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From Childhood Adversity to Adult Obesity, The Role of Early Life Stress in Shaping Future Weight Outcome

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Abstract

Background and Objectives: *Obesity is a growing global public health concern with multifactorial origins. This study investigates the relationship between adverse childhood experiences (ACEs)—including abuse, neglect, and household dysfunction—and obesity in adulthood. It aims to evaluate whether early life stress contributes to increased obesity risk later in life, while also examining potential associations with underweight status.*

Methods: *A retrospective cohort study was conducted involving 948 randomly selected individuals aged 18 years and above in the Sulaimani Governorate. Participants were assessed for exposure to ten recognized categories of ACEs using a structured questionnaire. Weight status (including obesity and underweight) was recorded and categorized according to established WHO-BMI classifications. Statistical analyses were performed to identify associations between cumulative ACE scores and weight-related outcomes.*

Results: *Among the participants, 59.4% reported exposure to at least one ACE category, and approximately 26% reported four or more. The most prevalent ACEs included physical abuse, emotional abuse, psychological and physical neglect, and exposure to domestic violence. A significant, graded relationship was identified between the number of ACEs and the prevalence of obesity. However, no statistically significant association was observed between ACEs and underweight status.*

Conclusion: *Adverse childhood experiences are both common and consequential, demonstrating a strong correlation with obesity in adulthood. However, no association was found between ACE exposure and underweight outcomes. These findings underscore the importance of early-life intervention strategies aimed at preventing childhood adversity to reduce obesity risk and promote healthier long- term outcomes.*

Keywords: Adverse Childhood Experiences (ACEs), Childhood Trauma, Early Life Stress, Adult Obesity, Abuse and Neglect, Toxic Stress

Introduction

Adverse Childhood Experiences (ACEs) refer to a range of potentially traumatic events occurring before the age of 18, including various forms of abuse, neglect, and household dysfunction. These experiences can significantly disrupt a child's development and are associated with long-term physical, mental, and behavioral health consequences in adulthood [1, 2].

ACEs are typically categorized into three domains:

1. **Abuse** (acts of commission): This includes physical, emotional, and sexual abuse, where harm is inflicted intentionally, though not always with the intent to injure [3].
2. **Neglect** (acts of omission): This involves the failure to provide for a child's basic physical, emotional, or educational needs [4].
3. **Household dysfunction**: This includes growing up in environments affected by parental substance use, mental illness, in-

carceration, domestic violence, or divorce [5].

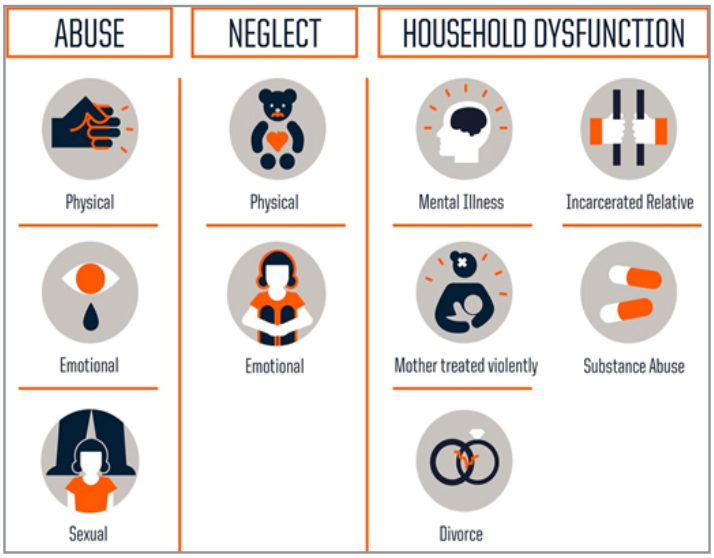

Figure 1: Types of ACEs from CDC site

These adverse experiences activate the body's stress response systems. While moderate stress in a supportive environment can foster resilience and adaptive coping, toxic stress—prolonged activation of stress systems in the absence of protective relationships—can impair brain architecture and organ development, leading to lifelong health issues [6, 7].

The impact of stress varies among individuals and is influenced by genetic predisposition, the presence of supportive caregivers, and the accumulation of other stressors [8]. Stress is thus classified into:

• Positive stress: brief and developmentally appropriate
• Tolerable stress: serious but buffered by supportive relationships
• Toxic stress: prolonged and unbuffered, leading to biological harm [9].

Biological mechanisms underlying ACEs involve dysregulation of neuroendocrine, immune, and metabolic systems. Brain development, particularly synaptic pruning and myelination is highly sensitive to environmental input during early life [10, 11]. Inadequate stimulation, poor nutrition, and exposure to toxins or neglect can impair these processes [12].

Emerging evidence also links ACEs to adult obesity, though the mechanisms remain complex. A notable longitudinal study by Lissau and Sørensen found that children identified as neglected had a tenfold increased risk of adult obesity compared to peers with average hygiene and care [13].

Recognizing child abuse requires vigilance for physical, behavioral, and emotional indicators. These may include unexplained injuries, developmental regression, inappropriate sexual behavior, or signs of neglect such as poor hygiene and malnutrition [14, 15]. Physicians should also be attentive to caregiver behaviors that may signal risk, such as indifference, excessive control, or inconsistent explanations for injuries [16].

Physical abuse can be suggested in the presence of the following:

• When marks of injuries, such as bruises, fractures or burns cannot be explained, Figure (2) shows some example pictures from the internet.
• When the physical finding and the given history do not match
. When a child has a medical issue for which the caregiver did not seek treatment.

Figure 2: Some physical findings that might indicate physical abuse

Abuse should be excluded in the presence of the following:
• When a child sexually behaves in a way that's inappropriate for his/her age
• When a child has sexually transmitted diseases or is pregnant.
• Presence of blood on the child's underwear
• When the child claims that he or she was sexually abused
• When a child complains of genital pain.

Emotional abuse is a possibility when:
• There is disproportional emotional development to the child's age.
• There is depression, low self-esteem or fearful children.
• There is withdrawal from or no interest in social activities.
• No medical explanation can be given for the child's complain like headaches or stomachaches.
• The child desperately seeks affection
• There is a declining school performance, or a child does not want to go to school
• There is regression in developmental skills

Physical and emotional neglect is noticed through:
• Low weight gain, personal hygiene, inadequate clothing or supplies that the child needs, when the parent or caregiver can provide it.
• Absence of or inappropriate medical, dental check-ups.
• A needy child who always seeks attention and has emotional swings that are out of norm.

Parental behavior
Most of the time the abuser is the parent or someone close to the family, that's why physicians should be aware of some behaviors of the parents like a parent who:
• It has little concern for the child's problem.
• Blames or hit the child for the problems
• Calls the child with negative terms, such as "worthless" or "evil"
• Follows difficult physical regulations or asks caregivers to do so
• Asks for inappropriate levels of physical or academic performance for child's age.
• Restricts the child's social interactions.

Tells incompatible explanations for a child's bruises fractures and sufferings.

Risk factors for perpetrating abuse include a history of being abused, mental illness, substance use, social isolation, and lack of parenting knowledge [17]. Effective intervention requires a multidisciplinary approach, prioritizing child safety, treating trauma-related conditions, and addressing family needs through specialized child protection services [18].

Study Aims
• To assess the prevalence of ACEs among a random sample of adolescents and adults (aged 14–87 years) in Sulaimani Governorate.
• To explore the association between ACE exposure and health-risk behaviors later in life.

Methods and Study Design

Study Design and Population
This study employed a retrospective cross-sectional design to assess the prevalence and impact of Adverse Childhood Experiences (ACEs) among a diverse sample of 948 individuals aged 18 to 87 years residing in Sulaimani Governorate, Iraq. Participants were selected using random sampling from various community sectors, including the general population, hospital patients, incarcerated individuals, and residents of rehabilitation centers. To enhance the likelihood of detecting associations between ACEs and adverse outcomes, recruitment was intentionally weighted toward populations with higher expected exposure to childhood adversity.

Data Collection Tool
Participants completed a regionally adapted version of the ACEs questionnaire, originally developed by the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO). The questionnaire was culturally modified in consultation with local experts to ensure relevance and sensitivity to Kurdish sociocultural norms. It was designed to assess exposure to multiple forms of childhood trauma and their potential influence on adult health-risk behaviors. (See Appendix 1 for the full questionnaire.)

Statistical Analysis
Data was analyzed using IBM SPSS Statistics, version 24. Descriptive statistics were used to summarize demographic characteristics and ACE exposure. To examine associations between ACEs and health-related outcomes, Compare Means analysis was conducted. A p-value < 0.05 was considered statistically significant.

In cases where participants left specific ACE-related items unanswered, responses were initially coded as "No", following a conservative approach that may bias results toward the null hypothesis. To assess the robustness of findings, a sensitivity analysis was performed by excluding all cases with missing ACE data. The results of this secondary analysis did not differ substantially from the primary findings, suggesting minimal impact of missing data on overall conclusions.

Obesity
To assess obesity as a health-risk outcome, participants self-reported their height and weight, from which Body Mass Index (BMI) was calculated. According to the World Health Organization (WHO) classification (Table-1), individuals with BMI ≥ 30 were categorized as obese.

Table 1: WHO Classification of BMI

BMI (kg/m²)	Classification
< 18.5	Underweight
18.5 – 24.9	Normal weight
25.0 – 29.9	Overweight

Results

A total of 948 participants were included in the study, comprising 529 males (55.8%) and 419 females (44.2%), aged between 18 and 87 years. The majority (60.02%) had attained high school education or higher.

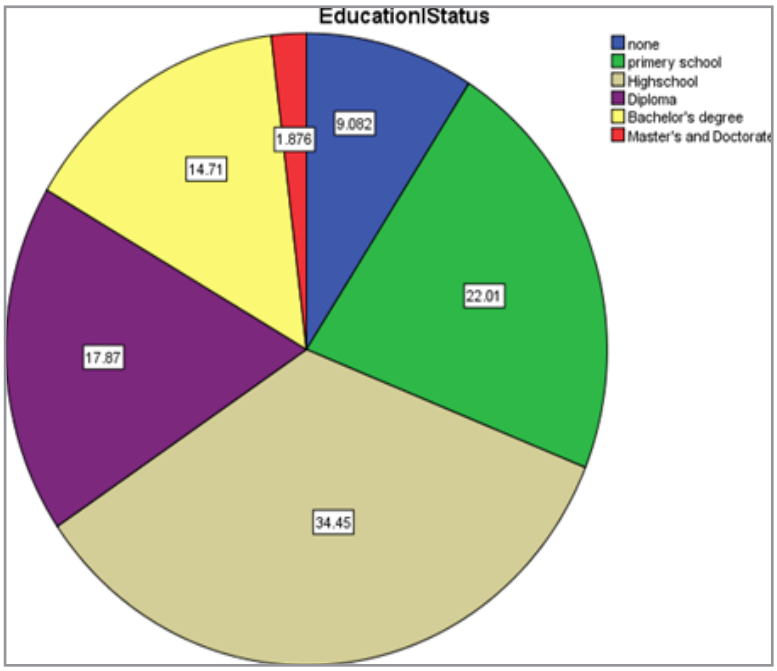

Figure 3: Educational status of the participants.

Prevalence of Adverse Childhood Experiences (ACEs)

Among the total sample, 59.4% of respondents reported exposure to at least one ACE, while 26% reported experiencing four or more ACEs. The distribution of ACE exposure is presented in Table 2

Table 2: Distribution of ACE Scores Among Participants

Number of ACEs	Frequency (n)
0	384
1	107
2	97
3	114
4	119
5	73
6	26
7	17
8	9
9	2
Total	948

Types of ACEs Reported

The most reported ACE was physical abuse (18.5%), followed by emotional abuse (14.4%), emotional neglect (14.2%), and physical neglect (13.9%). Less frequently reported ACEs included exposure to domestic violence (9.7%), incarceration of a family member (6.9%), mental illness in the household (5.9%), parental separation/divorce (5.7%), sexual abuse (5.6%), and household substance abuse (5.2%).

Table 3: Prevalence of Individual ACE Categories

ACE Category	Frequency (n)	Percentage (%)
Physical Abuse	175	18.5%
Emotional Abuse	136	14.4%
Emotional Neglect	134	14.2%
Physical Neglect	131	13.9%
Mother Treated Violently	91	9.7%
Incarcerated Family Member	65	6.9%
Mental Illness in Household	55	5.9%
Parental Separation/Divorce	54	5.7%
Sexual Abuse	53	5.6%
Household Substance Abuse	49	5.2%

Association Between ACEs and Obesity

After excluding participants with incomplete BMI data, 12.4% of the remaining samples were classified as obese (BMI ≥ 30). Statistical analysis revealed a significant positive association between the number of ACEs and obesity (mean ACE score in obese group: 5.40 ± 2.68, p = 0.023).

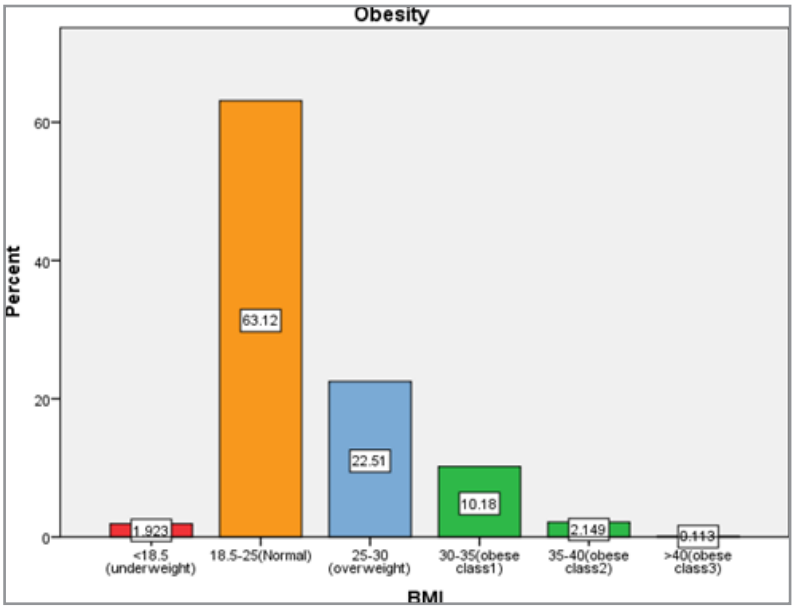

Figure 4: BMI percentage in Bar chart

Association Between ACEs and Underweight

Participants classified as underweight (BMI < 18.5) did not show a statistically significant association with ACE exposure. The mean ACE score among underweight individuals was not significantly different from those with normal BMI (p = 0.412), indicating no meaningful correlation between ACEs and underweight status in this population.

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Discussion

The gender distribution of participants in this study was approximately balanced, reducing the potential for gender-based bias—a pattern also observed in previous research [19–22]. Participants were drawn from a diverse range of educational and socioeconomic backgrounds to enhance generalizability and minimize sampling bias.

A total of 59.4% of respondents reported experiencing at least one Adverse Childhood Experience (ACE), with approximately 26% reporting four or more. The most reported ACEs were physical abuse, emotional abuse, physical neglect, and emotional neglect, closely aligning with findings from a multi-country study conducted between 2010 and 2013 in parts of Eastern Europe and Central Asia.

That study, which included 10,696 respondents from Albania, Latvia, Lithuania, Montenegro, Romania, the Russian Federation, North Macedonia, and Turkey, revealed that over 50% of participants had been exposed to at least one form of abuse [23].

As consistently demonstrated in ACE literature, ACEs tend to co-occur experiencing one increases the likelihood of exposure to others [22]. In our study, a graded association was evident

between the number of ACEs and subsequent health-risk behaviors. This finding mirrors a study conducted in Saudi Arabia, in which physical abuse and neglect were also the most prevalent ACEs [23].

Interestingly, ACE prevalence in our study exceeded that reported in the original CDC-Kaiser ACE study, which found that 36.1% of participants experienced one or more ACEs and 12.5% experienced four or more [26]. That foundational study reported the most common ACEs in descending order as physical abuse, household substance use, parental separation, sexual abuse, household mental illness, emotional neglect, emotional abuse, physical neglect, and incarceration of a family member.

These regional differences may reflect cultural norms, where behaviors such as corporal punishment and verbal aggression are socially accepted as disciplinary methods. Meanwhile, other ACE types—such as sexual abuse, parental separation, and drug misuse—may be underreported due to stigma or denial, even when they are present. The association between ACEs and obesity has been documented in multiple studies. Williamson et al. found that exposure to multiple ACEs significantly increased the risk of both overweight and morbid obesity [24]. A later U.S.-based study in 2016 confirmed this relationship, particularly among those exposed to physical abuse. In our sample, although obesity was less prevalent, the association with higher ACE scores was evident. The comparatively lower prevalence of obesity may reflect regional dietary patterns and lifestyle factors—although definitive conclusions are limited due to a lack of regional obesity surveillance data.

Importantly, our study found no statistically significant association between ACEs and underweight status ($p = 0.412$). This aligns with findings from a Polish cohort study, which reported that while ACEs were associated with both obesity and underweight in unadjusted models, ACE accumulation was not significantly related to underweight after adjusting for socioeconomic factors [25]. A global meta- analysis also found stronger associations between ACEs and overweight/obesity, with less consistent evidence linking ACEs to underweight [26].

Conclusion

• Child abuse and neglect are alarmingly common and often underrecognized in both healthcare and community settings.
• The presence of a single ACE often indicates exposure to multiple forms of adversity; in this study, approximately 26% of participants reported four or more ACEs.
• A graded relationship exists between the number of ACEs and increased health-risk behaviors in later life, including substance use, depression, obesity, and marital instability.

Recommendations

To reduce the burden of ACEs and prevent intergenerational trauma, we recommend the following:
• Parental awareness and support: Educate caregivers about positive parenting practices, the importance of emotional connection, and the impact of stress and anger. Encourage treatment-seeking for mental health or substance use disorders, especially among caregivers with their own histories of childhood adversity.
• Community interventions: Increase public education through mass media campaigns, workshops, and training for teachers, social workers, and healthcare professionals on ACE prevention and response.
• Emergency support: Strengthen public access to immediate assistance through services like the Child Helpline 116, a dedicated resource in Sulaimani Governorate.
• Policy reform: Establish a comprehensive, rights-based child protection framework involving proactive identification, early intervention, long-term rehabilitation, and reintegration. Given Iraq's context of ongoing conflict and displacement, urgent action is needed to address the heightened vulnerability of children to violence, exploitation, and economic hardship.
• Multidisciplinary care centers: Expand integrated child protection units composed of pediatricians, mental health professionals, legal advocates, educators, and social workers to ensure coordinated, holistic care [27].

Appendix one: ACEs questionnaire:
Prior to your 18th birthday:
• Did a parent or other adult in the household often or very often…. insult you, put you down, or humiliate you? Or Act in a way that made you afraid that you might be physically hurt?
• Did a parent or other adult in the household often or very often… Push, grab, slap, or throw something at you? or ever hit you so hard that you had marks or were injured?
• Did an adult or person at least 5 years older than you ever… Touch or fondle you or have you touch their body in a sexual way? or Attempt or actually have oral, anal, or vaginal intercourse with you?
• Did you often or very often feel that … No one in your family loved you or thought you were important or special? or Your family didn't look out for each other, feel close to each other, or support each other?
• Did you often or very often feel that … You didn't have enough to eat, had to wear dirty clothes, and had no one to protect you? or Your parents were too drunk or high to take care of you or take you to the doctor if you needed it?
• Were your parents ever separated or divorced?
• Was your mother or stepmother:
Often or very often pushed, grabbed, slapped, or had something thrown at her? or sometimes, often, or very often kicked, bitten, hit with a fist, or hit with something hard? or ever repeatedly hit over at least a few minutes or threatened with a gun or knife?
• Did you live with anyone who was a problem drinker or alcoholic, or who used street drugs?
• Was a household member depressed or mentally ill, or did a household member attempt suicide?
• Did a household member go to prison?
We gave 1 to each Yes answers and 0 to No answers and we added up "Yes" answers.

There are, of course, many other types of childhood trauma — watching a sibling being abused, losing a caregiver (grandmother, mother, grandfather, etc.), homelessness, surviving and recovering from a severe accident, witnessing a father being abused by a mother, witnessing a grandmother abusing a father, etc. The ACE Study included only those 10 childhood traumas because those were mentioned as most common by previous researches and we tried to find the correlation between them and adverse outcomes like smoking, alcoholism, drug abuse, obesity, depression and rate of divorce.

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