Effect of Food Insecurity on the HIV Progression among the HIV-infected Patients in Iran

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Authors’ contributions

This work was carried out in collaboration between all authors. Authors NK and SD designed the study. Author MT wrote the protocol. Author NO wrote the first draft of the manuscript. Author MG managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: Acquired immune deficiency syndrome (AIDS) is a common condition mainly associated with human immunodeficiency virus (HIV) infection. The virus destroys the immune system by attacking the cluster of differentiation 4 (CD4⁺) cells in the body. However, the extent of CD4⁺ cell destruction has not been evaluated among the HIV-infected individuals facing various levels of food insecurity.

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Aim: The study investigated the effect of food insecurity on the HIV progression among the HIV-infected individuals in Tehran, Iran.

Materials and Methods: A total of 123 HIV-infected participants with AIDS were selected randomly at four behavioral health specialist centers in Tehran. The demographic data and information on food security situation for each person and the family was collected using the household food security valid questionnaire. The CD4 cell count was obtained from medical records of each patient. The effect of food insecurity on the CD4 cell counts among the HIV-infected individuals was evaluated by linear regression method.

Results: More than 46 percent of the participants in this study were moderately to severely food insecure. Food insecurity significantly affected the CD4+ cell counts (P=0.001) of the HIV-infected individuals in the study.

Conclusion: The results suggest that food security situation of HIV/AIDS patients affects the CD4+ cell counts and improvement in the nutritional state of AIDS patients may help to prevent progression of the disease among these patients.

Keywords: AIDS; food insecurity; CD4 cell counts.

1. INTRODUCTION

The progression of human immunodeficiency virus (HIV) infection to acquired immune deficiency syndrome (AIDS) due to reduction in the cluster of differentiation 4 (CD4⁺) cell count can be enhanced by the nutritional status of the individual especially due to changes in the level of food security. The level of progression of the HIV/AIDS is reported to occur in three main stages including [1] the person may experience a flu-like disease for a short time. The disease usually persists without any signs for a long time in a state called latent period. [2] As the disease progresses, it interferes more with the body immune system and weakening it thus predisposing the individual to opportunistic infections and tumors. However, its effect on people with healthy immune system retard the progression of such individuals to AIDS and increases their chances of survival. [3] In this stage, AIDS develop and the CD4⁺ cell counts are below 200 cells per microliter [1]. And the patients at this stage remains a global challenge especially in the developing countries where access to antiretroviral (ARVS) drugs is still a challenge.

According to WHO/UNAIDS reports, at the end of 2010, about 34 million people worldwide were infected with HIV/AIDS [2]. Approximately 16.8 million were women, and 3.4 million were less than 15 years old. As a result about 1.8 million deaths occurred in 2010. This proportion decreased in comparison with 2001 (3.1 million deaths in 2001) statistics [3]. Although the number of AIDS patient was low in Iran according to the worldwide health organizations report (WHO), AIDS epidemic growth rate is increasing dangerously in Iran [4]. Although official statistics are inadequate, the main ways of HIV transmission in Iran are sexual intercourse (10%) and intravenous drug users with sharing needles (69.5%) [2].

According to data collected by the University of Medical Sciences and Health Services, up to March 2016, total of 29,414 people with HIV/AIDS have been identified in Iran to be infected with HIV virus; with 88 percent of them males and 12 percent females [5]. So far, 6990 people with AIDS and 6202 people with "HIV" have lost their lives. According to the Joint United Nations Program on HIV/AIDS (UNAIDS) and the World Health Organization (WHO) reports, about 80 thousand of people are HIV positive, and according to unofficial statistics, 120 thousand of people are carriers of the HIV virus in Iran [5]. However, some of these patients are on treatment and many of them are affected by various factors including the food insecurity which may affect their treatment outcomes and the degree of progression to HIV/AIDS. The other factors that have reported to effect the disease progression include gender, age, marital status, education, occupation, social class, family income and household food security and diversity [6]. Food insecurity, is a situation of "limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways", according to the United States Department of Agriculture (USDA). Considering

CD4 is a glycoprotein found on the surface of immune cells such as T helper cells, monocytes, macrophages, and dendritic cells.
the fact that food insecurity in many situations is due to limited resources available, and the burden of food insecurity remains a global challenge especially among poor nations. This factor is an important risk factor in the HIV progression and deaths among AIDS patients [7]. According to the Food and Agriculture Organization (FAO) of the United Nations report, nearly 870 million people of 7.1 billion or about one-eighth of the world’s population are suffering from chronic malnutrition. About 852 million hungry people are living in developing countries with this amount constituting approximately 15% population of these countries. Nearly 16 million people are suffering from malnutrition in developed countries too [8]. Food insecurity during the past two decades has attracted the attention of experts and policymakers as a major public health problem. Food insecurity in Iran has been reported to range from 20 to 60% and it has been reported in 75 to 86% of female-headed households and low-income community respectively [9]. Food insecurity is a key factor in HIV progression globally especially in third world countries and is an important factor for poor health outcomes among people with AIDS. Without food or income, some family members may migrate in search of work, increasing their chances of contracting HIV — and bringing it back home. For others, commercial sex may be their only option to feed and support their family. Food insecurity also leads to malnutrition, which can aggravate and accelerate the progression to AIDS. Likewise, the disease itself can contribute to malnutrition by reducing appetite, interfering with nutrient absorption, and making additional demands on the body’s nutritional status [10]. Overall, in the world, 232 studies has been done on the effect of food insecurity on AIDS, and 152 studies showed that there is a relationship between food insecurity and the treatment process of AIDS [11]. Food insecurity has been studied as a key indicator in reduced response to Anti-Retroviral Therapy (ART) treatment in patients with HIV/AIDS. A range of undesirable results in health status have been observed in patients with food insecurity, such as decreasing physical health conditions, reduced viral suppression, reduced immunity, increasing the risk of opportunistic infections [12]. Considering the fact that, no study has been done in this field in Iran and undesirable level of knowledge about the relationship between lifestyle and infection diseases in Iranian people [13], this study evaluated the effect of food insecurity on the HIV progression among the HIV-infected patients on ART treatment in the four behavioral health specialist centers in Tehran, Iran.

2. METHODS

A cross sectional study was done among 123 HIV-infected patients that were randomly selected using stratified sampling method from the triangular ART centers in Tehran, Iran. There are five triangular clinics in Tehran; two centers in northern Tehran, one center in Eastern Tehran, one Center in southern Tehran and one Center in Western of Tehran. The triangular centers operate as behavioral diseases consultation centers in Tehran. The distributions of the centers were relatively normal; however, this variable has been investigated as a residential area, because it shows an overview of socio-economic conditions of patients with other variables. A total of 30 subjects were randomly selected from each of the centers. Consent was thought from the participants and the consent forms were collected from the subjects a few days prior to data collection. All the participants that participated in the study were HIV positive and on ART treatment. The data collection was performed via surveys and interviews during 3 months from December 2015 to February 2016.

Food security was evaluated by Farsi version of Household Food Insecurity Access Scale (HFIAS) questionnaire which has been validated by Nasrabadi et al. [14]. This questionnaire assessed the food security of persons and their family members over the previous month. The scale consisted of 9 items (e.g. Worry about food and Go a whole day and night without eating) with 4 frequency options that classified households into secure (experiences none of the food insecurity conditions), mild (experiences worries about not having enough food sometimes or often, and/or is unable to eat preferred foods, and/or eats a more monotonous diet than desired and/or some foods considered undesirable, but only rarely), moderate (eating a monotonous diet or undesirable foods sometimes or often, and/or has started to cut back on quantity by reducing the size of meals or number of meals, rarely or sometimes), and severe (has graduated to cutting back on meal size or number of meals often, and/or experiences running out of food, going to bed hungry, or going a whole day and night without eating, even once in the last four weeks) food insecure [14].

All analysis was done using SPSS-23. Linear regression analysis was used to examine the
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3. RESULTS

In this study, 123 patients (98 males and 25 females) diagnosed with HIV participated. Their average age was 42.71(±10.16) and the age range of patients was 10 to 70 years. The CD4 cell counts were 28 to 1066 per mm$^3$ for all cases. Distribution of responses to the nine questions in HFIAS is presented in Table 1.

About the food insecurity of the participants in the study, more than 46% of participants suffered from moderate to severe food insecurity (Table 2).

Table 3 shows the relationship between food insecurity and CD4 cell counts in HIV patients. Food insecurity level was inversely related to CD4 cell counts ($P=.011$).

4. DISCUSSION

The results showed that food insecurity was prevalent among AIDS patients. Also, the food insecurity has a significant inverse correlation with the number of CD4 cells in AIDS patients. The high prevalence of food insecurity in AIDS patients has been confirmed by most previous studies. Norman et al. studied food insecurity and hunger among HIV patients in Canada in 2005 and found that it was prevalent [11]. Measurement of food intake and hunger was done using Radimer/Cornell questionnaire. A total of 1213 participants were participated in this study. 52% of them had food security, 27% had food insecurity without hunger and 21% had food insecurity with hunger which is consistent with our results for moderate and severe food insecurity. Although a study in rural Uganda by Tsai et al. [7] in evaluated the social context of food insecurity among HIV/AIDS patients which 456 who participated in this study were reached through another cohort study that was being done in Uganda (Uganda Aids Rural Treatment Outcomes Study). In this prospective cohort study, data was collected in Mobaraaba-Uganda through structured interviews. The prevalence of severe food insecurity was 38% and was more common among women than men. On the other hand, the relationship between nutritional status and CD4 cell counts and between nutritional status and CD4 cell counts has been taken into consideration in recent years. The results of most studies report the existence of a connection. A study was done in the U.S by Wang et al. [10] in found Food insecurity was associated with a weaker immune response among AIDS patients receiving ART. This cross-sectional study

| HFIAS questions | Options* |
|----------------|----------|
| Q1: Worry about food | No (48) | Rarely (7.3) | Sometimes (12.2) | Often (32.5) |
| Q2: Unable to eat preferred foods | 58 (47.2) | 8 (6.5) | 25 (20.3) | 32 (26) |
| Q3: Eat just a few kinds of foods | 30 (24.4) | 23 (18.7) | 26 (21.1) | 44 (35.8) |
| Q4: Eat foods that really do not want to eat | 88 (71.5) | 14 (11.4) | 11 (8.9) | 10 (8.1) |
| Q5: Eat a smaller meal | 77 (62.6) | 8 (6.5) | 21 (17.1) | 17 (13.8) |
| Q6: Eat fewer meals in a day | 74 (60.2) | 7 (5.7) | 16 (13) | 26 (21.1) |
| Q7: No food of any kind in the household | 66 (53.7) | 20 (16.3) | 10 (8.1) | 27 (22) |
| Q8: Go to sleep hungry | 71 (57.7) | 15 (12.2) | 19 (15.4) | 18 (14.6) |
| Q9: Go a whole day and night without eating | 78 (63.4) | 20 (16.3) | 14 (11.4) | 11 (8.9) |

*Figures in parentheses indicate percentages

Table 2. The food insecurity level and the CD4 for those at that level count

| INSEC classification | Total |
|----------------------|-------|
| Mild | Moderate | Severe |
| cd4new | count ≤ 200 cells/µl | 20 | 4 | 10 | 34 |
| count 200 to 500 cells/µl | 24 | 16 | 12 | 52 |
| count ≥ 500 cells/µl | 22 | 15 | 0 | 37 |
| Total | 66 | 35 | 22 | 123 |
Table 3. Linear regression of the relationship between food insecurity and CD4 cell counts in HIV patients

| Unstandardized coefficients | Standardized coefficients | t  | Sig. |
|-----------------------------|----------------------------|----|------|
| Food insecurity             | -7.371                     | 2.863 | -.228 | -2.575 | .011 |

was done among 2353 HIV patients who had undergone ART treatment. These were joint participants in the study Veterans Aging Cohort Study in 2002-2008. The participants who were worried about having enough food for themselves and their families over the course of 30 days were considered food insecure. A relationship was confirmed between food insecurity and CD4 counts of < 200 cells/µl and unsuppressed HIV-1 RNA of >500 copies/µl; 24% of the participants were food insecure. In adjusted analysis of this study, participants with food insecurity were more likely than those who were food secure to have HIV which is consistent with our results for moderate and severe food insecurity. Recently, studies also have examined the causes of association between food insecurity and HIV disease progression. Weiser et al. [15], a case study in the US in 2011, presented a conceptual framework for bilateral relations between food insecurity and HIV/AIDS [15]. The study pointed to multiple cycles through which food insecurity and HIV/AIDS were linked in the community, family and individual levels. The study examined the feeding cycle, mental health cycle and behavioral cycle, for which food insecurity increases HIV acquisition and AIDS progression. Weiser et al. [16] found in Uganda that food insecurity is an obstacle to the treatment of ART in patients with AIDS. The present study conducted interviews with open-ended questions with 47 AIDS patients (30 women and 17 men) to determine how to combine food insecurity and ART therapeutic activity in patients with AIDS. After rewriting the interviews and encoding them, they were analyzed by using basic theories the results introduce food insecurity as an important factor in the continuation of medical care and treatment. Five mechanisms have been suggested for the intervention in food insecurity in the lack of continuity in ART treatment or treatment interruption and delay of its start: 1- ART increased the appetite and caused intolerable hunger in the absence of food, 2- In the absence of food, the side effects of ART treatment increased, 3- Participants believed that if they could not resolve the food load added to their households, or they should not begin ART, if begun, they should just tolerate the drug doses, 4- Competition between food and health care costs prompted people to leave treatment to provide for their food requirements, or refuse to eat so that they could afford medical costs, and 5- Participants forgot to take their medicinal doses because many were employed on farms to provide for their food and treatment costs. Food insecurity can lead to deficiencies in micronutrients and macronutrients, which is an intensifying factor in the development of AIDS. Food insecurity has a significant effect on weakening the immune system and will intensify and accelerate the pathogenesis of the disease. The death rate will increase in such patients.

5. CONCLUSION

The results suggest that food security situation of HIV/AIDS patients affects the CD4+ cell counts and improvement in the nutritional state of AIDS patients may help to prevent progression of the disease among these patients.

6. LIMITATIONS

The cross-sectional nature of the study used to identify causal relationship was insufficient. It was possible that individual reports about food insecurity could have been biased.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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