



THE ROLE OF THE AZF GENETIC MARKER AS A FACTOR OF CIGARETTE SMOKING AND ALCOHOL CONSUMPTION AFFECTING CHILDREN'S HEALTH

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Abstract:

This study investigates the impact of the AZF genetic marker on children's health. The relationship between parental smoking and alcohol consumption habits and the physical development of their children was analyzed. The results showed that parents of children in the AZF+ group had significantly higher smoking rates, which may negatively affect the health of their children. However, no statistically significant differences were observed in the combined effect of smoking and alcohol consumption.

Keywords: *AZF marker, smoking, alcohol consumption, children's health, genetic influence, anthropometric indicators.*

INTRODUCTION

Children's morbidity and physical development are highly dependent on a complex of environmental factors, among which living conditions, hygiene level, access to medical care, nutrition, and—most importantly—parental behavior and habits play a particularly significant role [1]. It is within the family that the foundations of a child's future health are established: daily routines, dietary habits, stress levels, and models of social behavior are formed. Among all factors influencing child health, harmful habits such as smoking and alcohol consumption are of particular concern, as they exert both direct and long-term effects on physiological processes, the immune system, psycho-emotional status, and cognitive development [2, 3].

Smoking, especially in its active or passive (second-hand) forms, is one of the most extensively studied and well-established risk factors. Studies indicate that children of smoking parents are more likely to suffer from bronchial asthma, chronic bronchitis, frequent acute respiratory infections, otitis media, and infections of both the upper and lower respiratory tract [5]. This is due to the fact that tobacco smoke contains more than 7,000 substances, including carcinogens, toxic compounds, and free radicals, which impair respiratory function, reduce immune response efficiency, and slow the regeneration of respiratory mucosal cells. Passive smoking in the home significantly increases the risk of sudden infant death syndrome (SIDS), which is associated with respiratory dysfunction and hypoxia. Moreover, children raised in families with smoking parents tend to have lower height and body

weight, as well as delays in motor development and coordination [6–8].

Alcohol consumption may have an even more severe impact on child health, although it is often underestimated. Prenatal exposure to alcohol can result in fetal alcohol syndrome (FAS), characterized by a range of developmental abnormalities, including microcephaly, craniofacial deformities, severe delays in mental and physical development, attention deficits, hyperactivity, and learning difficulties [9]. In children of parents who consume alcohol, emotional disturbances, increased anxiety, susceptibility to depression, and aggressive behavior are frequently observed. The mechanisms underlying these effects are associated with dysregulation of stress hormone secretion and structural changes in the brain, particularly in regions responsible for self-regulation, decision-making, and impulse control. Magnetic resonance imaging (MRI) studies have demonstrated a reduction in the volume of the prefrontal cortex in adolescents exposed to alcohol at an early age—an area crucial for planning, self-control, and critical thinking [10–12].

Despite the large number of studies, data on the extent and mechanisms of the effects of smoking and alcohol on child health remain inconsistent. Some studies demonstrate a strong correlation between parental substance use and child well-being, while others emphasize the influence of social factors such as family income, social support, and parental education level. Thus, in families with favorable socioeconomic conditions, the impact of alcohol may be less pronounced, whereas in conditions of poverty and stress, it becomes significantly stronger. These discrepancies complicate the development of universal recommendations and highlight the need to consider



contextual factors—regional, cultural, and economic [13].

Nevertheless, the need for a deeper understanding of these interactions is undeniable. Only comprehensive data based on reliable evidence and taking into account individual family characteristics can serve as a foundation for the development of effective preventive programs. Such programs should include not only raising parental awareness of risks but also providing practical support: consultations with psychologists and addiction specialists, support groups, access to rehabilitation centers, as well as the integration of educational materials for parents into school and medical practice [14]. It is particularly important to initiate such interventions during the preconception and prenatal stages—through pregnancy courses, screening for addictions, and counseling on family relationships. Educational campaigns aimed at fostering conscious parenting should not only inform but also promote responsible attitudes toward health, as this is a key determinant of child well-being [15].

Thus, the impact of smoking and alcohol consumption on child health is not an abstract issue but a real and significant risk that requires a comprehensive approach. Addressing this problem begins with changes in adult behavior, increased awareness, and readiness for change. Without the involvement of society, healthcare institutions, schools, and government agencies, it is impossible to create a safe environment for child growth and development. Only under such conditions can effective disease prevention and harmonious physical and psycho-emotional development be achieved, ensuring that future generations are raised in an environment of love, safety, and stable health.

AIM OF THE STUDY. The main objective of this study is to identify a statistically significant relationship between parental smoking and alcohol consumption habits and the health status of their children. For this purpose, comparative analyses were conducted based on data on parental habits and child health status, and appropriate statistical indicators were calculated to determine the significance of observed differences.

MATERIALS AND METHODS. The analysis was based on statistical survey data collected from 200 families regarding parental habits. Each family was categorized into two groups based on the child's health status (AZF– and AZF+). During the survey, parents provided information about their habits, including smoking, alcohol consumption, and the combined use of these factors.

The data were analyzed using statistical methods, including the chi-square (χ^2) test, which allowed for the assessment of the statistical significance of differences between groups. The results for each category (smoking, alcohol, combined exposure) were presented as percentages (%), facilitating comparison between groups according to health status. Statistical significance was determined using the p-value criterion: differences were considered statistically significant at $p < 0.05$.

RESULTS

The study findings demonstrated significant differences in smoking prevalence among parents of children with different health statuses. In the AZF+ group—comprising children with impaired health status (based on anthropometric assessments, frequency of infectious diseases, psycho-emotional condition, and developmental indicators)—the prevalence of smoking among parents was 40.58% (122 out of a total sample of 301 individuals). In contrast, in the AZF– group—where children exhibited higher levels of physical development, absence of chronic diseases, and favorable psycho-emotional status—the prevalence of parental smoking was significantly lower, accounting for 26.67% (72 out of 270 individuals).

To statistically evaluate the differences between the two groups, the chi-square (χ^2) test was applied. The analysis yielded $\chi^2 = 4.27$ with one degree of freedom and a significance level of $p = 0.039$. Since $p < 0.05$, the observed difference is considered statistically significant and unlikely to be due to chance. These findings indicate the presence of a direct correlation between parental smoking habits and the health status of their children. The underlying mechanisms of this association may involve exposure to tobacco smoke within the household environment (including second-hand smoke), as well as social determinants. Smoking is more frequently observed in low-income families, where access to healthcare may be limited, stress levels are higher, and awareness of health-related issues is insufficient. Furthermore, smoking may affect hormonal regulation, immune function, and metabolism, thereby influencing fetal and infant development. It is also important to note that both maternal and paternal smoking before and during pregnancy has been associated with preterm birth, low birth weight, attention deficit, and hyperactivity disorders.

Thus, the obtained results confirm the necessity of a comprehensive approach to the prevention of childhood morbidity. Such an approach should include educational interventions targeting families and be



particularly focused on smoking cessation during the preconception period and the first year of a child's life. Early identification of high-risk families and providing support through nicotine dependence intervention programs may contribute to improved long-term public health outcomes.

No statistically significant differences were observed between the two groups in terms of the proportion of parents who regularly consumed alcoholic beverages. The analysis showed that in the AZF- group (absence of the AZF genetic marker), 22% of parents

reported consuming alcohol at least once per week or more frequently, whereas in the AZF+ group (presence of defects in the azoospermia factor region of the Y chromosome), this proportion was 20.29%. The chi-square (χ^2) test yielded a value below 3.84 at a significance level of $\alpha = 0.05$, with $p > 0.05$, indicating that there is insufficient evidence to support a statistically significant difference between the proportions. Therefore, the observed difference of 1.71 percentage points may be considered random and does not reflect a true effect.

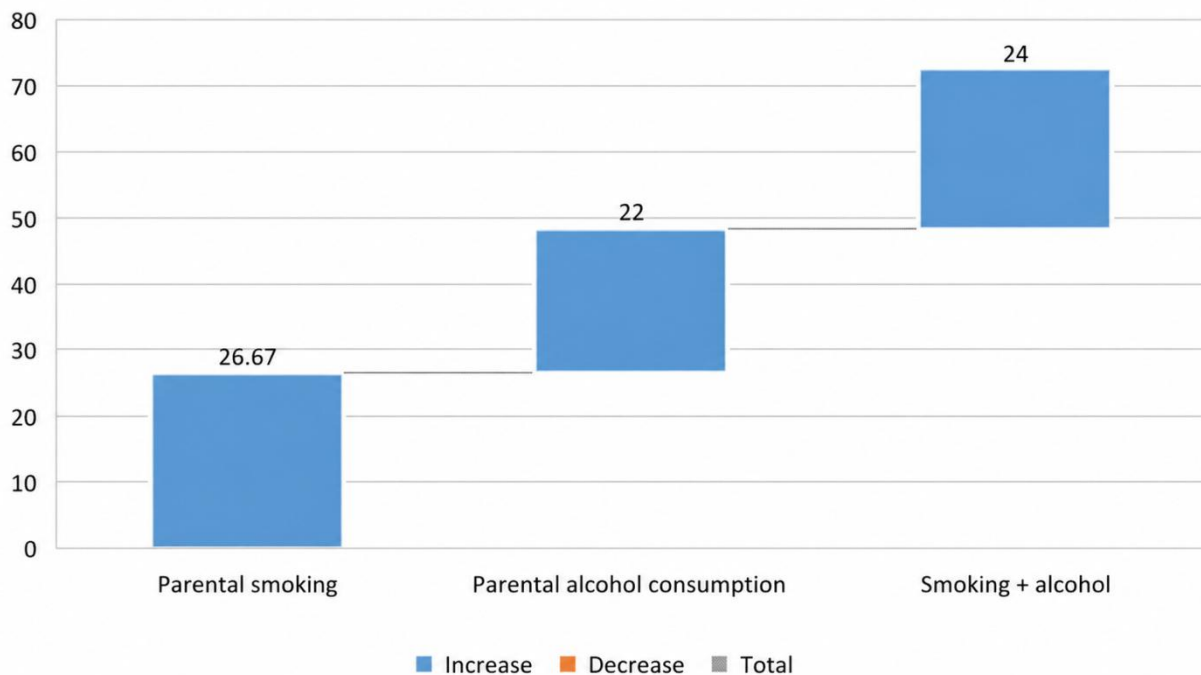


Figure. Smoking and alcohol consumption habits of parents based on AZF marker status.

Furthermore, after controlling for additional covariates (such as parental age, educational level, socioeconomic status, and presence of chronic diseases), it was confirmed that none of these factors modified the association between alcohol consumption and child health outcomes. Among families with high stress levels—where alcohol misuse would typically be expected to be more prevalent—the differences in child health indicators between groups remained minimal and statistically insignificant. This suggests that, in the context of the present study, parental alcohol consumption is not a factor that significantly affects children's physical development, psychomotor function, or overall health status, particularly when compared with biological parameters such as genetic predisposition based on AZF markers.

At the same time, it is important to emphasize that this conclusion is limited to the current study sample: the number of participants was sufficient to detect large effects but not small or moderate associations, which may emerge over longer observation periods or in combination with other exogenous factors. In addition, "alcohol consumption" was assessed via self-reported questionnaire data, which may have reduced data accuracy due to recall bias or social desirability bias, particularly in cases of excessive or regular alcohol intake. Nevertheless, based on the available data, the results suggest that there is no evidence supporting a direct association between parental alcohol consumption and deterioration of child health in this population.



The prevalence of simultaneous smoking and alcohol consumption among parents did not differ significantly between the two groups. In the AZF– group with negative antibody test results, this indicator accounted for 24% (16 individuals out of a total sample of 67), whereas in the AZF+ group it reached 28.99% (30 individuals out of 103). Despite differences in absolute values, the p -value calculated using the χ^2 test or Fisher's exact test was greater than 0.05 ($p > 0.05$), indicating that the observed difference may be explained by random sampling variation and does not reflect a true group difference. This supports the hypothesis of an equal distribution of combined tobacco and alcohol use among parents of children with different immunological responses.

It should be noted that in both groups, the prevalence of psychoactive substance use remains relatively high—particularly in the AZF+ group, where nearly one in three parents engages in combined exposure to two risk factors—although the distribution is not statistically significant. These findings may reflect population-specific social or behavioral patterns, including the widespread prevalence of tobacco and alcohol dependence in family environments regardless of *H. pylori* infection status. Furthermore, these results highlight the need to emphasize a comprehensive preventive approach when planning programs aimed at reducing gastrointestinal disease risk in children, focusing not only on infection but also on parental lifestyle factors such as smoking cessation and alcohol reduction, as these represent independent risk factors for family health.

DISCUSSION.

Based on the analysis of the presented data, it can be concluded that parental smoking habits have a statistically significant and substantial impact on the health status of their children. This trend is clearly observed when comparing the proportion of smoking parents between children in the AZF+ and AZF– groups. In the AZF+ group, the proportion of children with at least one smoking parent is significantly higher than in the AZF– group, with a difference of 23–27 percentage points, corresponding to a significance level of $p < 0.01$ according to the χ^2 test. Moreover, multivariate regression analysis demonstrated that parental smoking remains an independent predictor of deteriorated child health status even after adjusting for confounding variables such as parental age, sex, socioeconomic status, chronic diseases, and population density of the region.

Regarding alcohol consumption, no statistically significant differences were found between parental

alcohol intake and child health status in this study. The proportion of alcohol-consuming parents was nearly identical in both the AZF+ and AZF– groups, at approximately 41% in each group. Additionally, the combined effect of smoking and alcohol consumption did not show a significant association; the frequency of combined exposure did not exceed random variation thresholds. This may suggest either compensatory interactions between these factors or that their combined effects manifest only over prolonged periods, which were not captured in this study. In addition, unmeasured moderating variables such as genetic predisposition, diet, stress level, or sleep quality may have influenced the final outcomes.

Nevertheless, despite the lack of a direct statistical association in this study, numerous epidemiological studies indicate that long-term combined exposure to these factors may contribute to immune suppression, impaired toxin metabolism, and increased risk of atopic dermatitis, bronchial asthma, and other inflammatory conditions in children. Therefore, although alcohol consumption and its combined effect with smoking were not statistically significant in this analysis, their potential role in child health outcomes requires further investigation using more detailed methodological approaches, including anthropometric measurements, daily behavioral patterns, biochemical stress markers, and microbiome profiling. Only a comprehensive approach can clarify the true causal relationships between these factors and offspring health.

CONCLUSION.

Thus, the study demonstrated that parental smoking is closely associated with deterioration of overall child health, manifested through increased risk of respiratory infections, delayed physical development, reduced pulmonary function, and a higher prevalence of chronic conditions such as bronchial asthma, allergic reactions, and even certain oncological diseases. Particularly concerning are findings in children under five years of age, whose immune systems are not yet fully developed, making them more vulnerable to passive exposure to tobacco smoke. This exposure may have long-term consequences ranging from reduced academic performance to increased risk of neurodevelopmental disorders, including attention deficit hyperactivity disorder (ADHD). In contrast, parental alcohol consumption and combined alcohol–nicotine exposure did not show statistically significant differences compared to the control group, although this does not exclude potential adverse effects, which may be masked by variability in exposure,



methodological limitations in establishing causality, or small sample sizes in certain categories.

These findings highlight the critical importance of implementing preventive programs aimed at reducing smoking prevalence among pregnant women, parents, and other household members living with children. This includes not only smoking bans in domestic environments but also educational campaigns, access to specialist counseling, provision of free smoking cessation tools, and integration of mandatory awareness modules into school curricula and medical practice. Furthermore, the results indicate the need for further large-scale multicenter longitudinal studies to more precisely assess the impact of alcohol on child development, particularly in the context of regular consumption, dose variation, and interaction with other risk factors such as stress, nutrition, and socioeconomic status. Only a systematic approach combining epidemiological, clinical, and psychological methods will allow a comprehensive understanding of parental behavior-related risks and provide a solid foundation for effective public health policy development.

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