Scientific Research Publishing

Advances in Infectious Diseases, 2025, 15(3), 564-571
https://www.scirp.org/journal/aid
ISSN Online: 2164-2656
ISSN Print: 2164-2648

Antiretroviral Agents and Weight Change in People Living with HIV at Sultan Qaboos University Hospital Oman. An Observational Single-Center Study

Kowthar Salman Hassan

Department of Medicine, Infectious Diseases Unit, Sultan Qaboos University Hospital, Muscat, Oman
Email: kowsan@squ.edu.om

How to cite this paper: Hassan, K.S. (2025) Antiretroviral Agents and Weight Change in People Living with HIV at Sultan Qaboos University Hospital Oman. An Observational Single-Center Study. *Advances in Infectious Diseases*, **15**, 564-571.
https://doi.org/10.4236/aid.2025.153042

Received: August 23, 2025
Accepted: September 21, 2025
Published: September 24, 2025

Abstract

Objectives: Weight gain in patients living with human immunodeficiency virus infection has been linked to a number of antiretroviral medications including tenofovir alafenamide and integrase strand transfer inhibitors. We studied our cohort of patients with regard to weight changes after introduction of tenofovir alafenamide either on its own or in combo drugs such as Taffic. **Methods**: this is an observational retro- and prospective study covering the period from 8th Feb 2020 until 20th March 2025 under Ethical approval: MREC: #3230. Relevant data were extracted from the hospital electronic records. Excel was used to do statistical analysis for descriptive analysis, chi-square for independence and Mann-Whitney tests. **Results**: 46.4% of patients had genuine weight gain 1 year post initiation of tenofovir alafenamide-containing agents with a median age 41 (21 - 69) and M:F of 41:29. Median age gain was 4.45 kg. Weight was stable or lost in 41%, and the remaining 12.6% had weight gain before the initiation of the agent. Age (above or below 50 years) had no impact on determining weight gain (X^2: (1, N = 132) = 2.6, p: 0.106), however, it had a significant impact on the amount of weight gained (6.1 vs 4 kg in patients ≤50 and >50 years of age respectively (6.1 vs 4 kg, U: 335, n1 = 86, n2 = 46, z score: 2.14, p: 0.032, with a small size effect r = 0.186). Gender had no impact on determining weight gain (X^2: (1, N: 132) = 1.66, p 0.198) nor in the magnitude of gained weight (6 vs 4.7 kg in males and females respectively (U = 565, n1: 84, n2: 48 z score = 0.27, p = 0.79, r: 0.0234). Diabetes mellitus was lower in the group that gained weight (27.4% vs 12.9%, X^2 (1, N: 132) = 4.46, p = 0.035). **Conclusion**: genuine weight gain was observed in our population in patients on a combination of TAF and bictegravir. Diabetes mellitus was higher in the group that did not gain weight in contrast to other studies. This could

reflect ethnic differences or the effect of diabetes on the metabolic effects of the weight-increasing antiretroviral agents.

Keywords

HIV, Taffic, Weight Gain, Oman, INSTIs

1. Introduction

Since the introduction of Anti-Retroviral Therapy (ART), life expectancy has greatly improved for Patients Living With Human immunodeficiency virus (PLWH). New agents and new classes of ART were introduced to minimise adverse effects such as Tenofovir Alafenamide (TAF) and combat resistance such as Integrase Strand Transfer Inhibitors (INSTIs) [1]. However, a number of studies reported new side effects such as weight gain in PLWH with potential morbid metabolic consequences in such patients [2]. The results of the studies have not been consistent regarding the agent most responsible for this adverse effect, the factors determining it and the metabolic consequences. Mallon reported a significant and immediate weight gain after switch from tenofovir disoproxil (TDF) to TAF regardless of the core class or core agents. [3]. A meta-analysis on 73 studies revealed greater average weight gain in TAF group than other backbone groups [4]. However, faster weight gain was observed in the INSTIs group than in those on TAF 25 mg or lower. [5] Darnell showed greater weight gain one year after switch to TAF compared to those on TAF-free regimens but without translating to DM, HTN or HLD during this period [6]. Furthermore, Damas *et al.* reported a decrease in weight at one year of replacing TAF with TDF, which was associated with an improvement in the lipid profile [7].

Meanwhile, a Japanese study that was the first study to investigate the effects of ART on weight in non-Caucasians, showed similar weight gain with TAF and TDF while TAF with dolutegravir was associated with weight gain [8]. Hitherto, the mechanisms responsible for the weight gain have not been clearly explained.

Reported here are the effects of TAF/Taffic containing ART on weights of our cohort of PLWH and investigate the effects of some factors on determining development of weight gain.

To my knowledge, this is the first study of this effect in the Middle East population.

2. Methods

This is an observational retrospective and prospective study at a single center at Sultan Qaboos University Hospital in Oman covering the period from 8 Feb 2020 to 20 March 2025. We identified patients who are on TAF and Taffic (a combination tablet of TAF, bictegravir and emtricitabine) in our cohort. We collected relevant data from the electronic records of the Hospital Information System (HIS).

Data were collected on serial weights measured at our institute for the patients and the dates of change into TAF containing ART whether separately or in combination with Taffic. We also checked dates of starting them on INSTIs in case these patients were previously on INSTIs without TAF. Data were entered into an Excel sheet.

Weights taken into account included at −1 year, −6 months before, at time of starting TAF/Taffic (time 0), +6 months after and +1 year after making the change. When relevant weights were not available at these time points, we considered the nearest weight within 3 months.

2.1. Inclusion Criteria

All adult PLWH patients aged ≥ 20 years are regularly followed at our institute.

2.2. Exclusion Criteria

The following patients were from our study including:

Patients that have not completed at least one year on TAF/Taffic, patients with unreliable weight measures (difficult to measure weight due to use of wheel chair, female patients during pregnancy, patients that had bariatric surgery during the study period, patients diagnosed to have malignancy and were started on chemotherapy, patients starting TAF upon presentation with severe weight loss and young patients expected to have growth with normal physiological weight gain). We also excluded patients who defaulted during this period, or were not compliant with their medications or expats not capable of continuous follow-up at our institute.

Genuine weight gain was, therefore, taken as weight gain not related to normal physiological growth, not due to improvement from a low baseline due to recovery or other aforementioned cofactors.

2.3. Statistical Analysis

Excel was used to make descriptive statistics required for this study and to perform chi chi-square test for independence to investigate association of age with weight changes since age was used as a categorical variable (those below age of 50 years vs those above 50 years) and weight change was also used as categorical data (those who gained weight vs those with stable weight). Chi-square test for independence was also used to investigate relation of diabetes (DM) with weight changes. Statistics were double checked using QuickCalcs (GraphPad.com/quickcalcs; accessed on 1/4/2025). Mann-Whitney U test used to compare the magnitude of weight gain in patients under 50 years of age vs those above, we used Excel and confirmed results with Mann-Whitney U Test Calculator.
https://www.socscistatistics.com/tests/mannwhitney/default2.aspx.
Accessed 1/4/2025).

The study was conducted under Ethical approval: MREC: #3230

3. Results

After elimination of patients with exclusion criteria, we found a total of 163 pa-

tients on TAF/Taffic who fulfilled the above criteria. However, 12 patients did not have a good weight record for weight monitoring, hence they were also eliminated. Among the remaining 151 patients on ATF/Taffic the median age was 43 (min: 21-max: 69) with a M:F ratio of 51 (57.3%):38 (42.7%). In this group of 151 patients, 89 (59%) patients had weight gain (Weight-Gaining Group: WGG) and 62 (41%) patients had either stable weight or lost weight (Weight-Stable Group: WSG). Among the 89 patients who gained weight, 19 (21.34%) patients had wide fluctuations in their weight or had a trend of weight gain from before starting TAF/Taffic and 70 (78.6%) patients had a genuine weight gain post commencement of TAF/Taffic with M:F of 41 (58.6%): 29 (41.4%) and a median age of 41 (min: 21-max: 69). Weight gain was therefore, genuine in 70 of 151 patients on TAF/Taffic (46.4%). The amount of weight gained had a median of 4.45 kg ranging from 2 - 35.5. Weight was stable or decreased in 62 (41%) patients with a median age of 44.5 (min: 20-max: 79) and M:F of 43 (69.4%): 19 (30.6%). The amount of weight loss in this group had a median of 0 ranging from 0 - 11.7 kg.

There was no difference in the WGG and WSG regarding their age (X^2: (1, N = 132) = 2.6, p: 0.106). However, a greater amount of weight was gained in the ≤ 50-year-old patients (6.1 vs 4 kg in patients ≤50 and >50 years of age respectively (6.1 vs 4 kg, U: 335, n1 = 86, n2 = 46, z score: 2.14, p: 0.032, with a small size effect r = 0.186). Gender had no impact on determining weight gain X^2: (1, N: 132) = 1.66, p 0.198) nor in the magnitude of gained weight U = 565, n1: 84, n2: 48 z score = 0.27, p = 0.79, r: 0.0234). Diabetes mellitus was lower in the WGG (27.4% vs 12.9%, X^2 (1, N: 132) = 4.46, p = 0.035).

4. Discussion

In November 2016 tenofovir alafenamide TAF a pro-drug of tenofovir was approved by FDA as a formula conferring less nephrotoxicity and osteoporosis than its previous counterpart tenofovir disoproxil TDF [9]. Raltegravir, the first of the new class of ART INSTIs was approved in 2007 for treatment of HIV. The introduction of these had many advantages in minimising adverse effects and development of resistance [1]. Since 2016, however, various studies have reported weight gain in PLWH due to these ART with possible morbid metabolic complications. In our practice, we introduced TAF in Feb 2020 after a study that showed nephrotoxicity in our population due to TDF [10]. For the convenience of taking a single combination tablet per day and better compliance, we started to switch our patients to Taffic in August 2022. However, following the release of multiple studies reporting on the adverse effects of weight gain in patients on TAF and INSTIs and the lack of such studies on our population, we investigated this effect on our cohort.

Of the 151 patients, we found a total of 89 (59%) patients who gained weight. By monitoring the patients' weights retrospectively, we found that 21.34% of them had weight gain that was not related to the initiation of ART. We cannot determine how much weight gain was attributed to the ART in this group. Meanwhile,

we found 70 (46.4%) patients who genuinely gained weight the majority of whom denied having any problems with the new agents and were very appreciative of the switch from the previous Atripla (TDF, emtricitabine and efavirenz) that caused dizziness. This unawareness about the weight gain could partly be due to the loose traditional clothes for both men and women in our culture and partly because weight gain is not considered as much of a problem as weight loss. We could not compare our cohort with other TAF/Taffic-free groups as the majority of our patients have been switched to TAFfic. We could not compare the current TAF/Taffic group to historical TAF/Taffic-free group due to the poor weight records in that period. As most studies compare amount of weight gain between ART classes rather than proportion of patients gaining weight in each class, we could not compare our proportion with other studies.

Mechanisms of the weight gain following initiation of ART have not been clearly identified. Among postulated mechanisms, immune reconstitution and general improvement in patients' health are largely responsible for the weight gain [11]. We eliminated this factor by excluding all those presenting with severe weight loss and including only those who had a suppressed viral load (undetected or <20 copies) and good immune recovery for some time. We also eliminated other factors influencing weight such as bariatric surgery, pregnancy, chemotherapy, and natural growth process in young patients. We, therefore, included adults of ≥20 years of age unlike other studies including patients in their teens. [12]. Furthermore, since the average annual weight gain in adults is 0.5 - 1 kg, weight was considered as increased only if it was >1 kg from time 0 [13].

Young age taken as <50 years was reported to be the major determinant for the weight gain [8]. In our cohort of 132 patients (70 and 62 with genuine weight gain and weight stable group respectively) we had 50 and 36 patients aged ≤50 years and 20 and 26 patients aged >50 years in the WGG and WSG respectively. Age was not a determining factor for weight gain in our study. However, we did find a significantly greater magnitude of weight gain in those ≤50 years of age vs >50 years (6.1 vs 4, $p = 0.03$). This amount gained is less than the 8.9 kg reported in the ADVNCE study in patients on TAF/dolutegravir. This difference could be explained by dolutegravir being reported to be higher in rank of probability of causing weight gain than other INSTIs [14].

Another factor reported to determine weight gain is gender. The ADVANCE study showed greater weight increase in TAF/dolutegravir group vs TDF/dolutegravir group over 192 weeks and more weight gain was noticed in the females [15]. In our study, all the patients were on Taffic and only 4 were on TAF without INSTIs. We found no impact of gender on determining weight gain nor did gender have an impact on the amount of weight gained in the WGG. This could reflect differences in the population studied.

Weight gain post ART initiation was associated with a greater risk of developing DM [16]. In our cohort, we found a significantly greater proportion of patients with DM in the WSG than in the WGG. All these patients had DM for many years

before initiation of TAF/Taffic. The prevalence of DM (mainly type 2) in the general population in Oman is 15.7%, which is between the two values we have in our cohort of PLWH [17]. It is difficult to explain the lower rates of DM in the WGG rather than the WSG. However, most studies have investigated the effect of ART on inducing DM in the first year post initiation of TAF/INSTIs while our study could be reflecting the prevalence of DM in the general population. Furthermore, to our knowledge, hitherto, no study has investigated the effects of DM on the metabolic effects of the weight-inducing ART which could be very important in determining the type of ART agents to use in this group.

5. Conclusion

Traffic is associated with weight gain in PLWH in our population. The group experiencing weight gain had a lower prevalence of pre-existing DM. Age did not determine that weight gain had a significant impact on amount of weight gained. Gender had no impact on weight gain or its magnitude in our population.

Limitations

Not all required information was available in the system such as missing weights at each visit. Sample size was reduced due to defaulters and non-compliers with medication. Another limitation is that the majority of our patients were on Taffic which also contains INSTIs which prevents us from accurately attributing the weight gain to the culprit drug class or a synergistic effect of both classes. Finally, our study investigated proportions of patients gaining weight after commencement of TAF/INSTIs instead of comparing the effects before and after. This limits its comparison to previous studies.

Acknowledgements

Nurse Badar AlBusaidi, thank you for filling in some data in the Excel sheet.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Smith, S.J., Zhao, X.Z., Burke, T.R. and Hughes, S.H. (2018) HIV-1 Integrase Inhibitors That Are Broadly Effective against Drug-Resistant Mutants. *Antimicrobial Agents and Chemotherapy*, **62**, e01035-18. https://doi.org/10.1128/aac.01035-18

[2] Herrin, M., Tate, J.P., Akgün, K.M., Butt, A.A., Crothers, K., Freiberg, M.S., *et al.* (2016) Weight Gain and Incident Diabetes among HIV-Infected Veterans Initiating Antiretroviral Therapy Compared with Uninfected Individuals. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, **73**, 228-236. https://doi.org/10.1097/qai.0000000000001071

[3] Mallon, P.W., Brunet, L., Hsu, R.K., Fusco, J.S., Mounzer, K.C., Prajapati, G., *et al.* (2021) Weight Gain before and after Switch from TDF to TAF in a U.S. Cohort Study. *Journal of the International AIDS Society*, **24**, e25702.

https://doi.org/10.1002/jia2.25702

[4] Kanters, S., Renaud, F., Rangaraj, A., Zhang, K., Limbrick-Oldfield, E., Hughes, M., *et al.* (2022) Evidence Synthesis Evaluating Body Weight Gain among People Treating HIV with Antiretroviral Therapy—A Systematic Literature Review and Network Meta-Analysis. *eClinicalMedicine*, **48**, Article 101412. https://doi.org/10.1016/j.eclinm.2022.101412

[5] Emond, B., Rossi, C., Rogers, R., Lefebvre, P., Lafeuille, M. and Donga, P. (2022) Real-world Analysis of Weight Gain and Body Mass Index Increase among Patients with HIV-1 Using Antiretroviral Regimen Containing Tenofovir Alafenamide, Tenofovir Disoproxil Fumarate, or Neither in the United States. *Journal of Health Economics and Outcomes Research*, **9**, 39-49. https://doi.org/10.36469/jheor.2022.31825

[6] Darnell, J., Jain, S., Sun, X., Qin, H., Reynolds, T., Karris, M.Y., *et al.* (2021) Impact of Switching to Tenofovir Alafenamide on Weight Gain as Compared to Maintaining a Non-Tenofovir Alafenamide Containing Regimen. *Medicine*, **100**, e27047. https://doi.org/10.1097/md.0000000000027047

[7] Damas, J., Munting, A., Fellay, J., Haerry, D., Marzolini, C., Tarr, P.E., *et al.* (2024) Weight, Anthropometric and Metabolic Changes after Discontinuing Antiretroviral Therapy Containing Tenofovir Alafenamide (TAF) in People with Human Immunodeficiency Virus (HIV). *Clinical Infectious Diseases*, **79**, 990-998. https://doi.org/10.1093/cid/ciae189

[8] Sekiya, R., Muramatsu, T., Ichiki, A., Chikasawa, Y., Bingo, M., Yotsumoto, M., *et al.* (2023) Young Age Is a Key Determinant of Body Weight Gain after Switching from Tenofovir Disoproxil Fumarate to Tenofovir Alafenamide in Japanese People Living with HIV. *Journal of Infection and Chemotherapy*, **29**, 171-178. https://doi.org/10.1016/j.jiac.2022.10.014

[9] Gallant, J.E., Daar, E.S., Raffi, F., Brinson, C., Ruane, P., DeJesus, E., *et al.* (2016) Efficacy and Safety of Tenofovir Alafenamide versus Tenofovir Disoproxil Fumarate Given as Fixed-Dose Combinations Containing Emtricitabine as Backbones for Treatment of HIV-1 Infection in Virologically Suppressed Adults: A Randomised, Double-Blind, Active-Controlled Phase 3 Trial. *The Lancet HIV*, **3**, e158-e165. https://doi.org/10.1016/s2352-3018(16)00024-2

[10] Hassan, K.S. and Balkhair, A. (2019) Prevalence of Nephrotoxicity in HIV Patients Treated with Tenofovir Disoproxil Fumarate: A Single-Center Observational Study. *Oman Medical Journal*, **34**, 231-237. https://doi.org/10.5001/omj.2019.44

[11] Yuh, B., Tate, J., Butt, A.A., Crothers, K., Freiberg, M., Leaf, D., *et al.* (2015) Weight Change after Antiretroviral Therapy and Mortality. *Clinical Infectious Diseases*, **60**, 1852-1859. https://doi.org/10.1093/cid/civ192

[12] Zhao, X., Prajapati, G., Tse, J., Near, A.M. and Kumar, P.N. (2023) Weight Gain after Antiretroviral Therapy Initiation in People Living with HIV in the United States: Analyses of Electronic Medical Records and Prescription Claims. *Current Medical Research and Opinion*, **39**, 997-1006. https://doi.org/10.1080/03007995.2023.2224165

[13] Hutfless, S., Maruthur, N.M., Wilson, R.F., *et al.* (2013) Strategies to Prevent Weight Gain Among Adults [Internet]. Agency for Healthcare Research and Quality (US). https://www.ncbi.nlm.nih.gov/books/NBK133211/

[14] Bai, R., Lv, S., Wu, H. and Dai, L. (2022) Effects of Different Integrase Strand Transfer Inhibitors on Body Weight in Patients with HIV/AIDS: A Network Meta-Analysis. *BMC Infectious Diseases*, **22**, Article No. 118. https://doi.org/10.1186/s12879-022-07091-1

[15] Sokhela, S., Venter, W.D.F., Bosch, B., Woods, J., McCann, K., Akpomiemie, G., *et*

al. (2024) Final 192-Week Efficacy and Safety Results of the ADVANCE Trial, Comparing 3 First-Line Antiretroviral Regimens. *Open Forum Infectious Diseases*, **11**, ofae007. https://doi.org/10.1093/ofid/ofae007

[16] Bares, S.H., Wu, X., Tassiopoulos, K., Lake, J.E., Koletar, S.L., Kalayjian, R., *et al.* (2024) Weight Gain after Antiretroviral Therapy Initiation and Subsequent Risk of Metabolic and Cardiovascular Disease. *Clinical Infectious Diseases*, **78**, 395-401. https://doi.org/10.1093/cid/ciad545

[17] Al-Mawali, A., Al-Harrasi, A., Jayapal, S.K., Morsi, M., Pinto, A.D., Al-Shekaili, W., *et al.* (2021) Prevalence and Risk Factors of Diabetes in a Large Community-Based Study in the Sultanate of Oman: STEPS Survey 2017. *BMC Endocrine Disorders*, **21**, Article No. 42. https://doi.org/10.1186/s12902-020-00655-9