JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

Evaluation of Incidence of Awareness of Osteoporosis among the General and Schedule Tribal College Students

Gargee Mohanty

P.G. Department of Zoology, Maharaja Sriram Chandra Bhanja Deo University, Baripada, Mayurbhanj-757003, Odisha, India

gargee.mohanty@gmail.com (Corresponding Author)

ABSTRACT

Objectives: To appraise and compare the general awareness and knowledge of osteoporosis (OP) among college students of general and schedule tribe (ST) population. The study also focuses on the knowledge on the role of diet and exercise on OP onset as well as the attitude of students regarding the diagnosis and prevention practices.

Study design: The study was conducted through community survey, among general and tribal college students

Methods: A cross sectional study based on a reliable questionnaire was carried out among the students. The study was done from January 2018 to March 2018.

Results: Awareness amongst the students of both general and ST population on OP was below 60%. There was a significant difference in the knowledge of OP, role of diet, exercise, diagnosis and preventive practices between the two populations of students.

Conclusion: It was evident from the study that the awareness and knowledge on dietary habits and exercise as well as the diagnosis and preventive practices among the students belonging to ST population is significantly less than the general population. Students of general population also carry a moderate awareness and knowledge on different aspects of OP.

Keywords: Osteoporosis, Schedule Tribes, Diet, Calcium, Vitamin D.

1. Introduction

Osteoporosis can be defined as a systemic skeletal disease, characterized by reduction in the bone strength and an accelerated possibility of bone fracture. OP can also be associated with low bone mass and deterioration of micro-architectural arrangement of bone tissue [1]. The World Health Organization (WHO) has graded osteoporosis to be the 10th most common worldwide disease that has affected a lot of people of modern world [2], [3]. Data reveals that annually more than 8.9 million fractures are caused due to osteoporosis[4]. Osteoporosis can affect both male and female individuals but females are more prone to this disease especially women those who are in their postmenopausal phase of life[5].

There are many causes that lead to osteoporosis. Some are termed are non-modifiable factors like genetic traits, issues related to reproductive system, age, hormonal imbalance. Modifiable risk factors include smoking and alcohol drinking habits, doing less physical activity and sedentary life style, having a low body mass index and intake of less dietary calcium and vitamin D than their standard recommended doses.

Osteoporosis can be cured if diagnosed at an early stage of its occurrence. However,due to carelessness and ignorance about the signs and symptoms of this disease people often neglect them and thus suffer severely at a later stage in life. Sometimes due to late diagnosis the disease becomes incurable andas time lapses from the days of its initial attack bones become fragile, lose their micro – architectural arrangements and become more susceptible to bone fracture. In addition to this bone porosity which occurs due to OP becomes difficult to get repaired and recovered [6], [7].

The incidence of OP in Indian subcontinent has increased over a couple of years. People of this region of the globe are not much aware of OP, its signs and symptoms and about the adverse health impact it can cause after its onset. Hence, do not for a timely consultation with physician to seek advice and take curable measures. Therefore to check prevalence of OP in the society a proper knowhow about the signs and symptoms, its diagnostic protocols and knowledge of dietary calcium and exercise on OP needs to be undertaken [8], [9].

A few studies have been conducted on OP in Indian subcontinent [10]. Conversely, with regard to osteoporosis awareness amongst students, current literature is limited with only a small study being conducted amongst students in different parts of the globe[9], [11]. For this reason, awareness and spreading of knowledge regarding the risk factors, self – assessment methods, recommended diet, need of exercise, exposure to early morning sunlight and timely diagnosis and treatment should be imbibed in the youth of thecountry so that they can be ambassadors for the awareness campaign for OP in the society. Young students always bring a change in the society as they are able to connect both the younger and older generation of a nation[4], [11], [12].

Taking into consideration the fact that there is a scarcity of data on osteoporosis prevalence in Indian population, the present study aims to evaluate the percentage of awareness on osteoporosis among the college students of general and schedule tribe population. An assessment has also been made to understand the role of diet and exercise on osteoporosis occurrence, and the general practices associated with osteoporosis diagnosis and preventive measures. The study has been carried out in Baripada, the district headquarters of Mayurbhanj, Odisha. Mayurbhanj is one of the tribal dominated districts of Odisha. Its tribal population account for 58.7% of the total population of the district[13]. The tribes are considered to be economically backward the literacy percentage of tribal population is comparatively less than the other classes of the population. However, the Government of India as well as the State Government has taken enough measures to uplift this section of society. Presently, a lot of children and young people have joined educational institutes to pursue their education and hence many remarkable and positive societal changes have been recognized. Therefore, in the present study we have also tried to compare the extent of awareness of OP between the general and tribal community. The study tools include a questionnaire related to socio-demographic characteristics and general health information of the population and test of OP knowledge questionnaire that covers student attitude on OP, test of the knowledge on the role of diet and exercise on OP attack and awareness about the diagnosis and preventive protocols and practices.

2. Materials and Methods

2.1. Study design and setting:

The study was conducted through community survey, among general and tribal college students of Baripada Town from January 2018 to March 2018.

2.2. Sample size and population

This study included 400 college students aged 19-25 years studying in different colleges of Baripada, the district headquarters of Mayurbhanj district of Odisha, India. A simple random stratifiedsampling was done during the study.

2.3. Study Tools

Demographic data about the gender, stream of education, their BMI, caste, blood pressure was collected through a general set of questions. OKAT questionnaires were used to collect demographic data about the gender, stream of education along with 24 items for which the students to gave their response. The questionnaire was prepared with an intension to assess the knowledge on 3 basic areas of osteoporosis which included attitude on osteoporosis, relation of dietary habits and exercise on osteoporosis and diagnosis

and preventive practices that should be taken for osteoporosis[8]. The first 12 questions were intended to evaluate the attitude of college students on osteoporosis, question number 11-20 were asked to sort out the knowledge on the recommended calcium intake and relation of dietary habits and exercise on osteoporosis while the last 4 questions were asked to assess diagnostic and preventive practice against osteoporosis. The questionnaire contained questions with two options (correct/ incorrect). Students who answered more than 60% of the questions correctly were considered to be aware of osteoporosis. Data analysis was done with SPSS version 20. The categorical data was presented in terms of percentages and scale data was represented by mean and the standard deviation (SD). Chi-square test of the individual knowledge questions was carried out. One-way ANOVA as well as t-test were carried out to compare the mean score of total questions to know about attitude on OP, dietary habits and exercise as well as questions pertaining to diagnosis and preventive practices against osteoporosis at $p \leq 0.05$.

2.4. Ethical approval

A written consent was obtained from all participants who were enrolled in the survey.

3. RESULTS

Demographics results of the Participants

The demographic data of the total number of students those participated in the survey is represented in Table 1. Out of 400 samples, 242 belonged to general category whereas 158 students belonged to Schedule Tribe community. In both general and ST population; the numbers of female participants were more than that of the male participants (number of general female = 188 and number of ST female were 122). The percentage of students having normal basal metabolic rate (BMR) in general and ST classes are 62.81% and 54.43% respectively. However, the percentages of underweight, overweight and obese students among general category was comparatively less numbers than their corresponding counterparts present in ST population. Likewise, more than 90% students showed normal blood pressure (BP) in both general and ST populations (general = 94.04% and Scheduled Tribe = 92.41%). Out of the total participants of general category about 66% were from science stream and in ST population 41.77% students belong to science stream. In each population those students who gave more than 60% answers correctly were considered to be aware of OP. In the study 56.61% of general students and 37.34% of ST students were found to be aware OP (Table 1).

Table1: Demographics of Participants both General and Scheduled Tribes

Demographics of Students Participated in the Study					
n=400		General (n=242)		ST(n=158)	
	Items	No. of Participants(n)	Percentage (%)	No. of Participants(n)	Percentage (%)
Sl. No	Gender				
1	Male	54	22.31	36	22.78
	Female	188	77.69	122	77.22
	Basal Metabolic Rate (BMR)				
2	Underweight	46	19.01	38	24.05
	Normal	152	62.81	86	54.43
	Overweight	30	12.40	22	13.92
	Obesity	14	5.79	12	7.59
	Blood Pressure (BP)				
3	Low BP	12	4.96	12	7.59
	Normal	230	95.04	146	92.41
	High BP	0	0.00	0	0.00
	Stream				
4	Arts	56	23.14	72	45.57

	Science	160	66.12	66	41.77
	Commerce	26	10.74	20	12.66
	Awareness				
	Aware	137	56.61	59	37.34
	Unaware	105	43.39	99	62.66

Comparison of OP knowledge scores of college students belonging to both general and ST populations is represented in Table 2. Comparing the perception of students towards OP it was found that the students belonging to general population have better knowledge than that of ST population. The average correct score of questions asked to students to judge the perception towards OP was found to be 7.79 and 4.9 for general and ST population respectively. There was a significant difference in the perception of students of general and ST categories ($t=2.968$ at $p\leq0.05$). Likewise the attitude of the students towards the quality of diet and role of exercise on OP revealed that the general students carry a significantly higher average score than the ST students. The scores of dietary habits and exercise in general and ST students were found to be 6.56 and 4.97 respectively with a t-test of 3.026 at $p\leq0.05$. The average knowledge scores for diagnosis and preventive practices are found to be 0.88 and 0.38 in general and ST students with a t-test value of 4.170 at $p\leq0.05$ which is very significant. Both the population found to have less competence in pursuing the diagnosis and preventive practices needed for OP.

Table 3 compares the individual knowledge question scores between the two categories of college students. Chi square analysis with Phi Cramer V test were carried out to evaluate the existence of relationship between the individual question and students score and to find the strength of their association. It was found that except for 2 questions there exists a significant difference in the knowledge score on individual question between the general and ST population. There seems to be less knowledge on diagnosis and preventive practices of OP. The Phi Cramer V score were high and significant for Q21 to Q24 (Table 3). Though significant difference in the score lies for all other variables but the chi square and Phi Cramer V score were very high. The students of general population were found to score significantly high than their corresponding counter fellows for all variables (except for variable number 14 and 15).

A drawback of this study is that the sample selections were limited to college students and therefore may not be representative of osteoporosis knowledge, perceptions, and self-efficacy across the whole country. An additional curb of the tool used is that impenetrable variables such as family history of osteoporosis or existence of an illness involving medication were not medically assessed.

Table 2: Comparison of Osteoporosis Knowledge Scores of College Students belonging to General and Scheduled Tribes population

Osteoporosis Knowledge Score of College students belonging to General and Schedule Tribe Population					
Sl. No	**Test Field**	**Total Students (n=400) Mean ± SD**	**General Population (n=242) Mean ± SD**	**Schedule Tribe Population (n=158) Mean ± SD**	**t-test**
1	**Perception towards OP(Q1 – Q12)**	9.87 ± 0.23	7.79 ± 0.22	4.9 ± 0.28	2.968*
2	**Dietary Habits and Exercise (Q11-Q20)**	10.36 ± 0.18	6.56 ± 0.09	4.17 ±0.14	3.026*
3	**Diagnosis and Preventive Practices (Q21-24)**	2.39 ± 0.21	0.88 ± 0.05	0.38 ±0 .01	4.170*

Table 3: Comparison of individual Responses of College Students of both General and Schedule Tribe Population to Osteoporosis Knowledge Test

Responses of College Students of both General and Schedule Tribe Population to Osteoporosis Knowledge Test					
Sl. No	**Questions**	**% of Correct Answer by General Population**	**% of Correct Answer by ST Population**	**Pearson's Chi square Value**	**Phi - Cramer V Value**
1	Having any type of pain with bone is indicative of risk of getting OP	74.68	60.32	8.291*	0.144*
2	Having a pain before bone fracture is an indication of OP	59.88	38.72	17.379*	0.208*
3	Fracture of bones after a minor fall is indicative of getting OP	62.33	13.92	91.507*	0.478*
4	In females the risk of OP increases after menopause	78.15	30.19	90.154*	0.475*
5	Rheumatoid Arthritis can lead to OP	75.23	58.23	12.771*	0.179*
6	Thyroid Problems can contribute in getting OP	52.34	26.74	26.175*	0.256*
7	Having a family history of OP increases the risk of getting OP in the subsequent generations	65.53	43.18	20.037*	0.224*
8	Aging process leads to the onset of OP	89.26	66.59	31.354*	0.28*
9	Having a higher BMR (Basal Metabolic Rate) enhance the chances of getting OP	37.48	18.36	16.866*	0.205*
10	Taking steroids and or Cortisone for a longer periods (more than 2 months) can enhance the chances of getting OP	21.96	14.22	3.992*	0.1*
11	Daily smoking of cigarette can lead to OP	79.85	58.03	21.405*	0.231*
12	Alcohol consumption lead to OP	82.02	62.15	20.413*	0.226*
13	Doing regular exercise or physical works like gardening, swimming, household works, cycling etc. for 30 minutes can prevent OP onset	57.88	46.19	5.21*	0.114*
14	Intake of recommended amount of calcium through diet can prevent from OP onset	64.54	59.88	0.769	0.044
15	Intake of Calcium and Vitamin supplements can prevent from OP	65.99	58.08	2.551	0.08
16	Vitamin D is required for good bone health	57.48	42.17	43.059*	0.328*
17	Exposure to Sunlight for at least for 10 minutes per day is required for Vitamin D synthesis	67.17	51.66	9.622*	0.155*
18	Vitamin D is required for calcium absorption by the bones	68.39	48.78	15.128*	0.194*
19	2 cups of milk is a good source of dietary calcium and can prevent OP onset	63.21	50.78	718.01*	0.173*

20	Vegetables and Fruits rich in calcium (banana, sardines, broccoli, guava) can be taken as alternative to dairy products in diet to get calcium	49.68	13.28	804.517*	0.754*
21	Low bone mass is a risk factor for OP	24.71	9.38	732.961*	0.72*
22	Bone Densitometry Test is carried out for OP diagnosis	19.38	8.74	721.58*	0.714*
23	Vitamin D test is carried out to know about bone health	28.88	10.6	739.761*	0.723*
24	Early detection and timely treatment can prevent from onset of OP	15.25	8.8	713.276*	0.71*

4. Discussions

Complicated bone health related problems those happen due to osteoporosis are prime causes of disability and transience. Globally each year about 9 million cases of osteoporosis lead to bone fractures. It has been found that the disability caused due to osteoporosis is larger than disability caused due to cancer like diseases[14]. Students should have enough knowledge about osteoporosis so that they can help to bring awareness in the society to avoid the severe damage caused due to OP. Awareness include self – diagnosis by analyzing the signs and symptoms, seeking timely advice from an orthopedic doctor, conduct of relevant medical tests and intake of medicines timely for its cure and preventive measures, physical exercise, intake of recommended amount of calcium through diet or supplements, getting exposure to sunlight for vitamin D synthesis [15]. With such objectives the present cross sectional survey was carried out. The study intended to evaluate the knowledge and practices associated with osteoporosis of college students belonging to general and tribal population. Choosing college students as our sample was done for two reasons. The first reason was that the college students often represent a youth and literate class and if through the study we evaluate their rate of awareness on OP then we can extrapolate the status of OP awareness among other generations of the societal hierarchy. The second reason is that these students can further be instrumental in spreading the message of risk factors associated with OP and adopting preventive and timely measures for its early diagnosis and cure[9]. The findings of the study indicate that knowledge on osteoporosis amongst the respondents was limited; only 56. 61% of general and 37.34% of tribal students achieved a score of ≥ 60% of total knowledge score on awareness (Table 1). Less awareness on OP indicates that the students do not have a thorough idea on OP. It would be due to the reason that they might not have heard and discussed about OP vividly as their course curriculum do not include any topics regarding OP directly or indirectly. From the survey it is found that the students of tribal population scored less in comparison to general students on overall OP awareness. The difference in the score might be due to the fact that the tribal very often confine themselves to their community only and so do not interact much with other people and hence do not get timely and necessary knowledge required for them [16]. Moreover, the percentage of tribal people studying science was also found to be less. So getting knowledge about the signs and symptoms, its perception and diagnosis and preventive measures are likely to be known less to them.

Similar reasons were cited by[9]when they carried out cross sectional studies with medical interns. It was seen that the level of awareness among the female medical interns were less. The worker suggested that the low scoring was obtained as the students participated in the study were fresh and have not started reading them medical course curriculum. They were also found not to have any course material in their previous syllabi pertaining to OP, thus the knowledge of OP among them was limited. In another study accomplished on female medical school entrants of Sri Lanka, similar results were obtained with mean and median scores being 34.8 ± 10 and 35 respectively out of a total score out of 100[17]. Knowledge on perception and ways of early diagnosis, preventive measures and role of dietary habits and exercise on OP is essential because knowing about these things can help in framing prevention programs for the disease[18]. However, in the present study both the populations got average scores on the assessment of role of dietary habits (importance of calcium intake, their recommended amounts and sources) and exercise (Table 2). From table 3 it has been noticed that for each question the percentage of correct answer given by the general students were significantly more than that of the tribal students. In response to the question whether fracture after minor fall indicates that the

subject is prone to OP, about 78% general students opined true for it while only 30% of tribal students gave the correct answer. Similarly the risk of OP increases with menopause in female were supported by more students in general community than the tribal population indicating that the tribal students know very less about OP as they are unable to opine correct answers for very basic questions on osteoporosis. The students however seemed to be conscious about the fact that genetics plays a vital role in the occurrence of OP as the micro architectural structure of bone is believed to be inheritable [19].

However, students of both populations opined that ageing, smoking; alcohol drinking and not doing regular exercise might lead to getting osteoporosis. Participants of both populations reported that intake of recommended amount of calcium, exposure to sunlight is necessary to avoid getting OP (Table 3). Absence of required amount of exercise can play a crucial role in causing low bone density and muscle atrophy both of which enhance the threat of getting osteoporosis[20]. Likewise exposure to adequate amount of sunlight prevents calcium depletion and helps in vitamin D synthesis. Calcium absorption by the bone and muscle cells from the extracellular matrix mainly is done with the help of Vitamin D. Hence, maintenance of calcium and vitamin D in the body can put a check on osteoporosis inception[21], [22]. Further, our study reveals that the percentages of students belonging to both communities are unaware of relation between low bone mass and early onset of OP. The students are also having poor knowledge on diagnosis protocols for bone health tests and the measures that can be taken for cure of OP (Table 2 and 3). Hence, it is necessary to make them responsive for the test to be conducted for early prognosis and treatment of osteoporosis.

There are certain limitations to the study. Only two groups of students belongingto general and tribal populations were included hence, the population studied was not representative of the entire nation. Knowledge on OP was evaluated through identification of perception of students towards OP. Furthermore, factors like socio-economic difference, availability of exercise facilities and intake of balanced diet were not investigated in the study. These factors could have been the probable explanations for disparities noted amongst the studied populations. Further research exclusively targeted to appraise these parameters would be practical in understanding the noted discrepancies. This study thus imitates the need about not only spreading awareness about osteoporosis among young students but also for backing preventative steps against this disease. This would incorporate educating society through youth about intake of recommended amount of calcium either through diet or through supplements and incorporating physical activities in daily life along with having regular exposure to sunlight.

5. Conclusion

It can be concluded that the respondents had a limited understanding regarding osteoporosis. Information did not decipher into practices in averting osteoporosis. Therefore, there is a requirement for health education amongst Indians specially the deprived sections of the society like schedule tribes related to risk factors, dietary habits and exercise as well as diagnosis and prevention practices about osteoporosis in order to weigh down the load of disease on the society.

6. References

[1] Rafraf M, Bazyun B, and Afsharnia F, “Osteoporosis-related life habits and knowledge about osteoporosis among women in Tabriz, Iran,” 2009. Accessed: Jul. 08, 2020. [Online]. Available: www.ipaq.ki.se.

[2] J. A. Kanis, E. V. McCloskey, H. Johansson, C. Cooper, R. Rizzoli, and J. Y. Reginster, “European guidance for the diagnosis and management of osteoporosis in postmenopausal women,” *Osteoporos. Int.*, vol. 24, no. 1, pp. 23–57, Jan. 2013, doi: 10.1007/s00198-012-2074-y.

[3] T. O. Alonge *et al.*, “Factors associated with osteoporosis among older patients at the geriatric centre in Nigeria: A cross-sectional study,” *South African Fam. Pract.*, vol. 59, no. 3, pp. 87–93, 2017, doi: 10.1080/20786190.2016.1272248.

[4] “Osteoporosis Facts and Statistics | International Osteoporosis Foundation.” https://www.iofbonehealth.org/facts-and-statistics/references.html (accessed Jul. 09, 2020).

[5] S. J. Spencer, “Lack of knowledge of osteoporosis: a multi-centre, observational study.,” *Scott. Med. J.*, vol. 52, no. 1, pp.

13–6, Feb. 2007, doi: 10.1258/rsmsmj.52.1.13.

[6] S. L. Greenspan, E. Von Stetten, S. K. Emond, L. Jones, and R. A. Parker, "Instant vertebral assessment: A noninvasive dual X-ray absorptiometry technique to avoid misclassification and clinical mismanagement of osteoporosis," *J. Clin. Densitom.*, vol. 4, no. 4, pp. 373–380, Dec. 2001, doi: 10.1385/JCD:4:4:373.

[7] M. Janiszewska, E. Firlej, D. Zonierczuk-Kieliszek, and M. Dziedzic, "Knowledge about osteoporosis prevention among women screened by bone densitometry," *Prz. Menopauzalny*, vol. 15, no. 2, pp. 96–103, 2016, doi: 10.5114/pm.2016.61192.

[8] T. M. Winzenberg, B. Oldenburg, S. Frendin, and G. Jones, "The design of a valid and reliable questionnaire to measure osteoporosis knowledge in women: The Osteoporosis Knowledge Assessment Tool (OKAT)," *BMC Musculoskelet. Disord.*, vol. 4, pp. 1–7, Jul. 2003, doi: 10.1186/1471-2474-4-17.

[9] M. Bilal *et al.*, "Knowledge, beliefs and practices regarding osteoporosis among female medical school entrants in Pakistan," *Asia Pac. Fam. Med.*, vol. 16, no. 1, pp. 1–7, Sep. 2017, doi: 10.1186/s12930-017-0036-4.

[10] A. Mithal, V. Dhingra, E. L. -, C. A. I. O. F. (IOF, and U. 2009, "The asian audit: Epidemiology, costs and burden of osteoporosis in Asia," *Int Osteoporos Found.*, 2009.

[11] M. Tahir, Q. Iqbal, and A. Naseem, "Exploration of Osteoporosis Knowledge and Perception among Young Women in Quetta, Pakistan," doi: 10.4172/2329-9509.1000145.

[12] D. A. Bailey, R. A. Faulkner, and H. A. Mc kay, "Growth, physical activity, and bone mineral acquisition," *Exerc. Sport Sci. Rev.*, vol. 24, no. 1, pp. 233–266, 1996, doi: 10.1249/00003677-199600240-00010.

[13] "Demography | Mayurbhanj District, Government of Odisha | India." https://mayurbhanj.nic.in/demography/ (accessed Jul. 11, 2020).

[14] O. Johnell and J. A. Kanis, "An estimate of the worldwide prevalence and disability associated with osteoporotic fractures," *Osteoporos. Int.*, vol. 17, no. 12, pp. 1726–1733, Dec. 2006, doi: 10.1007/s00198-006-0172-4.

[15] N. R. Almalki, F. Algahtany, and K. Alswat, "Osteoporosis Knowledge Assessment among Medical Interns," 2016. Accessed: Jul. 09, 2020. [Online]. Available: www.usa-journals.com.

[16] N. Chandra Jana, A. Banerjee, and P. Kumar Ghosh, "Comparing Patterns and Variations in Health Status between Tribes and Non-Tribes in Odisha of Eastern India with Special Reference to Mayurbhanj District," *J. Geogr. Earth Sci.*, vol. 2, no. 2, pp. 49–69, 2014, doi: 10.15640/jges.v2n2a4.

[17] R. E. E. De Silva, M. R. Haniffa, K. D. K. Gunathillaka, I. Atukorala, E. D. P. S. Fernando, and W. L. S. P. Perera, "A descriptive study of knowledge, beliefs an practices regarding osteoporosis among femal medical school entrants in Sri Lanka," *Asia Pac. Fam. Med.*, vol. 13, no. 1, pp. 1–6, Dec. 2014, doi: 10.1186/s12930-014-0015-y.

[18] M. Riaz, N. Abid, M. J. Patel, M. Tariq, and M. Shoaib Khan, "Knowledge about osteoporosis among healthy women attending a tertiary care hospital," 2008. Accessed: Jul. 09, 2020. [Online]. Available: http://ecommons.aku.edu/pakistan_fhs_mc_med_intern_med.

[19] Rafraf M, Bazyun B, and Afsharnia F, "Osteoporosis-related life habits and knowledge about osteoporosis among women in Tabriz, Iran," 2009. Accessed: Jul. 09, 2020. [Online]. Available: www.ipaq.ki.se.

[20] R. Iqbal and A. H. Khan, "Editorial Possible Causes of Vitamin D Deficiency (VDD) in Pakistani Population Residing in Pakistan," 2010.

[21] G. Tortora, *Principles of anatomy & physiology*. Hoboken New Jersey: John Wiley & Sons Inc., 2017.

[22] K. T. Borer, "Physical activity in the prevention and amelioration of osteoporosis in women: Interaction of mechanical, hormonal and dietary factors," *Sports Medicine*, vol. 35, no. 9. Springer, pp. 779–830, Sep. 23, 2005, doi: 10.2165/00007256-200535090-00004.