Exercise impacts positively on bone mineral density in human immunodeficiency virus seropositives: Do health professionals know?

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Abstract

Background

Despite the concomitant negative effects of human immunodeficiency virus on bone mineral density in HIV-infected persons, studies on knowledge of effect of exercise on this health parameter in HIV population among health professionals seem unavailable. This study therefore examined knowledge of effect of exercise on BMD in HIV-infected persons among health professionals.

Methods

This cross sectional survey employed researcher designed, experts - validated questionnaire to enroll 434 respondents. The reliability coefficient “r” of the questionnaire was 0.75 with 92% response rate. Descriptive and inferential statistics were used to summarize and analyze the data respectively. The alpha value was set at 0.05.

Results

Age range and mean age in years of the respondents were 21–59 and 35.88 ± 9.09 respectively; age group of 30–39 years predominated (45.3%). Males were in preponderance (52.4%), and most (74.4%) were married; while majority (54.7%) were nurses. Substantial proportion (54.2%) had less than good knowledge on the subject examined in this study. Significant difference ($p < 0.05$; $p = 0.015$) in knowledge of effect of exercise on BMD in HIV population existed among the professions. Post hoc showed that knowledge of the physicians ($p = 0.001$) and laboratory scientists ($p = 0.029$) was significantly higher than that of the nurses. Physiotherapists’ knowledge on this subject compared to that of other health professionals was statistically insignificant ($p > 0.05$).

Conclusion

Knowledge of effect of exercise on BMD in HIV infected persons among health professionals was surprisingly below expectation, and therefore appalling.

Background

Human immunodeficiency virus (HIV) is one of the rampaging public health issues with profound negative impacts on lives of the infected persons, their families, communities and the society at large [1]. With its pandemic proportion, it behooves health professionals to be familiar and equipped with current facts, information and knowledge on the effect of exercise on the overall wellbeing of this population [2]. This infection ferociously attacks different systems of the body with resultant ominous complications. Such complications according to Kruger and Nell [3], include irregularities in lipid and glucose

metabolism culminating to cardiovascular disorders and other non-communicable ailments; redistributions of adipose tissues as seen in lipodystrophy with attendant loss of body image; alteration in musculoskeletal apparatus as observed in muscle weakness and atrophy, and reduced bone mineral density (BMD) resulting to osteopenia and osteoporosis with inherent future fall related fractures, and legions of psychosocial issues. These complications invariably affect not only the psychological, but also physical and physiological well-being of HIV-infected persons which inadvertently result to increased risk for morbidity and mortality.

Most HIV seropositives present with bones that are fragile and less thick or dense than those in the normal population. This cohort possesses low BMD as measured by dual energy x-ray absorptiometry (DEXA) [4]. Bone density is a quantitative measurement of bone mass by the amount of minerals in grams per square centimeter (g/cm^2) of bones [5]. This quantitative measurement is used in clinical medicine as an indicator of osteoporosis and fracture risks 5]. Highly active antiretroviral therapy (HAART), a combined therapy effective in HIV management also reduces BMD just as the infection itself [6]. Brown et al.[7] reported that studies assessing effects of initiation of HAART on BMD unanimously reported 2%–6% loss of BMD after 48–96 weeks of therapy, regardless of HAART's type. This quantity of bone loss is larger than that obtained in aging alone [8]; and is equivalent to one seen in women aged 50–59 years over a period of two years [9]. Earlier commencement of HAART mitigates bone loss, because lower CD4 cell count before the initiation of HAART leads to greater loss in BMD [10].

Effective strategies to prevent and treat reduced BMD in HIV seropositives receiving HAART are presently obscure [11]. Ali et al. [12] asserted that some pharmacological agents like bisphosphonates, teriparatide and denosumab, as well as vitamin D and calcium supplements are beneficial in the management of reduced BMD resulting from HIV and its drug therapy. However, earlier studies [13-15] found that these pharmacological remedies are associated with severe unpleasant effects such as tumors, infections, nasopharyngitis, osteosarcoma and bronchitis. Harris and Brown [15] therefore advised that these drugs should be utilized cautiously in HIV cohort. Additionally, the cost of these pharmacological agents is quite exorbitant [16]; and according to Chisati et al. [11], the drugs tend to amplify the pill burden inherent in HIV seropositives who are already saddled with HAART. Furthermore, use of pharmacological agents to treat low bone mass in HIV is known to increase non therapy adherence and compliance in the overall management of the infection [17

With these manifold adverse effects of drugs that combat bone loss in HIV infected persons, Howe et al. [18] reported that exercises (jogging, weight lifting, press ups, quadriceps drilling, squatting etc.) which impact forces on bones and muscles are unanimously recommended as non-pharmacological strategies for preventing and managing bone loss in HIV seropositives. Grace et al. [19] posited that impact activities and relatively high intensity progressive resistance exercises are beneficial in managing reduced BMD in this population receiving HAART. Kelley et al. [20] had also found that progressive resistance exercise interventions seem to yield higher adherence rate and compliance compared to pharmacological intervention in treating low BMD. Over two decades ago, Standish et al. [2] reported that exercise is consistently identified as the most common accessible and easily available, nontoxic and cheapest

adjunct therapy for HIV management in the developed countries such as the United States (US). Indeed, the common catchphrase, “exercise is medicine in health and disease”, is never more apposite than when applied to the universal management of HIV infection.

Despite growing evidence that exercise increases BMD in the normal population [21,22] the impact of exercise on loss of bone mass resulting from either HAART, HIV infection or both has neither been fully explored nor promoted [19]. One study by Santos et al. [23] in Brazil seems to have so far empirically examined the effect of progressive resistance exercise on BMD in HIV population. Earlier, Santos et al. [24] acknowledged the absence of data on knowledge of impact of exercise on bone health in HIV population known to be vulnerable to fracture risks. In corroboration, Chisati et al. [11] stated that knowledge on effect of exercise in increasing BMD among HIV population is presently not easily available for referencing. Maduagwu et al. [25] had hypothesized that lack of knowledge on the effect of exercise on HIV-infected persons among health professionals might be the reason for the dearth of literature in the developing nations on the impact of exercise on this population living with HIV. Additionally, Oyeyemi et al. [26] posited that adequate knowledge, skills, readiness and willingness to provide care are prerequisites for effective management of persons infected with diseases such as HIV.

We envisage that knowing and understanding the favorable impact of exercise on bone mass in HIV cohort among health professionals may stimulate interest to conduct empirical studies on this field. The authors also hope that the outcome of the envisioned studies may encourage the utilization of exercise in the management of low BMD and probably other amenable complications inherent in HIV population, especially in low income countries. It was based on this premise, we conceived and designed this survey to evaluate the knowledge of health professionals on the impact of exercise on bone mineral density in HIV seropositives. This survey also serves as a precursor to our future study on the effect of exercise on bone mass in HIV infected persons.

Methods

This cross-sectional survey was conducted at a tertiary teaching hospital located in Maiduguri, Borno State, Nigeria which comprises over 500 beds. This health facility serves approximately 25 million people in Nigeria, and the adjoining countries (Cameroun, Chad and Niger republics). The facility has remained as a focal point of excellence in immunology and infectious diseases for more than three decades. Maiduguri is the largest and most commercialized city in the North-eastern geopolitical zone of Nigeria; and was also the capital city of the then North-eastern Nigeria. It is presently the capital of Borno State which occupies an area of about 50,778km^2, and lies on latitude 115^{0}N and longitude 135^{0}E. The estimated population of Borno State based on 2006 population census is 4,098,391 and it is bordered by three countries; Niger to the North, Chad to the Northeast and Cameroun to the East [27].

Population for this survey was health professionals (nurses, physicians, medical laboratory scientists, pharmacists, physiotherapists and radiographers) practicing at the teaching hospital and had contact with HIV seropositives. From the database of the hospital managed by the administrative office, we took

permission from the head of the administration and obtained the list of each of these professional groups by their individual staff number. From the list, there were 473 nurses, 223 physicians, 58 medical laboratory scientists (MLSs), 23 pharmacists, 18 physiotherapists and 15 radiographers who had practiced for at least one year. We used simple random sampling technique to enroll the nurses, physicians and MLSs; whilst the whole population of each of the pharmacists, physiotherapists and radiographers was used due to their respective small population sizes [28].

The simple random sampling technique for the enrolment of the first three health professional groups was as follows: the staff numbers of the nurses were arranged chronologically and serially; so also those of the physicians and MLSs. In essence, the oldest staff number on the list was the number one, followed by others. We selected every odd number from the chronologically arranged numbers of each aforementioned three professional groups. For instance, for the nurses, we selected 1,3,5,7,9,…,473. At the end of this sampling method, we had 237 nurses, 112 physicians and 29 MLSs, totaling 378. Total number of the pharmacists, physiotherapists and radiographers was 56. Thus, the sample size for this survey was 434. For easy administration and identification, and to avoid confusion, every staff number selected was written on each questionnaire for individual professional group. A participant was therefore administered the questionnaire that bore her/his staff number.

A researcher designed questionnaire on knowledge of effect of exercise on bone mineral density in HIV infected persons was the tool for this survey. The questionnaire was developed by the authors, and subjected to face and content validity by four professors who are experts in orthopedics and sports physiotherapy, cardiopulmonary physiotherapy, exercise physiology and infectious diseases. To ensure consistency, test re-test reliability of the instrument was administered on 20 health professionals randomly selected from the studied population, but were not part of the study. After two weeks, we re-administered the instrument on the same 20 health professionals. The computed reliability co-efficient, “r” was 0.75, signifying that the questionnaire is very strongly reliable. Section A of this questionnaire comprises both open and close-ended questions on respondents’ socio-demographic characteristics**.** Before completing section B of the questionnaire, every respondent was expected to tick/check YES or NO to a question, “Do you have knowledge on effect of exercise on bone mineral density in HIV- infected persons”? Those that checked YES continued with section B. Section B contains close-ended questions of 20 items, each with three domains (“Agree”, “Disagree” or “not sure” responses) for assessing the knowledge of effect of exercise on bone mineral density in HIV- infected persons. Examples of the wordings on the items are: **“**Exercise is an alternative therapy in management of reduced bone mineral density in HIV patients”, “Swimming is a better exercise for bone mineral density than walking”, “Progressive resistance exercises are proven not to be safe or beneficial in improving bone health in HIV population”, “Brisk walking and cycling can provide significant improvement in bone mineral density for HIV seropositives”, “Strength increases after training protocol in HIV seropositives, it may as well increase bone mineral density because of the more expressive traction of the muscles to the bones”, “Stepping or stair climbing exercise is not ideal when administering exercise for bone mineral density in HIV infection”. A correct and wrong answer to each question scores 1 and 0 respectively; hence the summative and maximum score is 20, and minimum 0. An “Agree” response to a correct statement scores 1, a “Disagree”

response to a wrong statement also scores 1. Whilst an “Agree” response to a wrong statement scores 0, a “Disagree” response to a correct statement also scores 0. “Not sure” response is disregarded.

The aggregate of these scores were computed and the cumulative mean scores of the respondents in each professional group were compared with one another in the analysis. Also, the cumulative mean scores of the respondents based on their sociodemographics were compared. The higher the score, the more knowledgeable the health professionals were on the effect of exercise on bone mineral density in HIV seropositives. To determine the level of knowledge on the effect of exercise on bone mineral density in the HIV population among the health professionals, the scores were ranked as follows: 0 – 4 signifies poor knowledge; 5 – 9 indicates fair knowledge; 10 – 14 connotes good knowledge; ≥15 suggests very good knowledge.

The Research and Ethics Committee of the tertiary teaching hospital gave approval for the survey (approval number: UMTH/REC/19/425). We took permission from the Heads of Departments of each professional group enrolled for this study to enable us administer the questionnaire. We then approached and implored each Departmental secretary of the Departments to assist in issuing each copy of the questionnaire to each respondent. Written informed consent form containing the purpose, protocol, benefits and essence of the study as well as the assurance of confidentiality of the information obtained was attached to each of the questionnaire. Completing the questionnaire confirmed consent to participate in the study. We gave each secretary the corresponding number of the copies of the questionnaire based on the computed sample size. We instructed them to give each participant a questionnaire that bore her/his staff number. We also instructed the secretaries to inform the participants to drop the completed questionnaire in a medium sized carton which had an opening large enough to enter the completed questionnaire. We placed each carton at the office of the secretary of each Department. This adopted method of administering and returning the questionnaire, and the comprehensive enrolment of the 23 pharmacists, 18 physiotherapists and 15 radiographers were to guarantee anonymity and increase the response rate.

Statistical analysis

Descriptive statistics of mean, standard deviation, frequency counts and percentages summarized the sociodemographic characteristics and level of knowledge of the participants. Inferential statistic of Student t- test for independent samples analyzed the knowledge of effect of exercise on BMD in HIV-infected persons between male and female participants, and between those with and without post-graduate qualifications. One way analysis of variance (ANOVA) analyzed differences in the knowledge of effect of exercise on bone mineral density in HIV- infected persons among health professionals in other five remaining socio-demographic variables. Level of significance was set at $p \leq 0.05$ using Statistical Package for the Social Sciences (SPSS) version 20.0 software (SPSS Inc. Chicago, Illinois, USA).

Results

Out of the 434 copies of the questionnaire administered, 18 nurses, 10 physicians, three MLSs, two pharmacists and two radiographers did not return their copies; all physiotherapists returned theirs. Thus, copies returned were as follows: 219 nurses, 102 physicians, 26 MLSs, 21 pharmacists, 18 physiotherapists and 13 radiographers; totaling 399 equating to 92% response rate. Of these 399 retrieved copies, three nurses and one laboratory scientist did not duly complete theirs, and were discarded. We summarized and analyzed data based on 395 copies duly completed. All the respondents have knowledge on the effect of exercise on BMD in HIV seropositives.

Age range and mean age in years of the respondents were 21-59 and 35.88±9.09 respectively; those in the age group of 30-39 years predominated (45.3%). Males were in preponderance (52.4%), and most (74.4%) were married; while majority (54.7%) were nurses. Participants with degree certificates accounted for 85.3% and those without post graduate qualification constituted 80.2%. Respondents with one to 10 years working experience comprised 70.1% and most (56.0%) were of low rank. Table 1 shows the demographic characteristics of the respondents. Respondents with fair knowledge of effect of exercise on HIV- infected adult questionnaire accounted for 47.3% as portrayed in Table 2.

Table 3 depicts significant difference ($p>0.05$; $p = 0.015$) in knowledge of effect of exercise on bone mineral density in HIV seropositives across the professional groups. Least significant difference (LSD) Post-hoc test (Table 4) shows that this significant difference existed between Medicine and Nursing, and Medical Laboratory Science (MLS) and Nursing. The mean score depicts that physicians (9.97±3.178) and MLSs (9.67±2.302) are more knowledgeable on this subject than Nurses (8.76±2.951). The mean score (10.25±3.751) of the Physiotherapists portrays that they have knowledge on effect of exercise on BMD in HIV population more than the other respondents, although this knowledge is statistically insignificant ($p > 0.05$).

Discussion

Our study on knowledge of effect of exercise on BMD in HIV seropositives among health professionals seems to enjoy global novelty. Thus, we hope that its publication in highly impact, competitive journal with open accessibility may contribute in stimulating health related exercise scientists to employ this nontoxic, low cost, easily available and accessible therapy in the prevention and management of reduced BMD, and other complications inherent in HIV seropositives.

There was a relatively more male respondents (52.4%) in this study. This is not confounding, because in Nigeria most health professions from training, apart from nursing, are dominated by males. This male preponderance conforms to the findings from a study by Maduagwu et al. [25]. The male bias in this study might also be linked to socio-cultural and religious factors which play a major role in the social and public lives of the inhabitants of Northeastern Nigeria where the study site is situated. In this part of Nigeria, most women are saddled with child bearing and upbringing, and are therefore restricted to the four walls of their homes; neither public nor work life is encouraged [29]. Nurses predominated other professions in this study, the reason is not implausible because in most public hospitals in Nigeria,

nurses constitute the highest workforce among other health professionals. It may also be likely that the relative short periods of their training at many non-university public health institutions in the country might be a factor.

Substantial proportion of the participants was between the ages of 20 and 39 years. It could be reasoned that this age bracket constitutes the age of graduation for most health professionals in our clime, apart from nurses trained at non-university institutions. It could also be deduced that this age group is the peak age of productivity and strength of any work force in most organizations. Majority of the respondents had degree certificates which means they acquired university education. In our clime, diplomas are awarded to non-university graduates; most nurses are trained in non-university institutions, and these professionals predominated our study. It is therefore confounding that respondents in this study possessing degree certificates were in preponderance. From the authors' observations and anecdotal findings, some nurses, while working, strive to gain admission into the universities (mostly on part-time bases) to obtain degrees, some of these degree qualifications may necessarily not be in nursing. It was an over sight on the part of the authors not to instruct the respondents to report only the educational qualifications used in securing the employment. This may likely constitute one of the limitations to this study, because the result on educational qualification would perhaps have been different. The ratio of respondents without postgraduate qualification to those that possess such qualification is 4:1. This is not unexpected because in Nigeria, the minimum entry requirement for any health professional who desires to pursue a clinical career at the hospital is the first degree, apart from nurses whose entry requirement may either be diploma or degree for the few who graduated from the university, mostly the younger ones.

Significant number of the respondents had less than good knowledge on the subject under discussion. The reason for this may not be easily deduced since health professionals are expected to be conversant and furnished with current facts, information and knowledge on the effect of exercise on the overall wellbeing of individuals infected with HIV [2]. This laissez-faire in knowledge of the effect of exercise on BMD in HIV seropositives among the respondents may however be connected to the old time belief that exercise suppresses immune functions and thus increases HIV replication [30]. However, current evidence has debunked this belief and shows that exercise can reduce HIV replication and does no harm to the immune system [31]; but rather boosts and has promising effects on immune, cardiorespiratory and psychological functions, as well as body composition and metabolic status of HIV infected persons [32-34]; and improves BMD in this population [23].

Significant difference ($p<0.05$; $p=0.015$) in knowledge of effect of exercise on BMD in HIV seropositives existed among the professional groups. To determine where this significant difference was, we employed LSD post hoc test which showed that physicians' knowledge on the subject was significantly higher ($p<0.05$; $p=0.001$) than that of the nurses. The laboratory scientists also demonstrated significantly greater ($p<0.05$; $p=0.029$) knowledge on the effect of exercise on BMD in HIV seropositives than the nurses. Although the physiotherapists had the highest mean score (10.25 ± 3.751) on the subject, their knowledge was not significant ($p>0.05$) when compared with those of the other professional groups.

Ideally, it is expected that physiotherapists should demonstrate significantly greater knowledge than the other professional groups since they incorporate exercise therapy in their practice; design, prescribe and administer exercise in both disease and health. This observed insignificant difference may not be astounding, because Oyeyemi et al. [35] found that Nigerian physiotherapists were neither familiar nor willing to manage persons living with HIV/AIDS, and showed unsatisfactory knowledge of universal precautions and AIDS pathophysiology, and low ethical temperament when it comes to providing care for persons living with HIV/AIDS [26]. Also in Canada, Worthington et al. [36] reported that most physiotherapists hardly manage persons living with HIV, were uncomfortable with the idea and HIV training was not incorporated in the rehabilitation degree curricula. Additionally, O'Brien et al. [37] reported that few physiotherapists in Canada work with persons living with HIV.

Conclusion

Exercise has been shown to have a favorable effect on BMD in HIV seropositives, yet the findings of this study showed that the respondents had low knowledge about this effect. This low knowledge is worrisome as it beats the expectation of an average health professional regarding the importance of exercise among persons living with HIV. Since there is a low knowledge, this translates to inadequate utilization of exercise as a treatment option regardless of its numerous benefits among HIV seropositive individuals.

Limitations

This study was single setting centered, hence the outcome may not be a true representation of factual situation among health professionals across other centers and settings. This may affect the generalization of the findings. Further studies, therefore, are required in multiple centers in order to ascertain a clearer view of the knowledge level of health professionals about the effect of exercise on BMD in HIV seropositive individuals. Also, information on educational qualifications of the participants in this study did not take into account the varying qualifications among nurses which might have introduced some bias in the result on qualifications.

Abbreviations

HIV
Human immunodeficiency virus
BMD
Bone mineral density
DEXA
Dual energy x-ray absorpmetry
HAART
Highly active antiretroviral therapy
MLSs

Medical laboratory scientists

Declarations

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Authors' Contributions

SMM conceived and design the study, and contributed to data collection; SZ and UAM participated in the design of the study and contributed to data collection; CAN, KUA and EYI contributed to data analysis and interpretation of results; IBN, ACO and JOU contributed to data analysis; UPO and CSM contributed to data analysis and interpretation of results. All authors contributed immensely to the manuscript writing, corrections and rewriting. Finally, all authors read thoroughly and approved the final version of the manuscript. They also agree with the order of presentation of the authors.

Authors' information

SMM is presently a Nigerian Technical Aid Corps volunteer in Uganda, East Africa.

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Availability of Data and Materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The Research and Ethics Committee of the University of Maiduguri Teaching Hospital, Maiduguri, Nigeria gave approval for the survey (approval number: UMTH/REC/19/425). We took permission from the Heads of Departments of each professional group enrolled for this study and participants signed informed consents to enroll in the study. Furthermore, all the methods were carried out in accordance to relevant guideline and regulations.

Consent for publication

Not Applicable (NA)

Competing interests

The authors declare that they have no competing interests.

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Tables

Tables 1 to 4 are available in the Supplementary Files section.

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