ORIGINAL ARTICLE

The Influence of Socioeconomic Status and General Health on the Fracture Incidence

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Abstract

Background/Aim: There is an association between patient general health, socioeconomic status and fracture incidence. Aim of this study was to demonstrate the relation between the socioeconomic and health status and the occurrence of fractures in Al-Kindy Hospital residents.

Methods: A prospective cross-sectional study was performed by using data collected from fractured patients in Al-Kindy Teaching Hospital / Baghdad Orthopaedics Outpatient Clinic, between 12 December 2021 and 8 March 2022. A hundred patients aged 20 to 75 years were included in this study. The data were collected using a researcher-administered questionnaire, which included items to assess patient's socioeconomic status (accommodations, occupation, income status, level of education, owing motor vehicle) and assessed patient's health status (height, weight, presence of chronic disease(s), smoking status, alcohol consumption, water source quality, sun exposure, nutrition status).

Results: A 100 patients from Al-Kindy Teaching Hospital between the age 20-75 participated in the study. The incidence of fractures was higher in younger and more active males (68 %) than females (32 %). Highest percent appeared in lower group of socioeconomic status (58 %) and in lower group of health status (44 %). There was a significant relation between health status and body mass index (BMI). Obese and overweight patient were the more vulnerable to fractures.

Conclusion: Fractures are more likely to happen to people with low socioeconomic status, low general health status and overweight people.

Key words: Socioeconomic status; Fractures; Body mass index; General health.

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Introduction

A fracture refers to the occurrence of a discontinuity or disruption, often seen in the structure of a bone. An open or complex fracture is the term used when a shattered bone penetrates the skin. Fractures often occur as a result of vehicular collisions, accidental falls, or sports-related traumas. Additional factors contributing to bone deterioration include inadequate bone density and the presence of osteoporosis.[1]

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Socioeconomic status refers to the societal position or socioeconomic class occupied by a person or a collective entity. Socioeconomic status may be determined by many factors, including education level, occupation, house ownership (weighted by a factor of 0.5), car ownership (weighted by a factor of 0.1) and an adjustment for age relative to 20 (divided by 100). Additionally, those who are retired, jobless, or died are also taken into account when assessing socioeconomic status.[2]

The construct is often quantified as a composite of educational attainment, financial earnings and professional vocation. Analyses of socioeconomic position often uncover disparities in resource accessibility, as well as concerns pertaining to privilege, power and authority. Individuals with less educational attainment may have a higher likelihood of encountering risk variables that make them susceptible to experiencing a fracture, thereby elevating their potential mortality risk associated with such fractures. There is an observed correlation between lower educational attainment and increased death rates associated with fractures. This implies that efforts aimed at preventing and treating fractures should prioritise those with limited educational backgrounds. Moreover, there exists a correlation between lower income and an elevated likelihood of experiencing fractures. Nonetheless, there exists a dearth of knowledge on the influence of one's career, specifically in terms of its degree of physical activity and the socioeconomic status it signifies, on the susceptibility to hip fractures in the latter stages of life.

The elucidation of the connections between socioeconomic status and health often revolves around three primary causal hypotheses: (i) socioeconomic status serves as a determinant of health outcomes, (ii) health outcomes operate as determinants of socioeconomic status, or (iii) both socioeconomic status and health outcomes are influenced by a same underlying element. The existence of significant disparities in health status is a well-documented phenomenon, both among nations categorised as developed or developing, as well as within individual countries across various demographic groupings.[3]

Aim of this study was to demonstrate the relation between the socioeconomic status and the occurrence of fractures in Al-Kindy Hospital residents and to demonstrate the impact of level of education and type of occupation on occurrence of fractures, as well as to determine whether there was association between general health and fracture incidence and measuring the body mass index (BMI) of each patient and determine its effect on occurrence of fractures.

Methods

This was a prospective cross-sectional study. Data were collected from fractured patients in Al-Kindy Teaching Hospital / Baghdad Orthopaedics Outpatient Clinic, between 12 December 2021 and 8 March 2022.

A detailed baseline survey was performed from young and middle-aged adults including socioeconomic characteristics (accommodation, occupation, educational level, number of family members, income status, owning of motor vehicle). The socioeconomic index (SEI) was calculated based on careful assessment performed on a particular reference to:
SEI = education + occupation + house ownership x 0.5 + car ownership x 0.1 + (age—20)/100— retired/unemployed/deceased.[2]

Physical activity, past medical and drug history, sun exposure, nutritional status and water source quality, lifestyle risk factors (smoking, alcohol consuming) were obtained. Smoking behaviour recorded as the number of cigarettes smoked per day as (heavy, moderate, light). Physical activity and alcohol consumption were self-reported by patients. Anthropometric measures included height and weight and BMI was calculated (weight (kg) / (height (m) x height (m)). BMI was categorised as: underweight, normal weight, overweight, obese.[4]

A 100 patients participated in this survey. Inclusion criteria were patients with fracture, aged between 20-75 years. Non-inclusion criteria were patients below 20 years of age and where all data could not be collected. Informed consent was obtained from all participants verbally and in written form. This study was approved but the Scientific and Ethical Committee of Al-Kindy College of Medicine with the registration number EA-5842.

Statistical Analysis

Data were presented in tables and graphs. SPSS version 25 was used to calculate the associations of social and economic factors and various as-

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pects of public health with different age groups of the members participating in the study. Data were compared by using Chi-square test. P-value of < 0.05 was considered statistically significant.

Results

Of the 100 fractured participants 68 % were male, 32 % were female. Most patients were among young age group (49 %) and middle age group (40 %), while 11 % were elderly patients (Table 1).

Table 1: Demographic data of the studied sample and their socioeconomic index (SEI)

Variable	Categories	N	%
Gender	Male	68	68.00
	Female	32	32.00
Age categories	Young age	49	49.00
	Middle age	40	40.00
	Elderly	11	11.00
SEI	Upper	8	8.00
	Middle	34	34.00
	Lower	58	58.00
Income status	Poor	10	10.00
	Intermediate	52	52.00
	Good	31	31.00
	Very good	7	7.00
Owning motor vehicle	No	52	52.00
	Yes	48	48.00
Health status	Upper	16	16.00
	Middle	40	40.00
	Lower	44	44.00
Physical activity	No	86	86.00
	Yes	14	14.00
Chronic disease	Yes	28	28.00
	No	72	72.00
Smoking	Non smoker	47	47.00
	Moderate smoker	24	24.00
	Heavy smoker	29	29.00
Sun exposure	Poor	14	14.00
	Intermediate	22	22.00
	Good	39	39.00
	Very good	25	25.00
BMI	Underweight	1	1.00
	Normal weight	27	27.00
	Overweight	38	38.00
	Obese	34	34.00
Site of fracture	Upper extremity	31	31.00
	Lower extremity	64	64.00
	Others	5	5.00

BMI: body mass index;

Fractures increased with reduced physical activity (86.0 % reported lack of exercise) and increased BMI (38.0 % were overweight and 34.0 % were obese). Majority of the patients reported with lower extremity fracture - 64.0 % (leg 35 %, foot 17 %, thigh 7 %, knee 4 %, pelvis 3 %, ankle 1 %). Fifty-three percent were smokers (moderate smoker 24.0 % and heavy smoker 29.0 %), 28.0 % of patients had chronic disease, 14 % reported poor sun exposure and 22 % intermediate exposure.

Fractures increased with increased socioeconomic deprivation. This category of people with low socioeconomic status 58.0 % included low level of education (illiterate 22.4 %, primary 34.5 %, intermediate 17.2 %, secondary 24.1 % and only 1.7 % who got bachelor or higher degree) comparing with the category of people with higher socioeconomic status where 100.0 % were bachelor and higher (Table 2). In crowded houses in 50.0 % of cases were 5 to 10 members in the house and in 24.1 % more than 10 members.

Table 2: The number of family members according to socioeconomic status

Socioeconomic status	Number of family members	N	%
Upper	None	0	0.00
	3 to 5	3	37.50
	5 to 10	5	62.50
	More than 10	0	0.00
Middle	None	0	0.00
	3 to 5	19	55.90
	5 to 10	14	41.20
	More than 10	1	2.90
Lower	None	1	1.70
	3 to 5	14	24.10
	5 to 10	29	50.00
	More than 10	14	24.10

Majority low socioeconomic status patients (51.7 %) inhabit North Rusafa (Madinah, ALShaab, Jamilah, Binouk ,Saba Abkar, Hay Sumer, AL-Thaealiba, Al-Hussainiah and others) (Table 3).

Upper class people tended to have higher number of bachelor and other higher studies qualifications as compared with other classes (Table 4). People of low socioeconomic class tended to have higher number of unemployed people as compared to other classes (Table 5).

No significant difference was found according to Chi-squared test between BMI and different location of fractures (upper extremities, lower extremities, other sites) (Table 6).

Table 3: The residence according to socioeconomic status

Socioeconomic status	Residence	N	%
Upper	North Rusafa	5	62.50
	Karkh	1	12.50
	South Rusafa	0	0.00
	West Rusafa	0	0.00
	Central Rusafa	2	25.00
	Outside Baghdad	0	0.00
Middle	North Rusafa	16	47.10
	Karkh	7	20.60
	South Rusafa	6	17.60
	West Rusafa	0	0.00
	Central Rusafa	5	14.70
	Outside Baghdad	0	0.00
Lower	North Rusafa	30	51.70
	Karkh	7	12.10
	South Rusafa	10	17.20
	West Rusafa	3	5.20
	Central Rusafa	7	12.10
	Outside Baghdad	1	1.70

Table 4: The distribution of educational level according to socioeconomic status

Socioeconomic status	Level of education	N	%
Upper	Illiterate	0	0.00 %
	Primary	0	0.00 %
	Intermediate	0	0.00 %
	Secondary	0	0.00 %
	Bachelor and higher	8	100.00 %
Middle	Illiterate	0	0.00 %
	Primary	1	2.90 %
	Intermediate	3	8.80 %
	Secondary	11	32.40 %
	Bachelor and higher	19	55.90 %
Lower	Illiterate	13	22.40 %
	Primary	20	34.50 %
	Intermediate	10	17.20 %
	Secondary	14	24.10 %
	Bachelor and higher	1	1.70 %

Table 5: The distribution of occupational status according to socioeconomic status

Socioeconomic status	Occupational status	N	%
Upper	Employee	8	100.00 %
	Freelancer	0	0.00 %
	Unemployed	0	0.00 %
Middle	Employee	18	52.90 %
	Freelancer	5	14.70 %
	Unemployed	11	32.40 %
Lower	Employee	2	3.40 %
	Freelancer	32	55.20 %
	Unemployed	24	41.40 %

Table 6: The body mass index (BMI) in patients with fractures

BMI	Site of fracture (N; %)								p-value
	Upper extremity		Lower extremity		Other site		Total		
Underweight	0	0.00	1	1.56	0	0.00	1	1.00	
Normal weight	11	35.48	15	23.44	1	20.00	27	27.00	0.693
Overweight	12	38.71	23	35.94	3	60.00	38	38.00	
Obese	8	25.81	25	39.06	1	20.00	34	34.00	
Total	31	100.00	64	100.00	5	100.00	100	100.00	

p-value was calculated by Chi-squared test;

Table 7: The socioeconomic index (SEI) in patients with fractures

BMI	Site of fracture (N; %)								p-value
	Upper extremity		Lower extremity		Other site		Total		
Upper	3	9.68	4	6.25	1	20.00	8	8.00	
Middle	9	29.03	22	34.38	3	60.00	34	34.00	0.434
Lower	19	61.29	38	59.38	1	20.00	58	58.00	
Total	31	100.00	64	100.00	5	100.00	100	100.00	

p-value was calculated by Chi-squared test;

The prevalence of the fracture was higher among participants who were with lower socioeconomic status (58 %) and lower level of health status (44 %), but no significant difference was found between groups (Table 7).

Discussion

The association between SEI and fracture and other musculoskeletal disorder is little understood, despite there being an inverse relationship between SEI and most causes of morbidity.

In this study these two variables were chosen (socioeconomic status, general health status) due to the importance of them to determine whether they have a significant relation to the possibility of fractures incidence or not. Hypothesis stated that people with low SEI and low general health status would have a higher incidence rate than the others with higher SEI and general health levels.

There were 68 males with an average age of 35 and 32 females with an average age of 50.4 years which is acceptable since the incidence of fractures are higher in younger and more active males than females despite the increasing potentiality of fracture occurring in older females. This finding goes with results of study by Khalid[5] and is in contrast with finding of Kiebzak et al.[6]

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Moreover, 75 % of females were housewives and the rest were working in a relatively safe jobs like an employee compared to 52.9 % male workers, 16.2 % unemployed and 30.9 % employees. It is needed to be mentioned that even the safe occupations (eg, employee) have some kind of risk including transportation accidents and so on. Researchers noticed a pattern, so their opinion was that the occupation does have an effect on the probability of fracture incidence which was observed and found to be significant in this study. The more dangerous the occupation a higher probability of fracture occur. More male patients in this randomly taken sample were observed and most of them were prone to more danger than the females because of their occupational status. It also should be mentioned that most of these patients with relatively risky occupation belong to the low SEI class (when only males were considered).

In this study most patients were distributed geographically among the regions of Russafa / Baghdad (84 %) with the majority of their accommodations located in north Russafa (51 %) mainly Madinah (Madinah-t-Al-Sadder) and AL-Shaab and about 19 % were distributed among south and east Russafa mainly Baghdad AL-Jadeda, AL-Amin, AL-Mashtal and AL-Obaidi and a smaller percentage of 14 % and 15 % for central Russafa (eg Ziyouna, Karada, AL-Kiffah, Al-Baladiat) and Karkh (eg Jihad, AL-Mansur, AL- Salhia, AL-Baiaa, AL-Sakan), respectively. It was observed that the majority of the patients were from regions known for their active lifestyle considering the relationships between their residents and environmental interactions of them, this might cause a higher probability of getting involved in different accidents that will possibly lead to a higher rate of bone fracture incidences among the people living in this kind of regions, which goes with findings of Li et al.[7] It was also noticed that regions with more disadvantages would have a higher incidence rate of bone fractures, similar with findings of Lo et al.[8]

The effect of diet (nutritional status) on the probability of fracture incidence was also analyses and the BMI was chosen as the indicator of this variable due to a relatively good indication of body fatness.[9, 10] Of the 100 patients it was found that 34 % were obese, 38 % overweight, 27 % normal weight and 1 % underweight and a significant relation between the health status and the BMI index was found. Therefore, the obese

participants made about 60 % of the lower health status class in this sample which indicates more health problems for this group. Some studies suggest that being a bit overweight may not be so bad for the individuals.[11-13]

Moreover, obese patients constitute 39 % of the lower extremity fractures and about 25 % of the upper extremity fractures which does not go with Saverio et al[14] as they found that higher BMI levels is associated with higher incidence of upper extremity fractures (specifically humerus bone) but it does go with Ong et al[15, 16] who found that it is more likely for the obese people to break their lower extremity (specifically, ankle) as well as the upper extremity.

The 100 patients were arranged in three groups depending on the SEI - upper 8 %, middle 34 % and lower 58 %. In this study it was notice a higher incidence of fracture among the lower class of socioeconomic status and that goes with Valentin et al.[17, 18] Also, most of the fractures of the lower class were in the lower extremity which goes against Carlen et al who found that the wealthier population is at 30 % higher risk of lower extremity fractures incidence (specifically hip bone fractures).[19]

As for the general health status, patients were also arranged in three groups upper (16 %), middle (40 %) and lower (with slightly more individuals than the middle group with 44 %). Most of the patients were not exercising on regular bases (86 %) which does not indicate a good health status and that goes with Han et al[20] who found that higher levels of physical activity are associated with fracture prevention.

Limitations

The main limiting factor were the participants, most of them were suspicious and almost scared, even the individuals who agreed to cooperate were giving misleading answers to the questions due to cultural or personal reasons such as feeling ashamed of the answer. Eg there were only three patients who admitted that they have been consuming alcohol which is in some way suspicious and 47 % individuals responded that they had a good diet with a protein source and an amount of vegetables but actually 72 % of them were overweight and obese so it can be assumed that they were ashamed and it necessary to considered these results to be potentially misleading.

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Conclusion

The incidence of fracture is more likely to happen to people with low socioeconomic status and low general health status. The incidence of fracture was higher among men which may be due to their more active lifestyle. Obese and overweight patients were the most vulnerable to fractures, with the lower extremity to be the most common site of fracture in both of them. It was also noticed that the regions with a faster and more active lifestyle and regions with less advantages were associated with a higher incidence of bone fracture among their residents.

Acknowledgement

None.

Conflict of interest

None.

References

1. Witmer DK, Marshall ST, Browner BD. Emergency care of musculoskeletal injuries. In: Townsend CM, Beauchamp RD, Evers BM, Mattox KL, editors. Sabiston textbook of surgery. 20. New York: Elsevier; 2016. pp. 462–504.
2. Omer W, Al-Hadithi T. Developing a socioeconomic index for health research in Iraq. East Mediterr Health J 2017;23(10):670-7.
3. Stowasser T, Heiss F, McFadden D, Winter J. "Healthy, Wealthy and Wise?" Revisited: An analysis of the causal pathways from socioeconomic status to health. In: Wise D. Investigations in the Economics of Aging. Cambridge, MA: NBER Books; 2011. p. 267-317.
4. Weir CB, Jan A. BMI classification percentile and cut off points. 2023 Jun 26. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing. [Cited: 1-Oct-2023]. Available at: https://pubmed.ncbi.nlm.nih.gov/31082114/.
5. Alswat KA. Gender disparities in osteoporosis. J Clin Med Res 2017 May;9(5):382-7.
6. Kiebzak GM, Beinart GA, Perser K, Ambrose CG, Siff SJ, Heggeness MH. Undertreatment of osteoporosis in men with hip fracture. Arch Intern Med 2002 Oct 28;162(19):2217-22.
7. Li W, Keegan TH, Sternfeld B, Sidney S, Quesenberry CP Jr, Kelsey JL. Outdoor falls among middle-aged and older adults: a neglected public health problem. Am J Public Health 2006 Jul;96(7):1192-200.
8. Lo AX, Rundle AG, Buys D, Kennedy RE, Sawyer P, Allman RM, et al. Neighborhood disadvantage and life-space mobility are associated with incident falls in community-dwelling older adults. J Am Geriatr Soc 2016 Nov;64(11):2218-25.
9. Anjos LA. Body mass index as a tool in the nutritional assessment of adults: a review. Rev Saúde Pública 1992;26:431-6.
10. Deurenberg P, Weststrate JA, Seidell JC. Body mass index as a measure of body fatness: age- and sex-specific prediction formulas. Br J Nutr 1991 Mar;65(2):105-14.
11. Romero-Corral A, Montori VM, Somers VK, Korinek J, Thomas RJ, Allison TG, et al. Association of bodyweight with total mortality and with cardiovascular events in coronary artery disease: a systematic review of cohort studies. Lancet 2006;368(9536):666-78.
12. Adams KF, Schatzkin A, Harris TB, Kipnis V, Mouw T, Ballard-Barbash R, et al. Overweight, obesity, and mortality in a large prospective cohort of persons 50 to 71 years old. NEJM 2006;355(8):763-78.
13. Flegal KM, Graubard BI, Williamson DF, Gail MH. Excess deaths associated with underweight, overweight, and obesity. JAMA 2005;293(15):1861-7.
14. Gnudi S, Sitta E, Lisi L. Relationship of body mass index with main limb fragility fractures in postmenopausal women. J Bone Miner Metab 2009;27(4):479-84.
15. Ong T, Sahota O, Tan W, Marshall L. A United Kingdom perspective on the relationship between body mass index (BMI) and bone health: a cross sectional analysis of data from the Nottingham Fracture Liaison Service. Bone 2014;59:207-10.
16. Kelsey JL, Samelson EJ. Variation in risk factors for fractures at different sites. Curr Osteoporos Rep 2009;7(4):127-33.
17. Valentin G, Ravn MB, Jensen EK, Friis K, Bhimjiyani A, Ben-Shlomo Y, et al. Socio-economic inequalities in fragility fracture incidence: a systematic review and meta-analysis of 61 observational studies. Osteoporos Int 2021:1-16.
18. Crandall CJ, Han W, Greendale GA, Seeman T, Tepper P, Thurston R, et al. Socioeconomic status in relation to incident fracture risk in the Study of Women's Health Across the Nation. Osteoporos Int 2014;25(4):1379-88.
19. Reyes C, García-Gil M, Elorza JM, Fina-Avilés F, Mendez-Boo L, Hermosilla E, et al. Socioeconomic status and its association with the risk of developing hip fractures: a region-wide ecological study. Bone 2015;73:127-31.
20. Han S, Jang HD, Choi S, Kim GD, Han K, Lim H, et al. Changes in physical activity and risk of fracture: a Korean nationwide population-based cohort study. Sci Rep 2020 Oct 1;10(1):16266. doi: 10.1038/s41598-020-73495-1.