A Study Case of the Impact of Diet on prevalence of Alzheimer's Disease in Nigeria

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Abstract

In the past two decades, most of the research about the cause of Alzheimer's Disease (AD) were focusing on the genetics field, however, the achievements of these research were not satisfied. The treatment and prevention of AD remained stagnant. On the other hand, people in Nigeria having a low rate of the AD was given researchers a new hypothesis, that whether some certain food in Nigeria plays a more important role in morbidity of the AD. For testing the hypothesis a randomized controlled trial (RCT) was designed, the study will carry out in two locations in Nigeria, 320 AD patients will participate in the study within interventions, data will be collected periodically and analyzed by using the Cox (Proportional Hazards) Regression model. The study results could be used as a fundamental resource of a dietary impact study of the AD in future.

Keywords: Alzheimer's Disease, Food impact, Randomized controlled trial, Survival model, Nigeria

Introduction

Alzheimer's Disease (AD) is the most common cause of dementia and may contribute to 60-70% of cases, and as a chronic neurodegenerative disease, it has a physical, psychological, social, and economical impact on carers, families, and society(World Health Organization, 2017). In 2015, there were approximately 29.8 million people worldwide with the AD and resulted in about 1.9 million death. According to Dementia Fact Sheets of 2017, worldwide, about 47 million people have dementia and nearly 10 million new cases every year. The total number of people with the AD is projected to near 52 million in 2030 and almost triple by

2050 to 92 million. So with the global population aging AD will be a very serious issue which may hinder the development and progress of each country, even worldwide. Unfortunately, there is no treatment currently available to cure AD or to alter its progressive course. Offering more support and improving the lives of people with the AD and their carers and families was our first goal(WHO, 2017).

In the meantime, new research which based on prior results is designed to study AD via a different research direction. With the fact of that people in Nigeria have a low rate of AD, and based on Hendrie's research results of significant difference in rates of dementia in communities of similar ethnic origin in different countries by using the same method(Hendrie et al., 1995) and, Nwanna's research results of aqueous extracts of some commonly consumed green leafy vegetable in southern Nigeria have the ability to inhibit key enzymes relevant to neurodegeneration(Nwanna et al., 2016). A new hypothesis was proposed in this study that diet plays a more important role in morbidity of the AD in Nigeria, and the aim of this study is to identify whether special daily consumed food have the positive impacts on the AD, if not, what would be the reason for the low rate of the AD in Nigeria? Is it influenced subjectively by other factors?

Literature Review

In order to improve the study design and find the gap between this study and earlier research, many articles in different research direction were selected for analysis and archive.

a. Environment factors & Food composition research (positively view)

Back in the middle and late 90s, some researchers had already anticipated and texted the

hypothesis of some environmental factors may play an important role on AD(Chandra & Pandav, 1998 and Hendrie et al., 1995)in that study the age-adjusted prevalence rates for both dementia and AD were significantly lower for the Yorubas in Ibadan than for the African Americans in Indianapolis, and they were also lower for the Yorubas in every age group. The finding of these significant differences in the prevalence of AD and dementia in the two communities of related ethnic origin but different environment and culture offer unique opportunities for longitudinal studies to identify the interaction between genetic and environmental factors that could account for the differences. Also, the research's results in last year and this year all demonstrated that the aqueous extracts from Southern Nigeria's commonly consumed green leafy vegetables were have the abilities to inhibit key enzymes(AChE, BChE, and MAO) relevant to neurodegeneration and to chelate Fe2+ (in vitro), could be some of the mechanisms underlying their possible neuroprotective properties. These vegetables could offer possible dietary intervention in the management of neurodegenerative disease, especially AD, and PD(Elufioye, Berida, & Habtemariam, 2017, Nwanna et al., 2016, and Oboh et al., 2016).

b. Genetic research (Neutral view)

In addition, some medium-term researches in middle of the 2000s and early 2010s on genomic level reveal that there was a significant interaction between cholesterol, APOE-e4, and the risk of the AD in the Yoruba, a population that has lower cholesterol levels and lower incidence rates of AD compared to African Americans. APOE status needs to be considered when assessing the relationship between lipid levels and AD risk in population studies(Gureje et al., 2006, Hall et al., 2006, Ridge, Ebbert, & Kauwe, 2013, and Sabbagh et al., 2013). Or

even no relation between APOE-e4 and AD or dementia in the Yoruba(Verghese, Castellano, & Holtzman, 2011).

c. Other research (No definite view)

Moreover, one research has shown that AD could be classified as a vascular disorder since the value of scientific evidence generally revolves around probability and chance(De La Torre, 2002). And some other research had shown that the prevalence of dementia is low in certain cohort of community-dwelling elderly in northern Nigeria, but the increasing of age could be another factor that affects the disease's development(Ogunniyi et al., 2006, and Yusuf, Baiyewu, Sheikh, & Shehu, 2011), even the human's homocysteine level and weight were also studied as the potential factors of dementia's morbidity(Hendrie et al., 2013 and Ogunniyi et al., 2011).

d. Experimental method and Analysis method

These articles(Kenneth, Douglas, & David, 2010, and Cox Proportional-Hazards Model, n.d.) are selected as guidance for experimental design and data analysis.

The gap between this study and earlier research is that in this study the RCT experiment within interventions will decrease other potential influencing factors as much as possible, like personal habits, educational level, and economical level, which means only focus on the diet impact on the AD.

Methodology & Sampling Plan

Quantitative research method will be used in this study since it can quantify the problem by way of generating numerical data or data that can be transformed into usable statistics. It is used to quantify attitudes, opinions, behaviors, and other defined variables. And a Randomized Controlled Trials (RCT) is designed for testing the hypothesis.

a. Study population, recruitment, and setting

This study will carry out in two locations, 10 km from each other, in Yorubas, Ibadan. At the initial stage of study in the name of social care activity, approximately 300-500 patients which from 60-year old will be accepted previously diagnosis for evaluating their disease's condition in each location, the age setting is to maximally guarantee the data collection, and then according to their conditions, the final sample in each location will be randomly selected into 3 groups that are 60 patients in Mild, 60 patients in Moderate, and 40 patients in Severe. The precautions will be told to patients and their families, and patients' carers will be trained by professionals which aim to reduce the influence of their caring. For those patients who do not have family carers, they will be hospitalized in a local hospital and cared by professionals.

b. Intervention

The intervention included eating food and living habit. In detail, the controlled food are Afang, Editan, and Utazi, which had shown their aqueous extracts have the ability to inhibit certain enzymes relevant to neurodegeneration and to chelate Fe2+ (in vitro). Behavioral targets of the intervention are physical activity, daily schedule, and personal habits, like smoking and drinking, during the periods of research all these habits which might influence

the AD would be forbidden.

c. Study design

The study design was a single-blind randomized controlled trial. For mild and moderate samples, the total 60 participants will randomly subgroup into 3 control group, N-group, their daily meals do not have controlling food composition; H-group, their daily meals only have 50% controlling food composition; and W-group, their daily meals have 100% controlling food composition. And for the severe sample, the total 40 participants will only randomly subgroup into 2 group, N-group and W-group that as the same as described above. The first phase of the experiment will last one-year, and professionals will collect the data of each patient's health condition once a month, finally, all data will be analyzed by Cox regression model.

Data Analysis

The Cox proportional-hazards model is essentially a regression model commonly used statistical in medical research for investigating the association between the survival time of patients and one or more predictor variables. It works for both quantitative predictor variables and for categorical variables. Furthermore, the Cox regression model extends survival analysis methods to assess simultaneously the effect of several risk factors on survival time.

The Cox model is expressed by the *hazard function* denoted by h(t). Briefly, the hazard function can be interpreted as the risk of dying at time t. It can be estimated as follow:

$$\mathbf{h(t)=h0(t)\times exp(b1x1+b2x2+...+bpxp)}$$

where,

- *t* represents the survival time
- h(t) is the hazard function determined by a set of p covariates (x1,x2,...,xp)
- the coefficients (b1,b2,...,bp) measure the impact (i.e., the effect size) of covariates.
- the term h0 is called the baseline hazard. It corresponds to the value of the hazard if all the xi are equal to zero (the quantity exp(0) equals 1). The 't' in h(t) reminds us that the hazard may vary over time.

In summary, HR = 1: No effect; HR < 1: Reduction in the hazard; HR > 1: Increase in Hazard

In this study, covariates x1 is the subgroup of different composition percentage of controlling food in taking; x2 is patients' health condition before the experiment; x3 is the age.

Discussion

The limitation of this experiment would be the unstable amount of sample, with the patient died the amount of sample will decreasing, even if add some new standards-compliant samples we still need to wait a long time to collect and analyze the data. However, if we eventually have satisfying results which based on current experimental design, the study will make a huge contribution to future research.

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