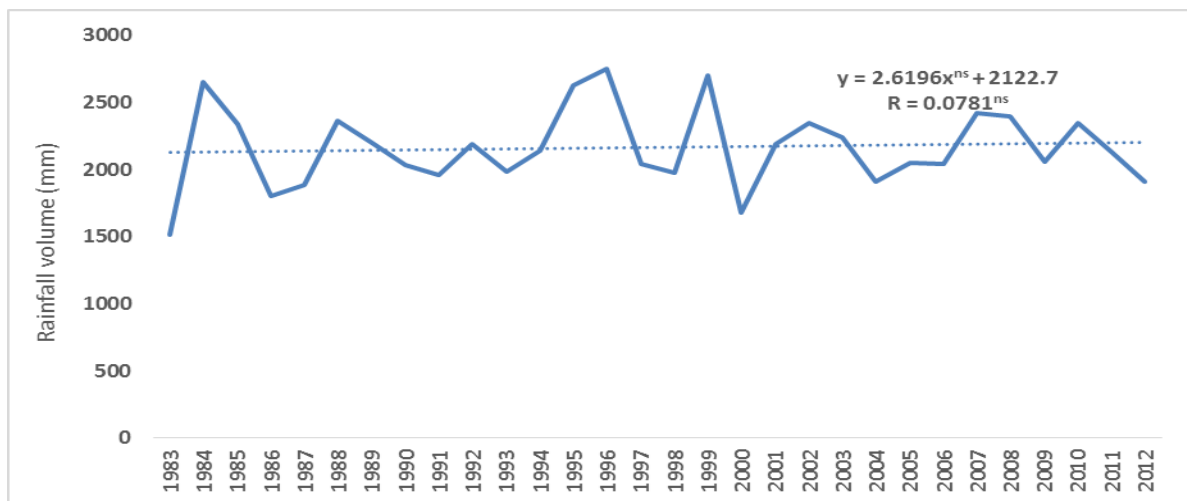
The respondents were asked to identify the incidences of climate variability (objective 2) from the list of possible effect. Therefore, the extent to which the identified causes of climate variability were perceived by the farmers were measured on 3- point Likert-type scale of very serious (3), serious (2), and not serious (1) with bench mark value of 2. The items with mean score  $\geq 2.0$  were regarded as having impacted on the respondents while items with mean score  $< 2.0$  were regarded as not having any impact. For objective three, similar procedure was adopted.

### 3. RESULTS AND DISCUSSION

#### 3.1. Trend of Climate Variability in Abia State, Nigeria

##### 3.1.1. Trend of Volume of Rainfall in Study Area

Figure 1 shows the trend of rainfall volume from 1983 to 2012. Aggregate volume of rainfall in the area shows that there is high inter-annual variability in the volume of rainfall from 1983 to 2012 which also resulted to a very low and insignificant correlation (0.0781) between rainfall volume and time. The trend line in figure 1 shows that volume of rainfall in the area has a positive trend coefficient. This indicates that rainfall volume in the area experienced slightly increasing but insignificant trend. This result is substantiated with the findings of Babatunde *et al.* (2011); Onyeneke and Mmagu (2014); Onyeneke and Madukwe (2010); Nwosu *et al.* (2014) who assert that aggregate rainfall in the rainforest and coastal regions of Nigeria has not changed significantly.



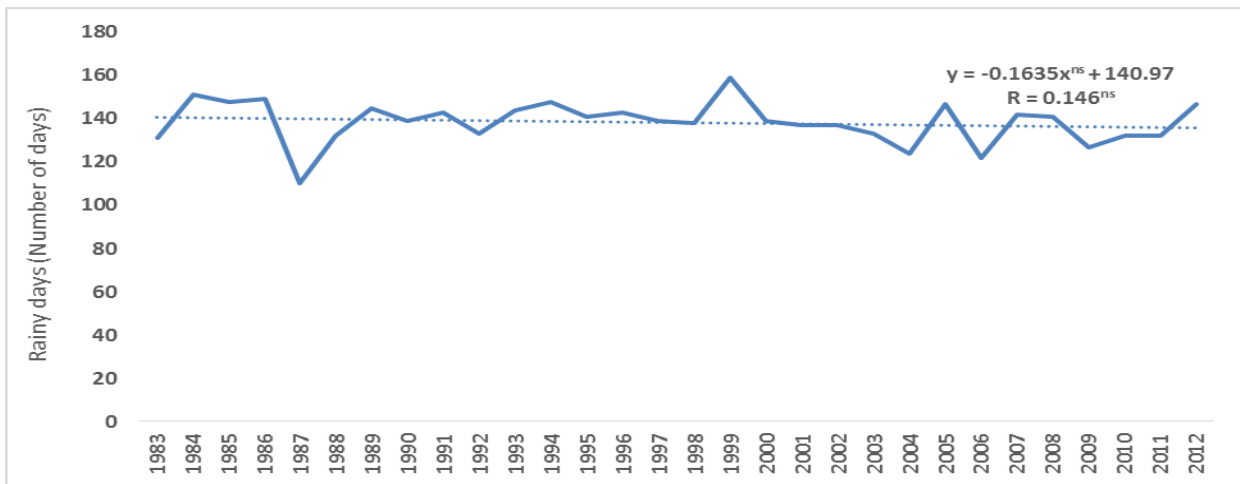
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Figure-1. Trend Result Of Rainfall Volume From 1983 – 2012

Source: Field Survey Data, 2015

##### 3.1.2. Trend of rainy days in Abia State Nigeria

Figure 2 demonstrates that there has been reduction in number of rainy days between 1983 and 2012. However, the trend is not significant as well as the correlation (0.146). This result supports Babatunde *et al.* (2011); Onyeneke and Mmagu (2014); Nwosu *et al.* (2014) who observed that the pattern of rainfall in southeast Nigeria in terms of number of rainy days is experiencing and will continue to experience a decreasing trend. This result implies that there could be increased occurrence of flood in the area because slightly increasing/unchanged annual volume of rainfall and decreasing number of rainy days may lead to hazards like flood and erosion as being experienced in the area now.



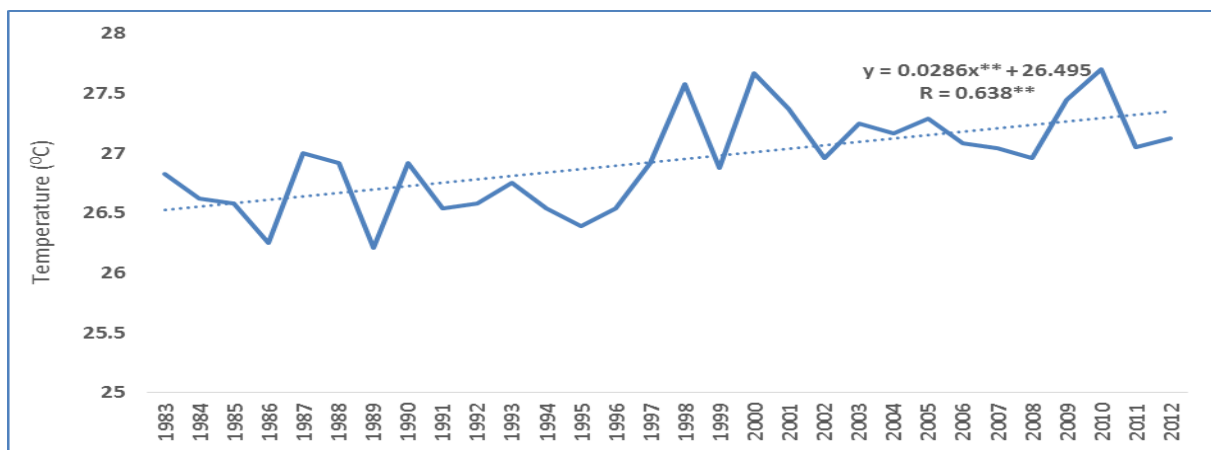
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Figure-2. Trend of rainy days from 1983 to 2012

Source: Field Survey Data, 2015

### 3.1.3. Trend of temperature in Abia State Nigeria

Data on temperature from 1983-2012 shows an increasing and statistically significant trend (Figure 3). The coefficient of correlation of temperature and time is 63.8% and is statistically significant implying that temperature has significant positive relationship with time. The trend coefficient is 0.03 implying that temperature is likely to increase by 0.3°C every ten years. Therefore, time is a major determinant for temperature changes. This means that global warming is real and significant in Abia State, Nigeria. This is in line with the findings of Onyeneke and Mmagu (2014); Chidiebere-Mark *et al.* (2014); Nwajiuba and Onyeneke (2010); Nwaiwu *et al.* (2013); Nwaiwu *et al.* (2013); Okorie *et al.* (2012); Babatunde *et al.* (2011); WACDI (Women and Children Development Initiative) (2011); Nwajiuba and Onyeneke (2010) who observed that the evidence of variation in the climate of rainforest zone of Nigeria is seen on steady increase in surface temperature.



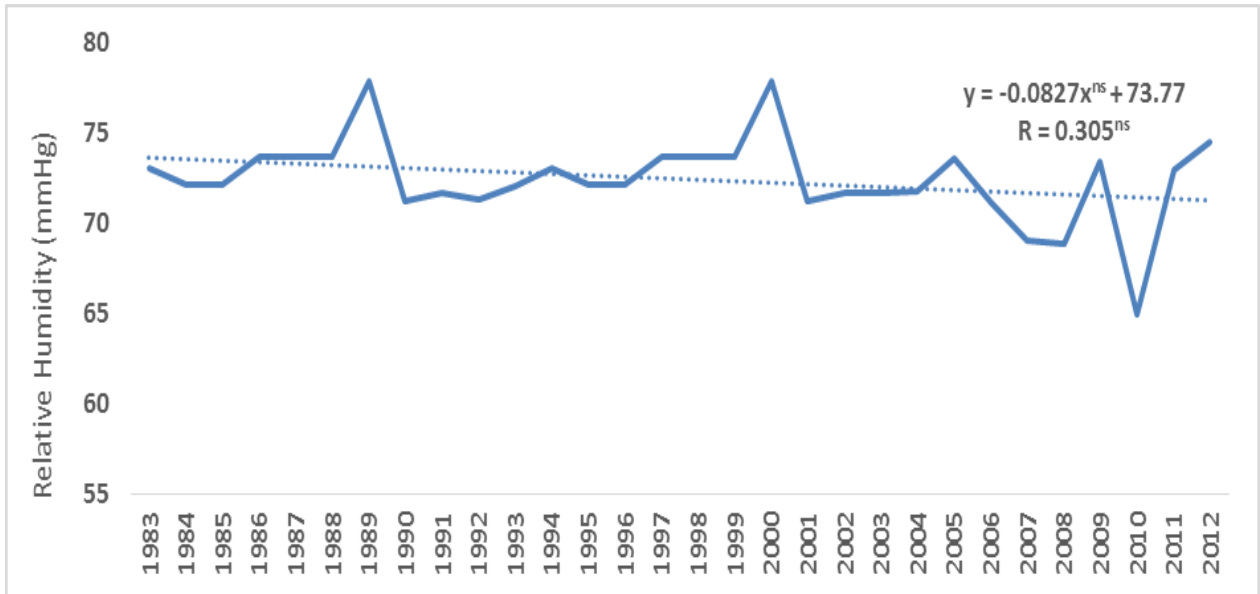
Nb: \*\* Significant at 1% level of probability

Figure-3. Trend result of temperature from 1983 – 2012

Source: Field Survey Data, 2015

### 3.1.4. Trend of Relative Humidity from 1983 to 2012

Figure 4 shows that there has been reduction in relative humidity between 1983 and 2012. However, the trend is not significant as well as the correlation (0.305). This findings corroborates with that of Onyeneke and Madukwe (2010); Nwajiuba and Onyeneke (2010) who observed that relative humidity in rainforest zone of Nigeria is recording insignificant trend.



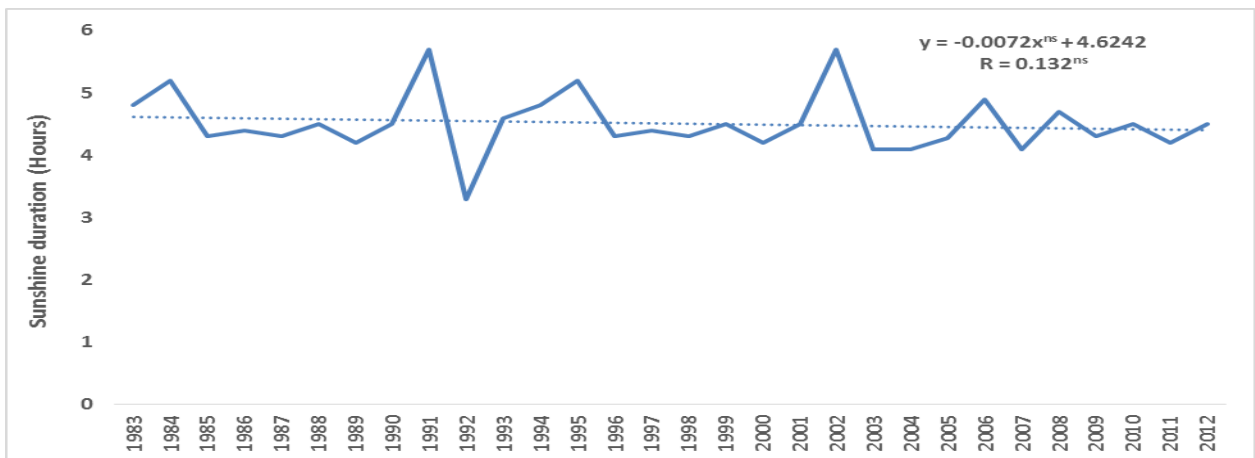
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Figure-4. Trend Of Relative Humidity From 1983 To 2012

Source: Field Survey Data, 2015

### 3.1.5. Trend of Sunshine Duration from 1983 To 2012

Figure 5 shows that there has been reduction in sunshine duration between 1983 and 2012. However, the trend is not significant as well as the correlation (0.132). This finding corroborates with that of [Onyeneke and Madukwe \(2010\)](#); [Nwajiuba and Onyeneke \(2010\)](#) who observed that duration in rainforest zone of Nigeria is recording insignificant trend.



Nb: Ns Is Not Significant

Figure-5. Trend Of Sunshine Duration From 1983 To 2012

Source: Field Survey Data, 2015

### 3.2. Observed Incidences in Poultry Production Due to Climate Variability

Table 1 Shows observed negative incidences in poultry production due the climate variability in the study area

**Table-1.** Climate variability incidences observed by respondents in Abia State

Observed Incidences	Very Serious	Serious	Not Serious	Mean	Rank
High mortality rate	120 (100)	0 (0)	0 (0)	3	1
Increase disease outbreak	70 (58.33)	40 (33.33)	10 (8.34)	2.5	4
Smallness of egg size	80 (66.67)	40 (33.33)	0 (0)	2.67	3
Poor quality of egg shell	100 (83.33)	20 (16.67)	0 (0)	2.83	2
Increase heat stress	120 (100)	0 (0)	0 (0)	3	1
Reduced feed intake	30 (25.00)	60 (50.00)	30 (25.00)	2	5
Dehydration	20 (16.67)	40 (33.33)	60 (50.00)	1.67	6

Source: Field Survey Data, 2015

According to the result, high mortality rate and increase heat stress ranked 1<sup>st</sup> and were perceived to be very serious by all the respondents in the study area. This had a mean score of 3 and this is more than the benchmark of 2. This means that high mortality and heat stress actually impacted on the poultry farmers; this must have been connected with the increased overall temperature in the period under review as indicated in Figure 1. This therefore implies that the farmers will be willing to adopt new technologies related to climate change mitigation. The table also shows that 58.33%, 33.33% and 8.34% of the respondents perceived disease outbreak (which ranked 4<sup>th</sup>) to be very serious, serious and not serious respectively. This had a weighted mean of 2.5 and more than the bench mark of 2. Here also, disease outbreak impacted on the performance of poultry birds in the study area.

Furthermore, smallness of egg size (ranked 3<sup>rd</sup>) was observed to be very serious and serious by 66.67% and 33.33% of the respondents respectively and the mean (2.67) is greater than the bench mark of (2) and it is adjudged to have impacted on poultry production. This finding is in line with the findings of Uzokwe and Bakare (2013) that changes in ambient temperature affects egg weights, shell thickness and the sizes of eggs. Bird kept at high ambient temperatures produce eggs of lighter weights than similar birds kept at lower ambient temperatures and this affects yolk weight and yolk production. For poor quality of egg shell which ranked 2<sup>nd</sup>, the responses were 100 (83.33%) and 20 (16.67%) for very serious and serious respectively. The mean score (2.83) is greater than the bench mark, again showing the incidence is extremely serious. Also, half of the poultry farmers perceived that reduced feed intake (mean of 2 equals the bench mark). Lastly, dehydration was adjudged by the poultry farmers as not being very serious going by the mean score (1.67) which is less than the bench mark.

### 3.3. Mitigation Strategies Adopted by Poultry Farmers in the Study Area

Table 2 shows the indigenous mitigation strategies adopted by poultry farmers to reduce the effect of climate variability in the area.

**Table-2.** Mitigation strategies adopted by responding poultry farmers

Strategies	Scores	Mean score	Rank
Use of climate resilient breeds	300	2.5	3
Closeness to hatchery	180	1.5	5
Feed improvement	316	2.63	2
Mixed farming	252	2.1	4
Use of artificial cooling system	360	3	1
Stocking less during harsh season	360	3	1

Source: Field Survey Data, 2015

Adopting a 3-point likert scale with bench mark 2, table 2 shows that a greater number of the respondents adopted the use of climate resilient poultry birds to reduce the effect of climate variable in the study area. It ranked 3<sup>rd</sup> with the average weighted score greater than the bench mark (2); meaning that it was very effective among the respondents. This is consistent with the findings of Adeloye and Sotomi (2013) that identified mixed farming and rearing early maturing breeds as important coping strategies to overcome the effect of climate variability. Also, the

result on table 2 indicates that the mean score for closeness to hatchery (which ranked 5<sup>th</sup>) was 1.5 and this is below the bench mark of 2, showing that it was not effective among the respondents.

Furthermore, a greater number of the poultry farmers improved on poultry feeds as a strategy for mitigating climate variability. This result supports Krishna (2011) who advocates that farm management and waste management as critical mitigation strategies, according him nutritional management aims to reduce pollution load by limiting excess nutrient intake and/or improving the nutrient utilization efficacy of the animal. It not only affects the quantity of mineral outputs from animals and the characteristics of manure, but also has cross-media effects – reducing the pollution load of soil, water and air.

Similarly, the result presented on table 2 indicates that mixed farming as a mitigating strategy had a score of 2.52 and a mean score of 2.1. This is greater than the bench mark (2) which implies a moderate effectiveness of the mitigating strategy. The use of cooling system and stocking less number of birds during harsh season as mitigation strategies to climate variability ranked 1<sup>st</sup>, with total scores and mean scores of 360 and 3 respectively.

#### 4. CONCLUSION AND RECOMMENDATION

The paper concludes that the climate over the period under review was not constant but varied and that high mortality rate, disease outbreak, smallness of egg size, poor quality of egg shell, heat stress and reduced feed intake actually impacted on poultry production in the study area. It is recommended that policies that will enhance the adaptive and mitigating capacities of poultry farmers be put in place.

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**Contributors/Acknowledgement:** All authors contributed equally to the conception and design of the study.

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