ORIGINAL ARTICLE

Psychological risk factors for upper extremity fractures in preschool children: A case-control study

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ABSTRACT

BACKGROUND: In school-age children, upper extremity fractures are associated with both parental and child-related factors and represent a multifactorial entity. This study aims to explore the psychological risk factors associated with upper extremity fractures in preschool children.

METHODS: This single-center, hospital-based, age-matched case-control study involved 55 cases of upper extremity fractures and 55 controls experiencing growing pains. Parents of the children participated in face-to-face interviews. We examined the potential associations between scores on the Mother-to-Infant Bonding Scale (MIBS), Adult Attention Deficit Hyperactivity Disorder Self-Report Scale (ASRS), Autism-Spectrum Quotient (AQ), State-Trait Anxiety Inventory (STAI), and Strengths and Difficulties Questionnaire (SDQ), and the risk of upper extremity fractures.

RESULTS: Advanced parental age and lower household income emerged as risk factors for upper extremity fractures, while longer maternal educational attainment was identified as a protective factor. In the univariate analyses, elevated scores on the Autism-Spectrum Quotient Communication subscale (AQ-C), overall AQ score, Strengths and Difficulties Questionnaire Hyperactivity subscale (SDQ-H), and Strengths and Difficulties Questionnaire Emotional and Peer Problems subscale (SDQ-Int) were associated with an increased fracture risk (Odds Ratio [OR] (95% Confidence Interval [CI]): 1.15 (1.05-1.27), OR: 1.05 (1.01-1.09), OR: 1.25 (1.01-1.54), and OR: 1.19 (1.04-1.37), respectively). The AQ-C and SDQ-Int scales remained statistically significant as risk factors for upper extremity fractures (OR: 1.15 (1.02-1.28) and OR: 1.21 (1.02-1.43), respectively) in the multivariate regression analyses.

CONCLUSION: Our findings suggest that psychological factors affecting both parents and children could potentially increase the risk of upper extremity fractures in preschool children.

Keywords: Injury; extremity fractures; preschool children; psychological factors; risk factors;

INTRODUCTION

Unintentional injuries are the leading cause of hospital admissions among young children, especially within the age group of up to 6 years, which corresponds to the preschool period.[1,2] A significant proportion of these injuries occur within the home or during recreational activities, with many being preventable.[3,4] Understanding the risk factors associated with injuries during the preschool years is crucial for developing effective injury prevention strategies.[5]

Fractures, often resulting from significant traumatic incidents within this age group, are a particular concern.[6,7] Factors such as inadequate parental supervision, environmental hazards, and child-specific characteristics contribute to an increased incidence of trauma and a higher risk of fractures.[2,5] Extremity fractures are common in childhood, with about one-third of both boys and girls experiencing at least one fracture before

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the age of 17.[8] Moreover, research indicates that upper extremity fractures are particularly prevalent among preschool-aged children.[8,9]

It is essential for parents to curb behaviors that could endanger their children and to equip them with the knowledge necessary for safe growth.[10] In the context of childhood injuries and resulting upper extremity fractures, the interaction between parental psychological attributes and demographic and sociocultural factors may be significant. Research indicates that a substantial portion of injuries among preschool-aged children occur at home and on playgrounds while under the supervision of parents or other caregivers.[9,10] However, despite these observations, there is a lack of controlled and comprehensive studies that systematically examine the psychological risk factors contributing to upper extremity fractures in this specific age group. As a result, a comprehensive understanding of the primary factors involved is still lacking. In response to this gap, the main objective of this study was to investigate the psychological risk factors associated with upper extremity fractures among preschool children.

MATERIALS AND METHODS

Study Design, Setting, and Ethical Adherence

This study was designed as a single-center, hospital-based, age-matched case-control study. Cases were selected from children under care at the orthopedics and traumatology clinic due to upper extremity fractures. Correspondingly, controls were matched with cases, originating from children attending the clinic for issues related to growing pains. Parents who willingly agreed to participate in the study were engaged in face-to-face interviews.

The study was conducted within a tertiary-care training and research hospital and adhered to the principles outlined in the Declaration of Helsinki. It also conformed to the criteria set forth by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement.[11] Ethical clearance was secured from the institutional research ethics committee prior to initiation (Approval date: 07/10/2022, Approval no: 161). Written informed consent was obtained from all parents who agreed to participate in the study.

Study Population

Inclusion criteria for the cases included: (1) admission to the hospital due to an upper extremity fracture, (2) age between 3 and 6 years, (3) maternal educational attainment of at least primary school level, and (4) cohabitation with biological parents. Parallel inclusion criteria were applied to the controls, requiring: (1) hospital admission due to growing pains in any anatomical location, (2) age within the 3 to 6 years range, (3) maternal educational attainment of at least primary school level, and (4) cohabitation with biological parents. In the control group, the diagnosis of growing pains was confirmed after excluding all other possible differential diagnoses.[12] Patients with chronic health conditions such as diabetes mellitus, cancer, etc., those with neurological or psychiatric disorders including neurodegenerative conditions, epilepsy, intellectual disability, autism spectrum disorder, schizophrenia, bipolar disorder, etc., as well as those undergoing psychopharmacological treatment, were systematically excluded from both the case and control groups.

Data and Variables

A comprehensive set of data was collected, covering the children's demographics, familial socioeconomic attributes, and the psychological-behavioral attributes of both parents and children, using a questionnaire. This questionnaire was administered by an orthopedist who was not directly involved in the study.

Household income was stratified into distinct categories based on the minimum monthly wage (MMW). These categories included: the lowest-income tier, which denoted an income below MMW; the next bracket, encompassing income up to twice the MMW; the following tier, which included income up to three times the MMW; and the highest-income category, comprising income exceeding three times the MMW. Alongside these categories, the Hollingshead Redlich Scale (HRS) was used to assess socioeconomic status. The HRS score was derived from a detailed evaluation of parental occupational classification and educational attainment. Within this framework, parents were stratified into five hierarchical strata, from stage I (highest socioeconomic status [SES]) to stage V (lowest SES).[13]

Psychological Instruments

The study utilized a suite of five psychological assessment tools. Four of these instruments were completed by parents, enabling an extensive evaluation of their psychological profiles. The instruments included the Mother-to-Infant Bonding Scale (MIBS), the Adult Attention-Deficit/Hyperactivity Disorder (ADHD) Self-Report Scale (ASRS), the Autism-Spectrum Quotient (AQ), and the State-Trait Anxiety Inventory (STAI). Additionally, the Strengths and Difficulties Questionnaire (SDQ) was specifically used to assess the psychological attributes of the children participating in the study.

The MIBS is designed to facilitate assessment immediately post-birth, allowing mothers to express their feelings towards their infants in a concise descriptor. The MIBS serves as an efficient, quick evaluation tool, suitable for independent use by either parent. Its utility extends to illuminating the interplay between the established bond and the maternal postpartum emotional state. Remarkably, an inverse relationship becomes evident as the scale score increases, signifying a concomitant decrease in maternal affinity for the infant.[14]

The ASRS, devised under the auspices of the World Health Organization, serves as a diagnostic instrument tailored to assess adult ADHD. The scale comprises inquiries into 18 symptoms, aligned with the criteria delineated in the Diag-

nostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV). Operating in a bifurcated structure, the scale includes two distinct subscales: "Inattention (ASRS-I)" and "Hyperactivity/Impulsivity (ASRS-H)." Notably, escalations in both the subscale scores and the cumulative scale total correspondingly indicate an exacerbation in the severity of attention deficits, hyperactivity, and ADHD.[15]

The AQ scale features a comprehensive array of 50 questions, further delineated into five discrete subscales, each composed of 10 questions. These subscales are: "Social Skill (AQ-SS)," "Attention Switching (AQ-AS)," "Attention to Detail (AQ-AD)," "Communication (AQ-C)," and "Imagination (AQ-I)." A decline in social skills, imagination, attention switching, and communication, accompanied by an increase in attention to detail, corresponds to recognized features within the autistic spectrum. Elevations in scores across all subscales indicate an increase in autistic features.[16]

The STAI comprises a comprehensive set of 40 statements, divided into two distinct sections: 20 statements dedicated to evaluating state anxiety (STAI-S), and another 20 for assessing trait anxiety (STAI-T). Notably, elevated scores across both scales signify an increased level of anxiety.[17]

The SDQ is a comprehensive inventory comprising 25 inquiries that encompass a balance of affirmative and negative behavioral attributes. The questionnaire is designed with five distinct subscales: "Emotional Problems Scale (SDQ-EP)," "Conduct Problems Scale (SDQ-CP)," "Hyperactivity Scale (SDQ-H)," "Peer Problems Scale (SDQ-PP)," and "Prosocial Scale (SDQ-P)." Each subscale elicits distinct facets of behavioral features. While individual scoring can be conducted for each of these five subscales, the "Total Difficulty Score (SDQ-TD)" is computed by aggregating all subscales except the SDQ-P. Furthermore, the "Externalizing Score (SDQ-Ext)" is generated by summing the SDQ-CP and SDQ-H, while the "Internalizing Score (SDQ-Int)" is derived from the sum of SDQ-EP and SDQ-PP. Elevations in scores across SDQ-EP, SDQ-CP, SDQ-H, SDQ-PP, SDQ-TD, SDQ-Ext, and SDQ-Int, and diminished scores on SDQ-P, indicate a more pronounced issue of the corresponding behavioral attributes.[18]

Sample Size

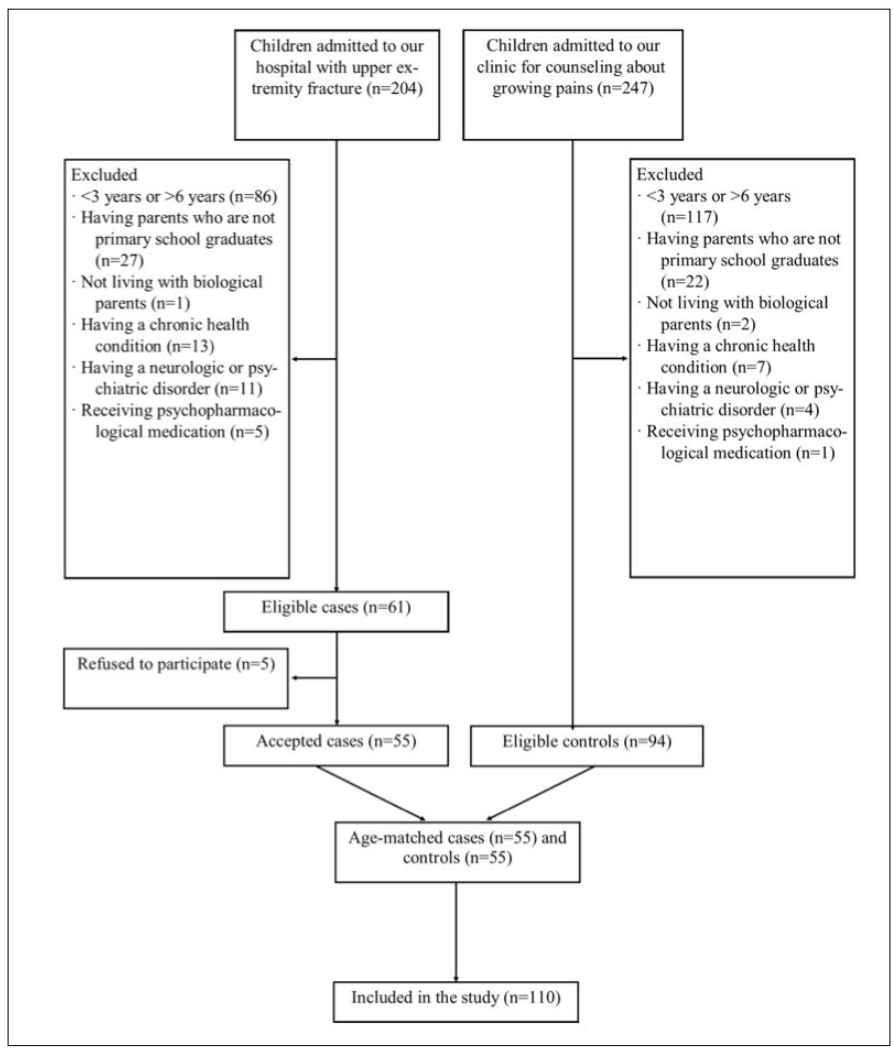

Figure 1. Flow diagram of the study.

Table 1. Demographic and socioeconomic characteristics of the participants

Characteristics	Controls (n=55)	Cases (n=55)	p
Age (Months), Median (IQR)	48.0 (26.0-64.0)	48.0 (26.0-65.0)	0.993[a]
Number of Siblings, Median (IQR)	1.0 (0.0-2.0)	1.0 (0.0-2.0)	0.122[a]
Mother's Age (Years), Median (IQR)	28.0 (25.0-32.0)	32.0 (28.0-37.0)	0.001[a]
Father's Age (Years), Median (IQR)	31.0 (30.0-35.0)	36.0 (31.0-42.0)	<0.001[a]
Mother's Educational Attainment (Years), Median (IQR)	9.0 (5.0-12.0)	5.0 (5.0-11.0)	0.003[a]
Father's Educational Attainment (Years), Median (IQR)	11.0 (8.0-12.0)	8.0 (5.0-12.0)	0.131[a]
Family Structure, n (%)			
Nuclear	53 (96.4)	53 (96.4)	0.999[b]
Separated	2 (3.6)	2 (3.6)	
Household Income, n (%)			
Below MMW	1 (1.8)	5 (9.1)	0.009[b]
Up to Twice MMW	10 (18.2)	19 (34.5)	
Up to Three-Times MMW	28 (50.9)	26 (47.3)	
Above Three-Times MMW	16 (29.1)	5 (9.1)	
HRS			
II	17 (30.9)	9 (16.7)	0.008[c]
III	16 (29.1)	9 (16.7)	
IV	14 (25.5)	13 (24.1)	
V	8 (14.5)	23 (42.5)	
Fracture History, n (%)	0 (0.0)	1 (1.8)	0.999[b]

HRS: Hollingshead Redlich Scale (I=highest, V=lowest); IQR: Interquartile Range; MMW: Minimum Monthly Wage. [a]Mann-Whitney U Test was used. [b]Fisher's Exact Test was used. [c]Pearson Chi-square Test was used.

A sample size calculation was performed using G*Power version 3.1. The minimum required study population was calculated to be 104 patients (52 cases and 52 controls) using an α value of 0.05 and a power of 0.90 with an allocation ratio of 1.

Statistical Analysis

Statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS) version 23 (IBM Corp., Armonk, NY). Descriptive statistics were presented as medians with interquartile range (IQR) for numerical variables, and frequencies (n) and percentages (%) for categorical variables. The Mann-Whitney U Test was used to compare numerical variables between the study groups. Pearson Chi-square Test or Fisher's Exact Test was used to compare categorical data. Univariate binomial logistic regression models were employed to estimate the impacts of psychological risk factors on upper extremity fractures. After univariate analyses, bivariate correlation analyses were performed on variables found to be statistically significant to assess multicollinearity. A correlation coefficient above 0.80 was considered indicative of multicollinearity. Two variables exhibiting multicollinearity were not included in the same model. Subsequently, multivariate logistic regression models using both Enter and Backward Conditional methods were constructed with the statistically significant variables from the univariate model. Odds Ratios (ORs) with a 95% confidence interval (CI) were calculated to evaluate the risk associated with demographic, socioeconomic, and psychological factors. A p-value of less than 0.05 was deemed statistically significant.

RESULTS

During the study period, 204 children were admitted to the orthopedics and traumatology clinic with an upper extremity fracture. After applying the inclusion and exclusion criteria, 61 children were found eligible for the case group, having excluded 143 patients. Conversely, 153 children were excluded from the control group based on the inclusion and exclusion criteria, leaving 94 controls eligible to participate. While 6 parents of the eligible cases refused to participate in the study, there were no refusals among the parents of the age-matched controls. Ultimately, data from 110 participants, consisting of 55 cases and 55 age-matched controls, were included in the analysis (Fig. 1). Of the cases, 5 had clavicle fractures, 11 had humeral fractures, 35 had radial and/or ulnar fractures, 1 had a metacarpal fracture, and 3 had phalangeal fractures (data not shown).

The demographics and socioeconomic characteristics of the participants were summarized in Table 1. The age distributions, numbers of siblings, fathers' educational attainment,

Table 2. Univariate analysis of demographic and socioeconomic characteristics of participants for estimating fracture risk

Characteristics	OR (95% CI)	p
Mother's Age (Years)	1.11 (1.04-1.19)	0.002
Father's Age (Years)	1.13 (1.06-1.21)	<0.001
Mother's Educational Attainment (Years)	0.86 (0.77-0.96)	0.006
Household Income, N (%)		
Below MMW	16.00 (1.50-171.20)	0.022
Up to Twice MMW	6.08 (1.72-21.50)	0.005
Up to Three Times MMW	2.97 (0.95-9.27)	0.061
Above Three Times MMW	1.00	
HRS		
II	1.00	
III	1.06 (0.34-3.35)	0.918
IV	1.75 (0.58-5.30)	0.319
V	5.43 (1.74-16.98)	0.004

CI: Confidence Interval; HRS: Hollingshead Redlich Scale (I=highest, V=lowest); MMW: Minimum Monthly Wage; OR: Odds Ratio.

Table 3. Univariate analysis of the psychological instrument scores of the participants in estimating fracture risk

Characteristics	Controls (n=55)	Cases (n=55)	OR (95% CI)	p[a]
MIBS, Median (IQR)	7.0 (6.0-9.0)	8.0 (7.0-10.0)	1.25 (0.99-1.55)	0.053
ASRS-I, Median (IQR)	10.0 (8.0-15.0)	9.0 (6.0-11.0)	0.93 (0.86-1.01)	0.066
ASRS-H, Median (IQR)	11.0 (8.0-16.0)	11.0 (8.0-15.0)	0.95 (0.88-1.03)	0.213
AQ-SS, Median (IQR)	21.0 (17.0-24.0)	22.0 (19.0-24.0)	1.02 (0.94-1.11)	0.614
AQ-AS, Median (IQR)	24.0 (21.0-26.0)	24.0 (23.0-26.0)	1.02 (0.93-1.12)	0.724
AQ-AD, Median (IQR)	25.0 (21.0-29.0)	27.0 (24.0-30.0)	1.07 (0.98-1.16)	0.112
AQ-C, Median (IQR)	19.0 (16.0-23.0)	22.0 (19.0-25.0)	1.15 (1.05-1.27)	0.004
AQ-I, Median (IQR)	20.0 (18.0-23.0)	22.0 (20.0-24.0)	1.06 (0.97-1.16)	0.234
AQ-Total, Median (IQR)	112.0 (106.0-120.0)	117.0 (110.0-120.0)	1.05 (1.01-1.09)	0.014
SDQ-EP, Median (IQR)	2.0 (1.0-4.0)	2.0 (1.0-4.0)	1.08 (0.89-1.30)	0.464
SDQ-CP, Median (IQR)	2.0 (1.0-3.0)	2.0 (1.0-3.0)	1.13 (0.88-1.45)	0.345
SDQ-H, Median (IQR)	3.0 (3.0-4.0)	4.0 (3.0-6.0)	1.25 (1.01-1.54)	0.039
SDQ-PP, Median (IQR)	3.0 (2.0-4.0)	3.0 (2.0-4.0)	0.96 (0.74-1.24)	0.739
SDQ-P, Median (IQR)	7.0 (5.0-8.0)	7.0 (6.0-8.0)	1.03 (0.84-1.26)	0.758
SDQ-TD, Median (IQR)	10.0 (8.0-14.0)	11.0 (7.0-15.0)	1.04 (0.97-1.12)	0.298
SDQ-Ext, Median (IQR)	5.0 (3.0-7.0)	6.0 (4.0-8.0)	1.12 (0.98-1.27)	0.103
SDQ-Int, Median (IQR)	6.0 (3.0-7.0)	7.0 (4.0-9.0)	1.19 (1.04-1.37)	0.010
STAI-S, Median (IQR)	40.0 (37.0-44.0)	41.0 (37.0-48.0)	1.05 (0.98-1.11)	0.166
STAI-T, Median (IQR)	46.0 (42.0-51.0)	48.0 (43.0-53.0)	1.02 (0.96-1.09)	0.470

AQ: Autism-Spectrum Quotient (SS: Social Skill; AS: Attention Switching; AD: Attention to Detail; C: Communication; I: Imagination; Total: Total Score); ASRS: Adult ADHD Self-Report Scale (I: Inattention; H: Hyperactivity); CI: Confidence Interval; IQR: Interquartile Range; MIBS: Mother-to-Infant Bonding Scale; OR: Odds Ratio; SDQ: Strengths and Difficulties Questionnaire (EP: Emotional Problems Scale; CP: Conduct Problems Scale; H: Hyperactivity Scale; PP: Peer Problems Scale; P: Prosocial Scale; TD: Total Difficulties Score; Ext: Externalizing Score; Int: Internalizing Score); STAI: State-Trait Anxiety Inventory (S: State; T: Trait). [a]Univariate logistic regression analysis with the Enter method was used.

family structure, and fracture history were statistically similar between the study groups. The median ages of the mothers and fathers of the children were statistically significantly higher in the case group than in the control group (p=0.001 and p<0.001, respectively). The median educational attainment of the mothers in the control group was statistically

Table 4. Multivariate analysis of psychological instrument scores in estimating fracture risk among participants

	Model 1[a]		Model 2[b]	
Characteristics	**[a]OR (95% CI)**	**p**	**[a]OR (95% CI)**	**p**
AQ-C	1.15 (1.02-1.28)	0.019	1.11 (1.01-1.38)	0.044
AQ-Total	1.04 (0.99-1.08)	0.088	-	-
SDQ-H	1.21 (0.95-1.54)	0.126	-	-
SDQ-Int	1.21 (1.02-1.43)	0.029	-	-

[a]OR: Adjusted Odds Ratio; AQ: Autism-Spectrum Quotient (C: Communication, Total: Total Score); CI: Confidence Interval; SDQ: Strengths and Difficulties Questionnaire (H: Hyperactivity Scale, Int: Internalizing Score). [a]Four different multivariate logistic regression models were employed, permanently including mother's age, mother's educational attainment, household income, and HRS scores as confounders. Each psychological instrument score was included in one model and analyzed using the Enter method. [b]One multivariate logistic regression model was employed using the Backward Conditional Method. Initially, mother's age, mother's educational attainment, household income, HRS, AQ-C, AQ-Total, SDQ-H, and SDQ-Int scores were included in the model. In the analysis, the model achieved its best fit at the fifth step. At this stage, only AQ-C was identified as a statistically significant factor.

significantly higher than that in the case group (9.0 years vs. 5.0 years, p=0.003). The household income of the control group was also statistically significantly higher than that of the case group (p=0.009). Furthermore, the control group had lower HRS grades, indicating a better socioeconomic status, compared to the case group (p=0.008) (Table 1).

Table 2 illustrates the univariate analysis results of the demographics and socioeconomic characteristics of the participants in estimating fracture risk. The ages of the mothers and fathers were identified as risk factors for upper extremity fractures (OR (95% CI): 1.11 (1.04-1.19) and OR (95% CI): 1.13 (1.06-1.21), respectively), while a longer educational level of mothers was found to be a protective factor (OR (95% CI): 0.86 (0.77-0.96), p=0.006). Families with a household income below the MMW and up to twice the MMW had a higher risk of fractures compared to those with an income above three times the MMW (OR (95% CI): 16.0 (1.50-171.20) and OR (95% CI): 6.08 (1.72-121.50), respectively). Similarly, having an HRS grade of V posed a statistically significant risk for fractures compared to having a grade of II (OR (95% CI): 5.43 (1.74-0.96), p=0.006) (Table 2).

Table 3 shows the univariate analysis results of the psychological instrument scores in estimating fracture risk. The scores for MIBS, ASRS-I, ASRS-H, AQ-SS, AQ-AS, AQ-AD, AQ-I, SDQ-EP, SDQ-CP, SDQ-PP, SDQ-P, SDQ-TD, SDQ-Ext, STAI-S, and STAI-T were not statistically significantly associated with fracture risk. However, higher scores on the AQ-C, AQ-Total, SDQ-H, and SDQ-Int scales were associated with an increased risk of fractures (OR (95% CI): 1.15 (1.05-1.27), OR (95% CI): 1.05 (1.01-1.09), OR (95% CI): 1.25 (1.01-1.54), and OR (95% CI): 1.19 (1.04-1.37), respectively) (Table 3).

Two types of multivariate regression modeling (Enter and Backward Conditional) were performed following univariate analyses. Initially, four different multivariate logistic regression models were employed. Demographic and socioeconomic factors that were statistically significantly associated with fracture risk (mother's age, mother's educational attainment, household income, and HRS scores) were included as confounders in all four models. Then, each psychological instrument score was included one by one in each model, and the models were analyzed using the Enter method. At this stage, while the AQ-Total and SDQ-H scales lost statistical significance, the AQ-C and SDQ-Int scales remained statistically significant risk factors for upper extremity fractures (OR (95% CI): 1.15 (1.02-1.28) and OR (95% CI): 1.21 (1.02-1.43), respectively) (Table 4).

In the second stage of the multivariate modeling, a multivariate logistic regression model was employed using the Backward Conditional Method. Initially, demographics and socioeconomic confounders (mother's age, mother's educational attainment, household income, and HRS scores), along with AQ-C, AQ-Total, SDQ-H, and SDQ-Int scores were included in the model. The analysis reached the best fit at the fifth step, where only the AQ-C was determined as a statistically significant psychological risk factor (OR (95% CI): 1.11 (1.01-1.38), respectively) (Table 4).

DISCUSSION

Within the framework of the current study, our endeavor revolved around developing a multifaceted lens to scrutinize the intricate landscape of risk factors underpinning fractures occurring among preschool-aged children. Conventionally, studies have often focused on demographic or sociocultural attributes as pivotal determinants.[6,19] In contrast, our approach is characterized by the incorporation of diverse psychological assessment questionnaires, strategically tailored to encapsulate various aspects of parental attributes.

As in other developing countries, severe injuries constitute one of the leading public health issues in Türkiye.[20,21] In a cross-sectional study, Ince et al.[22] revealed that a significant 13.8% of children under the age of ten had experienced at least one severe injury. Notably, previous investigations have highlighted the importance of several factors in shaping childhood unintentional injuries, including parents' age, maternal

education level, maternal occupation, family structure, and monthly household income.[2,20,23] A study conducted by Zhou et al.,[24] specifically focused on preschool children, emphasized the impact of low maternal and paternal education levels, as well as meager household income, in predisposing children to unintentional injuries. In line with the collective knowledge on childhood unintentional injuries, our study findings contribute to this broader understanding. Specifically, we found that increased parent age, lower household income, and diminished socioeconomic status emerged as risk factors, while extended maternal educational attainment acted as a protective factor against upper extremity fractures. These findings reinforce the prevailing understanding within the realm of childhood unintentional injuries.

The pivotal role of parenting style and the psychological well-being of both parents and children stands as the cornerstone influencing the occurrence of children's injuries and fractures.[25] A heightened focus on the behavior of preschool-age children enables parents to be proactive, poised to intervene and prevent potential injuries.[5] Given that preschool children predominantly spend their time under the vigilant care of their families, injuries and fractures often occur during such supervision.[10] Consequently, the physical and psychological health of parents plays a pivotal role in both the manifestation and prevention of injuries and fractures among preschool children.[26,27] In fact, elevated maternal levels of depression and anxiety have been associated with an increased risk of child injury within this young age group.[26] Furthermore, it is well established that children diagnosed with ADHD are at a heightened risk of injury and fracture.[28] Treatment of ADHD in children has proven to reduce this risk.[28,29] However, half of the children do not experience full recovery, and symptoms of ADHD may persist, posing challenges into adulthood.[30] These adults can face difficulties in their parental roles due to characteristics such as forgetfulness, lack of responsiveness to their children's needs, and inefficiencies in child supervision.[25] A robust connection has been observed between higher ADHD symptomatology in parents of injured or fractured children, compared to parents in control groups.[25,26] Remarkably, only AQ-C retained its statistical significance as a psychological risk factor in both multivariate regression models. This finding concurs with the prevailing understanding of the vital role psychological well-being plays in the prevention of childhood injuries.

Amidst a substantial body of research predominantly centered on maternal mental well-being and its implications for childhood injury or fracture risk, it is crucial to acknowledge the significant influence that the psychological state of fathers can exert on both the occurrence and the mitigation of childhood injuries.[31,32] A distinct body of literature underscores the protective role that fathers play in ensuring the safety of preschool-aged children, similar to the role typically attributed to mothers.[33] In the presented study, parental psychological well-being was evaluated collectively, without individualized assessments of mothers and fathers. However, a previous study revealed that parents tend to engage with preschool-aged children in distinctive ways when spending time together.[25] An overwhelming majority of reported injuries transpire occur under the supervision of mothers, primarily due to their increased time spent with preschool-aged children.[1] It is worth noting that fathers often engage in more physically demanding activities, such as play, which could occasionally entail potential dangers and subsequently increase the risk of injuries and fractures.[26] A study by Zhou et al. explored the association between parental instruction of safety regulations and preschool children's safety behaviors and unintentional injuries. Their findings indicated that when both mothers and fathers independently teach safety rules to children, it leads to improved child safety behaviors and consequently reduces the incidence of unintentional injuries.[24] In light of these intricate dynamics, the study chose to examine the collective psychological well-being of parents because the attitudes and behaviors cultivated by parents serve as the foundation for the wholesome and secure upbringing of children.

The preschool-age children's comprehension of the environment often lags behind their ability to discern potential hazards, resulting in responses that do not effectively align with risky situations.[24] Previous investigations have consistently affirmed the pivotal role parents play in establishing a secure environment for their children. This is achieved through vigilant supervision and the imparting of safety regulations.[24,34] As children approach increased independence around the age of 3, their vulnerability to trauma and untoward injuries becomes more pronounced.[24] Parents, in response, pivot from merely overseeing their children to actively teaching them safety protocols, a transition underpinned by the recognition that fostering safety-conscious behaviors is pivotal.[35,36] Numerous studies have underscored that effective safety directives issued by parents correlate with a diminished risk of injuries.[37,38] However, it is important to acknowledge that young children may not always rigorously adhere to safety rules.[35]

ADHD often engenders a repetitive behavior pattern that inherently heightens the vulnerability of affected children, making them more susceptible to injuries compared to their healthy counterparts.[39,40] In a study conducted by Lange et al., it was discerned that children with ADHD exhibited markedly higher SDQ scores compared to the non-ADHD cohort. The odds ratio (OR) for the risk of accidents among children with ADHD was quantified at 1.60, indicating a higher risk of accidents compared to children not affected by the condition.[27] Upper extremity fractures often result from falls during competitive games and activities requiring balance and motor coordination, such as playground activities that involve vehicles.[41] While Attention-Deficit/Hyperactivity Disorder (ADHD) is typically diagnosed during the school-age period, the early emergence of symptoms during the preschool years

is not uncommon.[42] A study by Genc et al.[43] found that children between the ages of 3 and 17 years who had sustained supracondylar humerus fractures exhibited significantly higher levels of ADHD symptoms. Based on these findings, the researchers recommend evaluating for early symptoms and diagnosing ADHD promptly in these children.

Impulsive behavior and compromised judgment have been consistently identified as psychosocial risk factors that increase children's susceptibility to injuries and fractures.[44] A study by Acar et al. investigated the underlying causes of injuries among preschool-aged children and found that both internalizing and externalizing scores, as measured by the Child Behavior Checklist (CBCL), were elevated in children who experienced unintentional injuries.[25] The internalizing problem score within the CBCL includes emotional, anxious, and somatic complaints, while the externalizing problem score covers attention problems and aggressive behaviors. In the study presented, SDQ scores were used to evaluate the behavioral characteristics of children. Higher scores on the SDQ-H and SDQ-Int scales were found to be associated with an increased risk of fractures in univariate analysis. Furthermore, SDQ-Int scores retained their statistical significance as risk factors for upper extremity fractures in the initial multivariate regression model. This convergence of findings aligns with prior research, reinforcing the assertion that children grappling with hyperactivity and/or internalizing disorders are at a heightened risk of injuries and fractures.[44] Consequently, it is prudent to consider child psychiatry evaluations for preschool children presenting with injury-related fractures upon their admission to healthcare facilities.

Limitations

Despite its contributions, the presented study does bear certain limitations that warrant acknowledgment. Foremost among these is the potential for response bias stemming from the collection of self-report data about individuals' psychological attributes through questionnaires. This mode of data collection may inadvertently introduce subjectivity and bias, thereby influencing the outcomes. Additionally, the relatively modest sample size may limit the extent to which the findings can be extrapolated and applied across broader populations. Consequently, the generalizability of the study's conclusions could be potentially limited due to this sample size constraint. Therefore, these limitations should be kept in mind when interpreting the results of the study.

CONCLUSION

In summary, severe injuries that lead to fractures in preschool children often occur in domestic and recreational settings and are largely preventable. Parental intervention programs that target risky behaviors have proven effective in reducing these injuries. It is crucial to identify parents who may benefit from such programs. This study comprehensively assessed the sociodemographic and psychological risk factors of both parents and children, reaffirming known risk factors and introducing parent-child psychology as a contributing factor to injuries and fractures in this demographic. The findings emphasize the importance of early diagnosis and intervention for conditions like ADHD, the role of both parents in teaching safety rules, and the need to address the psychological well-being of parents and children in injury prevention programs.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Okul öncesi çocuklarda üst ekstremite kırıkları için psikolojik risk faktörleri: Bir vaka-kontrol çalışması

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AMAÇ: Okul çağı çocuklarında üst ekstremite kırıkları gerek ebeveyn ve gerekse de çocuğun kendisine ait etkenler ile ilişkili ve çok faktörlü bir antitedir. Bu çalışma, okul öncesi çocuklarda üst ekstremite kırıkları ile ilişkilendirilen psikolojik risk faktörlerini araştırmayı amaçlamaktadır.

GEREÇ VE YÖNTEM: Bu tek merkezli, hastane tabanlı, yaş uyumlu vaka-kontrol çalışması, üst ekstremite kırığı vakalarını içeren 55 vaka ve büyüme ağrıları yaşayan 55 kontrol grubunu içermektedir. Çocukların ebeveynleri yüz yüze görüşmelerde bulundu. Üst ekstremite kırığı riski ile Anne-Bebek Bağlanma Ölçeği (MIBS), Yetişkin Dikkat Eksikliği Hiperaktivite Bozukluğu Kendi Bildirim Ölçeği (ASRS), Otizm Spektrum Kotası (AQ), Durum-Sürekli Kaygı Envanteri (STAI) ve Güçlükler ve Yetenekler Anketi (SDQ) skorları arasındaki potansiyel ilişkiler incelendi.

BULGULAR: İleri yaşta ebeveynler ve düşük hane geliri, üst ekstremite kırıkları için risk faktörleri olarak ortaya çıktı, annelerin daha uzun eğitim süresi ise koruyucu bir faktör olarak tanımlandı. Univariate analizlerde, Otizm Spektrum Kotası İletişim alt ölçeği (AQ-C), genel AQ skoru, Güçlükler ve Yetenekler Anketi Hiperaktivite alt ölçeği (SDQ-H) ve Güçlükler ve Yetenekler Anketi Duygusal ve Akran Problemler alt ölçeği (SDQ-Int) yüksek skorları, artmış bir kırık riski ile ilişkilendirildi (Odds Oranı (95% Güven Aralığı): 1.15 (1.05-1.27), OR: 1.05 (1.01-1.09), OR: 1.25 (1.01-1.54) ve OR: 1.19 (1.04-1.37), sırasıyla). AQ-C ve SDQ-Int ölçekleri, üst ekstremite kırıkları için risk faktörleri olarak çok değişkenli regresyon analizlerinde istatistiksel olarak anlamlı kaldı (OR: 1.15 (1.02-1.28) ve OR: 1.21 (1.02-1.43), sırasıyla).

SONUÇ: Bulgularımız, hem ebeveynleri hem de çocukları etkileyen psikolojik faktörlerin, okul öncesi çocuklarda üst ekstremite kırıkları riskini potansiyel olarak artırabileceğini göstermektedir.

Anahtar sözcükler: Ekstremite kırıkları; okul öncesi çocuklar; psikolojik faktörler; risk faktörleri, yaralanma.

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