Süleyman Demirel Üniversitesi
Sağlık Bilimleri Dergisi
Cilt 15, Sayı 1, 9 - 16, 2024

Suleyman Demirel University
Journal of Health Sciences
Volume 15, Issue 1, 9 - 16, 2024

Effect of Family Income Level on Pediatric Upper Extremity Fracture Rate

Aile Gelir Düzeyinin Pediatrik Üst Ekstremite Kırık Oranına Etkisi

Tuğba ARSLAN [1*], Muhammet Zeki GÜLTEKİN [2], Serdar ARSLAN [3], Gökmen YAPALI [3]

[1] Çankırı Karatekin University, Faculty of Health Sciences, Department of Occupational Therapy, Çankırı, Turkey
[2] Konya City Hospital, Orthopedics and Traumatology Clinic, Konya, Türkiye
[3] Necmettin Erbakan University, Faculty of Nezahat Keleşoğlu Health Sciences, Department of Physiotherapy and Rehabilitation, Konya, Turkey

ABSTRACT

Objective: The aim of the study was to compare the sociodemographic characteristics of children with upper extremity fractures with those of children without upper extremity fractures.

Materials and Methods: A total of 161 participants (age:11.24±2.95, female:53, male:108), 100 of whom were admitted to the orthopedics and traumatology clinic in 2022 with upper extremity fractures and 61 without upper extremity fractures, were included in the study. Participants; age, height, weight, mother's education level, mother's age, father's education level, father's age and monthly income of the family were recorded. Fracture and recurrent fracture rates of the participants who were members of a family whose monthly income was below the minimum wage and those who were included in a family with a monthly income above the minimum wage were compared.

Results: The age, height and weight of the participants without upper extremity fractures were greater than those with upper extremity fractures ($p<0.01$). The body mass index of those with upper extremity fractures was lower than those without upper extremity fractures ($p=0.001$). While the number of upper extremity fractures in the participants who were members of families with a monthly income below the minimum wage was 79 (63.70%), the number of fractures in the participants who were members of families with an income above the minimum wage was 21 (56.80%) ($p=0.44$). In addition, when those with upper extremity fractures were evaluated independently from those without upper extremity fractures; While the number of recurrent upper extremity fractures was 7 (33.3%) in the participants who grew up in families with an income above the minimum wage, the number of recurrent upper extremity fractures was 11 (13.9%) in the participants who grew up in families with an income above the minimum wage ($p= 0.04$).

Conclusion: Low body mass index may increase the rate of upper extremity fractures in children. For this reason, families should be informed about the possibility of physical development of children at risk for upper extremity fractures. In addition, the rate of recurrent upper extremity fractures is higher in children of families with a relatively high monthly income. Families with relatively high incomes should be made aware of the safety measures to be taken against accidents in their living spaces.

Keywords: Pediatrics, radius, socioeconomic variables

Alınış / Received: 01.11.2023 Kabul / Accepted: 13.02.2024 Online Yayınlanma / Published Online: 22.04.2024

DOI: 10.22312/sdusbed.1384414
ARAŞTIRMA MAKALESİ

*Corresponding author: tubapksr@gmail.com

ÖZET

Amaç: Çalışmanın amacı üst ekstremite kırığı bulunan çocukların sosyodemografik özellikleri ile üst ekstremite kırığı olmayan çocukların sosyodemografik özelliklerini karşılaştırmaktı.

Materyal ve Metot: Çalışmaya 2022 yılında ortopedi ve travmatoloji kliniğine üst ekstremite kırığı ile başvurmuş 100 ve üst ekstremite kırığı olmayan 61 olmak üzere toplam 161 katılımcı (yaş:11,24±2,95, kız:53, erkek:108) dahil edildi. Katılımcıların; yaşı, boyu, kilosu, annenin eğitim düzeyi, annenin yaşı, babanın eğitim düzeyi, babanın yaşı ve ailenin aylık geliri kaydedildi. Aylık geliri asgari ücret ve altında olan ailenin üyesi olan katılımcılar ile aylık geliri asgari ücretin üstünde geliri bulunan bir aileye dahil olan katılımcıların kırık ve rekürren kırık oranları karşılaştırıldı.

Bulgular: Üst ekstremite kırığı olmayan katılımcıların yaş, boy ve kilosu üst ekstremite kırığı olanlardan daha büyüktü (p<0,01). Üst ekstremite kırığı olanların vücut kütle indeksi üst ekstremite kırığı olmayanlardan küçüktü (p=0,001). Asgari ücret ve altında aylık gelire sahip ailelerin üyesi olan katılımcılarda görülen üst ekstremite kırık sayısı 79 (%63,70) iken asgari ücretin üzerinde gelire sahip aillerin üyesi olan katılımcılarda görülen kırık sayısı 21 (%56,80) idi (p=0,44). Ayrıca üst ekstremite kırığı olanlar üst ekstremite kırığı olmayanlardan bağımsız değerlendirildiğinde; asgari ücrete üzerinde gelire sahip ailerde yetişen katılımcılarda meydana gelen rekkürren üst ekstremite kırık sayısı 7 (%33,3) iken asgari ücret ve altında gelire sahip ailelerde yetişen katılımcılarda meydana gelen rekkürren üst ekstremite kırık sayısı 11 (%13,9) idi (p=0,04).

Sonuç: Çocuklarda düşük vücut kitle indeksi üst ekstremite kırık oranını arttırabilir. Bu nedenle çocukların fiziksel gelişimlerinin üst ekstremite kırığı açısından risk taşıma ihtimaline karşı aileler bilgilendirilmelidir. Ayrıca aylık geliri nispeten fazla olan ailelerin çocuklarında rekürren üst ekstremite kırık oranı daha fazladır. Geliri görece yüksek aileler yaşam alanlarında kazalara karşı alınacak güvenlik önlemleri hakkında bilinçlendirilmelidir.

Anahtar Kelimeler: Pediatri, radius, sosyoekonomik değişkenler.

1. Introduction

The incidence of pediatric fractures has been increasing over the years, and the annual pediatric fracture incidence rate for the entire pediatric population (0 to 19 years) is 9.47 per 1000 children [1, 2]. However, there is a need for large population studies to reveal the general incidence of childhood fractures in Türkiye [3]. It is reported that forearm distal end fractures are the most common (23.5%) childhood upper extremity fractures in our country [3, 4], and the fractures that most affect children in the world are forearm distal end fractures [5].

It is reported that sociodemographic characteristics affect the epidemiology of childhood fractures and are related. Boys have a higher risk of suffering a traumatic upper extremity fracture than girls. Approximately 10 years of age (9 years 7 months) is the age at which upper extremity fractures caused by simple falls are most common [6]. However, it has been reported that bone fragility may increase due to hormonal changes during adolescence and that girls may be more likely to encounter upper extremity fractures more frequently during this period [7]. The dominant extremity is more affected by childhood fractures than the nondominant extremity [8]. Summer and autumn are the periods when the highest number of upper extremity fractures occur in children [9, 10]. Diet is another variable that may alter the likelihood of upper extremity fractures in children [11]. Vegetarian diet negatively affects bone health and facilitates the formation of fractures [12]. Overweight and obesity increase the risk of physical injury and complete fracture due to low-energy trauma in children [13]. Additionally, the risk of postoperative complications and preoperative or postoperative nerve injury

following upper extremity fracture is higher in obese children [14]. A family's financial income is an important sociodemographic feature that determines its standard of living. However, to our knowledge, whether there is a relationship between monthly family income and upper extremity fractures has not been investigated before. However, financial gain is a sociodemographic characteristic that may indirectly affect children's upper extremity fractures, such as diet, environmental regulation, and access to quality health care.

Knowing the epidemiological characteristics of childhood upper extremity fractures may help prevent these fractures, reduce the risk of recurrent fractures, and treat fractures. Because upper extremity fractures can be prevented by measures such as public awareness, environmental regulations, and education of family or caregivers [3, 15]. Considering that income is the most important variable determining the standard of living of families today, determining the possible relationship between upper extremity fractures and the family's monthly income may contribute to taking more effective preventive measures [16]. Therefore, the aim of the study was to investigate whether the upper extremity fracture rate differs between children who are members of a family whose income is above the minimum wage and children who live in a family whose income is at or below the minimum wage.

2. Material and Method

The study included 100 (age: 10.44±2.74 year) participants who applied to Konya City Hospital Orthopedics and Traumatology Clinic in 2022 with an upper extremity fracture and 61 (age: 12.56±2.83 year) participants without an upper extremity fracture. The number of participants in the study was calculated with G*Power software according to the bone union time given for two different geographical regions in the study of Wang W et al. [17]. Accordingly, a total of at least 116 participants, 58 in each group, had to be included in the study (effect size = 0.99, alpha = 0.05, 1-beta = 0.90, actual power = 90). Inclusion criteria; there was an upper extremity single or multiple fractures between the ages of 7 and 16. Exclusion criteria; having a pathological fracture, congenital upper extremity deformity, systemic disease and neuromuscular disease. The study was conducted in accordance with the Declaration of Helsinki and ethical approval was obtained (Date: 05.04.2023, Decision number: 2023/401).

Among those who applied to our hospital's orthopedics and traumatology clinic due to upper extremity fractures, those who met the study inclusion criteria were determined. Participants; Age, height, weight, and presence of recurrent fractures were recorded. In addition, the participants' parents were contacted by phone to determine the mother's education level, mother's age, father's education level, father's age and monthly income of the family.

SPSS (SPSS,V20; IBM Corp) was used for data analysis. The suitability of the data for normal distribution was determined using visual methods (histogram and qq graphs), analytical methods (Shapiro Wilk test) and skewness and kurtosis coefficients. Continuous variables were expressed as mean±standard deviation values, and categorical variables were expressed as number (n) and percentage (%). The t test was used to compare data that met parametric test assumptions. Differences between categorical variables were examined with Chi-square.

3. Results

Of those with fractures, 76 (76%) were boys and 24 (24%) were girls (0,01>p). However of those without fractures, 32 (52.5%) were boys and 29 (47.5%) were girls (p=0.70). The age, height and weight of participants with fractures were smaller than participants without fractures (p<0.05). Body mass index of participants with fracture was lower than without fracture. However, the number of participants below the 5^{th} percentile was higher in those with fractures (n:59,59%) than those without (n:20,32.8%) (0,01>p). Mother's age, mother's years of education, father's age, father's years of education and family monthly income of participants with and without fractures were similar (p>0.05; Table 1).

The upper extremity fracture rate (63.7%) seen in children of families whose monthly income was minimum wage or below was similar to the upper extremity fracture rate (56.8%) seen in children of families whose monthly income was above the minimum wage (p>0.05; Figure 1). However, in the calculation made by taking into account children with upper extremity fractures; the rate of recurrent upper extremity fractures (13.9%) seen in children whose families earn a monthly income at or below

the minimum wage was less than the rate of recurrent fractures (33.3%) seen in children whose families earn a monthly income above the minimum wage ($p<0.05$; Figure 2).

Table 1: Demographic characteristics of the participants

Variables	With fracture (n=100)	Without fracture (n=61)	p
Age (year)	10.44±2.74	12.56±2.83	**0.01>**
Height (cm)	1.37±0.15	1.48±0.15	**0.01>**
Weight (kg)	35.28±13.05	43.97±13.16	**0.01>**
Body mass index (kg/m^2)	18.00±2.87	19.55±2.55	**0.01**
Mother's age (year)	37.97±7.75	38.38±5.44	0.69
Mother's education level (year)	6.70±3.66	7.52±3.46	0.16
Father's age (year)	41.31±6.72	42.11±6.01	0.45
Father's education level (year)	7.60±3.65	8.79±4.10	0.58
Monthly income of the family (₺)	7357.25±3802.20	7660.66±4408.24	0.65

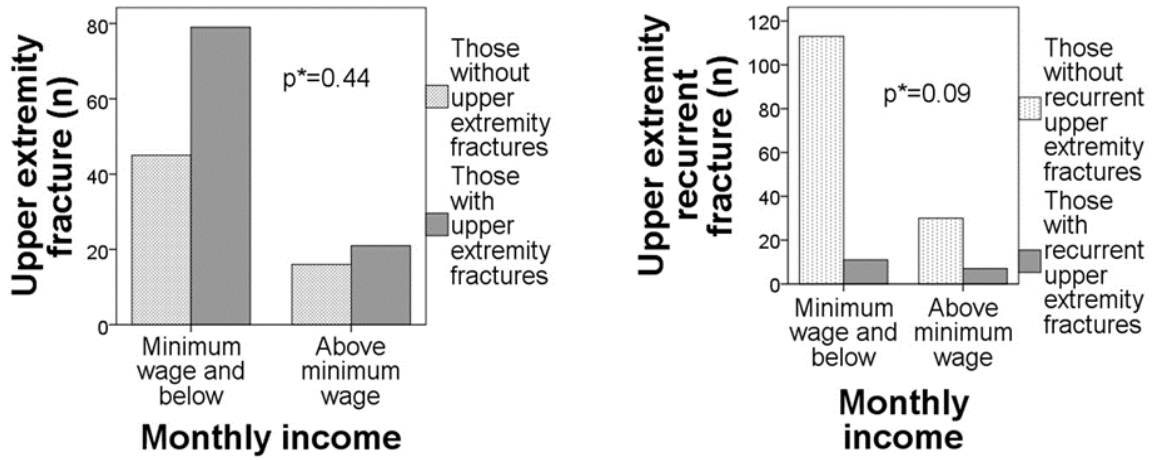

Figure 1: Distribution of the number of upper extremity fractures and recurrent upper extremity fractures according to monthly income (*: Chi-square test)

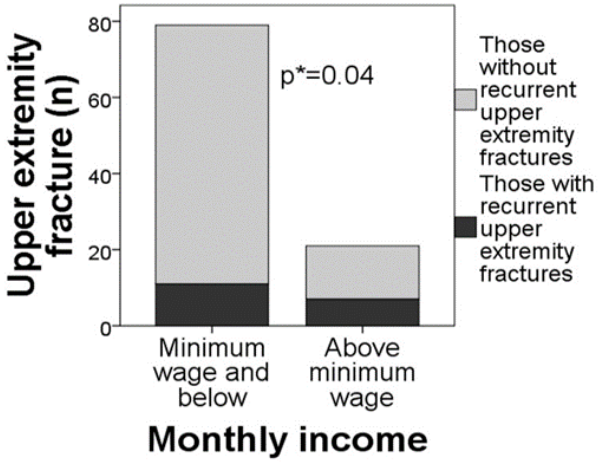

Figure 2: Distribution of recurrent fractures according to monthly income (*: Chi-square test)

4. Discussion and Conclusion

The aim of the study was to compare the upper extremity fracture rates in children from families with low family income and children from families with relatively high family income. The age, height and weight of children with upper extremity fractures were smaller than those without upper extremity fractures. There was no difference in the upper extremity fracture and recurrent fracture rates between children of families earning minimum wage or six months' income and children of families whose monthly income was above the minimum wage. However, when those with upper extremity fractures were examined separately, the rate of recurrent fractures in children from families with monthly income above the minimum wage was higher than that seen in children from families with minimum wage and six months' income.

According to the study results, the average age of children with upper extremity fractures was 10.44±2.74 year. In Aygün's studies where they analyzed the risk factors for fractures in children, it was reported that the most fractures in children were seen between the ages of 3-6 [18]. In their study examining the epidemiology of pediatric fractures by A.Safa Targal et al., it was reported that pediatric fractures peak at approximately 10 years of age in boys and between 6-10 years of age in girls [3]. In the study by Mäyränpää MK and colleagues, where they investigated the time-dependent changes in the incidence of fractures in Finnish children, they stated that the age at which fractures are most common is 13-14 years of age in boys and 10 years of age in girls [19]. The reason why the age at which pediatric fractures occur most frequently is reported differently in studies may be due to the characteristics of the populations studied.

There were approximately three times as many boys as girls with upper extremity fractures. A.Safa Targal et al. reported that the boy/girl ratio for upper extremity fractures in children was 1.7:1 for ages 6-12 and 2:1 for ages 12-16 [3]. Merckaert et al stated that the risk of boys suffering from upper extremity traumatic injuries is 1.35 times higher than girls [6]. Mäyränpää MK et al. reported that upper extremity fractures were almost twice as common in boys (63%) than in girls (37%) [19]. Both the results of this study and similar study results in the literature show that boys encounter upper extremity trauma more often than girls.

According to the study results, the BMIs of both those with and without fractures were lower than they should be. It was also noteworthy that the BMIs of those with fractures were lower than those without fractures. However, the rate of participants with BMIs below the 5th percentile was higher in those with fractures (59%) than in those without fractures (33%). This result suggests that there may be a relationship between inadequate physical development and upper extremity fractures. Factors that may negatively affect musculoskeletal system development, such as diet and physical activity, may have negatively affected the physical development of children with fractures, and this may have

increased the rate of upper extremity fractures. There is some information in the literature that may support this. Ma D et al. [11] reported that carbonated beverage consumption increases the risk of wrist and forearm fractures in children. Researchers also stated that this relationship is not independent of television viewing time and bone mineral density. There are also studies examining the relationship between obesity and low body weight and fractures in children. There is evidence to suggest that overweight and obesity are associated with upper extremity and lower extremity fractures in children [13, 20]. Nhan DT et al. [13] reported that overweight and obesity increase the risk of low-energy traumas and epiphyseal and complete fractures involving the upper extremity bones in children, compared to children of normal weight. Adams AL [20] reported that higher body mass index in children increases the likelihood of lower extremity injuries and pain. However, Sabhaney V et al. [21] stated that obese children have a lower risk of fracture than normal weight children. Researchers have reported that underweight children are more likely to face fractures. As can be seen, there are differences in the results of studies examining the relationship between body weight and fracture risk in children. It can be claimed that the forces acting on the bones during trauma in overweight and obese children are higher than in normal weight children, which may increase the risk of fracture in overweight and obese children [22]. However, the fact that normal weight children have higher physical activity levels and participation in games and sports than obese and overweight children may increase the risk of fracture in normal weight children compared to obese and overweight children [23, 24].

In the study, it was observed that the rate of recurrent fractures was higher in children with upper extremity fractures and in children whose families had a monthly income above the minimum wage. To our knowledge, there is no other study on the effect of family income level on the pediatric upper extremity fracture rate. Improving the socioeconomic levels of families also improves the living standards of family members. Families with better socioeconomic levels have the opportunity to direct their children towards different fields such as sports and arts [16]. Pediatric fractures are caused by simple falls, and these falls most commonly occur during sports [25]. High sports participation of children from high-income families may have caused an increase in the rate of recurrent upper extremity fractures. At the same time, considering that families with relatively high incomes are likely to live in urban and semi-urban areas, and especially considering that semi-urban areas increase the risk of falls and accidents, this may have led to the higher rate of upper extremity recurrent fractures in children of high-income families [25]. However, the fact that low-income families live in rural areas may have encouraged children to spend more time outside instead of indoors and increased their sun exposure [27]. This may have reduced the risk of recurrence and better healing of upper extremity fractures seen in children from low-income families. In addition, the high level of physical activity in people living in rural areas [28] and its positive effects on general bone health may have enabled better quality healing of fractures seen in people living in this region and reduced the rate of recurrence [29].

The study has some limitations. The possibility that the families hid some of their income level and information may have affected the study results. In addition, the existence of occasional income from families other than regular monthly income may change the results of the study. However, since the fracture characteristics (fracture location, type, etc.) are not detailed, the study results will be limited in associating a specific upper extremity fracture with family income level.

In the study, it was seen that the body mass index of children with upper extremity fractures was lower than those without upper extremity fractures. For this reason, regular monitoring of children's development and approaches that include variables such as family information and diet to support the development process may be useful in preventing upper extremity fractures in children. In addition, the monthly income of families of children with recurrent upper extremity fractures was relatively higher than that of family members without recurrent upper extremity fractures. Taking the necessary precautions to prevent falls that may occur due to factors such as participation in sports and urbanization in direct proportion to family income can reduce the risk of recurrent upper extremity fractures in children.

Declaration of Ethical Code

In this study, we undertake that all the rules required to be followed within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with, and that none of the actions stated under the heading "Actions Against Scientific Research and Publication Ethics" are not carried out.

The study was conducted in accordance with the Declaration of Helsinki and ethical approval was received from the Necmettin Erbakan University Health Sciences Scientific Research Ethics Committee (Date: 05.04.2023, Decision number: 2023/401)

References

[1] Naranje, S. M., Erali, R. A., Warner, W. C., Sawyer, J. R., Kelly, D. M. 2016. Epidemiology of pediatric fractures presenting to emergency departments in the United States. Journal of Pediatric Orthopaedics, 36(4), e45-e48.

[2] Korucu, İ. H. (2016). Treatment of School-Age Children with Femoral Shaft Fracture: Spica Casting versus Titanium Elastic Nail Fixation. Selcuk Medical Journal, 32(4), 80-83.

[3] Safa Targal, A., Haberal, B., Şeşen, H., Demirkale, İ., Ahmet, A. T., Altay, M. 2018. Pediatrik yaş grubunda acil serviste 1 yılda tespit edilen ekstremite kırıklarının etiyoloji ve epidemiyolojisi: 1878 çocuk ile çalışma. Akademik Araştırma Tıp Dergisi, 2(2), 44-48.

[4] Şimşek, İ., Memik, R., Demir, F., Ayata C., Oğuz, H. 1996. Cocukluk Donemı Suprakondıler Humerus Kırıklarının Rehabilitasyonu. Selcuk Medical Journal, 12(1), 87-90.

[5] Lempesis, V., Jerrhag, D., Rosengren, B. E., Landin, L., Tiderius, C. J., Karlsson, M. K. 2019. Pediatric Distal Forearm Fracture Epidemiology in Malmö, Sweden—Time Trends During Six Decades. Journal of wrist surgery, 8(06), 463-469.

[6] Merckaert, S., Chaibi, E., Meriem, S., Kwiatkowski, B., Divjak, N., Zambelli, P. Y. 2021. Epidemiology of pediatric upper extremity fractures in a tertiary care center in Switzerland. Pediatric emergency care, 37(12), e825-e835.

[7] Christoffersen, T., Ahmed, L. A., Winther, A., Nilsen, O. A., Furberg, A. S., Grimnes, G., Dennison, E., Center, J. R., Eisman, J. A., Emaus, N. 2016. fracture incidence rates in Norwegian children, the Tromsø study, fit futures. Archives of osteoporosis, 11, 1-8.

[8] Herdea, A., Ulici, A., Toma, A., Voicu, B., Charkaoui, A. 2021. The relationship between the dominant hand and the occurrence of the supracondylar humerus fracture in pediatric orthopedics. Children, 8(1), 51.

[9] Lund, A. R., Faergemann, C., Lauritsen, J. M. 2021. A population-based study of seasonal variation in children's fractures. Danish Medical Journal, 68(10), A1220934.

[10] Mehmet, G. Ü. L. (2003). Acil servise başvuran travma olgularının epidemiyolojik analizi. Selçuk Tıp Dergisi, 19(1), 33-36.

[11] Ma, D., Jones, G. 2004. Soft drink and milk consumption, physical activity, bone mass, and upper limb fractures in children: a population-based case-control study. Calcified tissue international, 75, 286-291.

[12] Yiğit, A., Samur, G. 2022. Is a Vegetarian Diet Safe to Follow During Childhood? Süleyman Demirel Üniversitesi Sağlık Bilimleri Dergisi, 13(3), 540-550.

[13] Nhan, D. T., Leet, A. I., Lee, R. J. 2021. Associations of childhood overweight and obesity with upper-extremity fracture characteristics. Medicine, 100(18), e25302.

[14] Seeley, M. A., Gagnier, J. J., Srinivasan, R. C., Hensinger, R. N., VanderHave, K. L., Farley, F. A., Caird, M. S. 2014. Obesity and its effects on pediatric supracondylar humeral fractures. JBJS, 96(3), e18.

[15] Altın, K. , Manav, G. & Karayağız, G. (2020). Hastanede Yatan 3-18 Yaş Arası Çocukların Düşme Riskinin Belirlenmesi . Genel Sağlık Bilimleri Dergisi , 2 (3) , 136-145.

[16] Männikkö, N., Ruotsalainen, H., Miettunen, J., Marttila-Tornio, K., Kääriäinen, M. 2020. Parental socioeconomic status, adolescents' screen time and sports participation through externalizing and internalizing characteristics. Heliyon, 6(2), e03415.

[17] Wang, W., Xiong, Z., Li, Y., Guo, Y., Li, M., Mei, H., Canavese, F., Chen, S., Chinese Multicenter Pediatric Orthopedic Study Group, 2022. Variables influencing radiological fracture healing in children with femoral neck fractures treated surgically: a review of 177 cases. Orthopaedics & Traumatology: Surgery & Research, 108(1), 103052.

[18] Aygun, U. 2020. The feature assessment of the bone fractures in 1020 children and review of the literature. Northern clinics of Istanbul, 7(5), 460-466.

[19] Mäyränpää, M. K., Mäkitie, O., Kallio, P. E. 2010. Decreasing incidence and changing pattern of childhood fractures: A population-based study. Journal of Bone and Mineral Research, 25(12), 2752-2759.

[20] Adams, A. L., Kessler, J. I., Deramerian, K., Smith, N., Black, M. H., Porter, A. H., Jacobsen, S. J., Koebnick, C. 2013. Associations between childhood obesity and upper and lower extremity injuries. Injury prevention, 19(3), 191-197.

[21] Sabhaney, V., Boutis, K., Yang, G., Barra, L., Tripathi, R., Tran, T. T., Doan, Q. 2014. Bone fractures in children: is there an association with obesity?. The Journal of pediatrics, 165(2), 313-318.

[22] Dimitri, P., Bishop, N., Walsh, J. S., Eastell, R. 2012. Obesity is a risk factor for fracture in children but is protective against fracture in adults: a paradox. Bone, 50(2), 457-466.

[23] Riso, E. M., Toplaan, L., Viira, P., Vaiksaar, S., Jürimäe, J. 2019. Physical fitness and physical activity of 6-7-year-old children according to weight status and sports participation. PLoS One, 14(6), e0218901.

[24] Yazıcı-gülay, M. , Korkmaz, Z. , Kaya Erten, Z. & Gürbüz, K. (2021). Çocukların Fiziksel Aktivite, Obezite Düzeylerinin İncelenmesi: Kayseri İli Örneği . Genel Sağlık Bilimleri Dergisi , 3 (3) , 228-238.

[25] Wang, H., Yu, H., Zhou, Y., Li, C., Liu, J., Ou, L., Zhao, Y., Song, G., Han, J., Chen, Y., Xiang, L. 2017. Traumatic fractures as a result of falls in children and adolescents: a retrospective observational study. Medicine, 96(37), e7879.

[26] Campbell-Lendrum, D., Bertollini, R. 2010. Urbanization and Health. Bulletin of the World Health Organization, Past Issues, 88, 241-320.

[27] Güllük İ. 2-12 yaş arası sağlıklı çocuklarda d vitamini düzeyleri ve etkileyen faktörler. Atatürk Üniversitesi, Tıp Fakültesi Çocuk Sağlığı ve Hastalıkları Ana Bilim Dalı, Uzmanlık Tezi, 61s, Erzurum.

[28] Özdirenç, M., Özcan, A., Akin, F., Gelecek, N. 2005. Physical fitness in rural children compared with urban children in Turkey. Pediatrics international, 47(1), 26-31.

[29] Faienza, M. F., Lassandro, G., Chiarito, M., Valente, F., Ciaccia, L., Giordano, P. 2020. How physical activity across the lifespan can reduce the impact of bone ageing: a literature review. International Journal of Environmental Research and Public Health, 17(6), 1862.