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Prevalence and risk factors of attention deficit hyperactive disorder among children aged 6–17 years in arbaminch City, Gamo zone, Southern Ethiopia: a community-based cross-sectional study

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Abstract

Introduction Attention deficit hyperactivity disorder (ADHD) is among the most common neurodevelopmental diseases affecting children and adolescents all over the world. There is limited evidence on the magnitude of ADHD among children in the Southern Nation and Nationality region in Ethiopia. Therefore, this study aimed to assess the magnitude and associated factors of ADHD among children aged 6–17 years in Arba Minch town, Southern Ethiopia.

Methods A community-based cross-sectional study was conducted in Arba Minch city from April 5 to May 5, 2023. A study included 520 participants. A multistage sampling followed by systematic random sampling was used to select the study participants. The Vanderbilt ADHD diagnostic DSM-IV criteria using a pre-tested, structured questionnaire with a face-to-face interview were used to assess the outcome. For data entry and analysis, Epi Info version 7 and STATA version 14 software were used, respectively. Variables with a $p < 0.25$ from the bivariate analysis were considered for the multivariable analysis. The multivariable logistic regression analysis was performed to identify statistically significant variables with a p-value of < 0.05. The adjusted odds ratio presented the strength of the association with a 95% confidence interval.

Result The prevalence of ADHD was found to be 9.77% (95% CI; 7.47–12.66) in Arbaminch city. Family history of mental illness (AOR = 2.27; 95% CI: 1.15–4.45), children with a history of previous mental health problems (AOR = 7.11; 95% CI: 1.66–30.41), children whose mothers used alcohol during pregnancy (AOR = 3.36; 95% CI: 1.41–7.99), and children whose mothers smoked tobacco during their lifetime (AOR = 4.17; 95% CI: 1.05–16.89) were significantly associated with attention-deficit hyperactivity disorder.

Conclusion According to this study, one in ten children in Arbaminch City, Ethiopia, is diagnosed with ADHD. Key predictors of ADHD include a prior history of mental illness in the child, maternal smoking, alcohol consumption during pregnancy, and a family history of mental disorders. Consequently, children with previous mental health

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issues and those from families with a history of mental illness should receive special attention. Additionally, expectant mothers must be informed about the harmful effects of alcohol and tobacco consumption on fetal development.

Keywords Attention-deficit hyperactivity disorder, Associated factors, Children, Arba minch

Introduction

Attention deficit hyperactivity disorder (ADHD) is a neurodevelopmental condition that can be diagnosed based on behavioral characteristics [1]. ADHD is usually first identified in school children when it leads to distraction in the class [2]. Children with ADHD have trouble focusing, being fidgety, and controlling impulsive behavior. ADHD has three main types: attention deficit, hyperactive impulsive, and combined types [3]. The most common subtype of ADHD was found to be primarily inattentive (ADHD-I), followed by hyperactive-impulsive (ADHD-HI) and the combined type (ADHD-C), with prevalence rates of 2.95%, 2.77%, and 2.44%, respectively. The most common type of ADHD in both boys (4.05%) and girls (2.21%) was the inattentive type (ADHD-I) [4, 5].

Attention deficit hyperactive disorder occurs all over the world [8]. For the past two decades, global surveys on ADHD in children have consistently shown an increase in diagnostic prevalence; it ranges from 5.29 to 8.0% [6]. However, it varies across countries. For instance, the prevalence of ADHD among children aged 6–17 years in Spain was found to be 4.9 [7], 12.9% in the USA [8], 5.9% in the Arab Gulf [9], 10.3% in the Middle East [10], and around 8.7% in Africa [11]. Prior studies in Ethiopia also revealed varied findings ranging from 7.3 to 44.3% [11–13]. However, there is a scarcity of studies on the southern nations nationalities and peoples region of Ethiopia.

The etiology of ADHD is unclear. As per prior researchs, there is a strong association between ADHD in children and various factors such as drug addiction, psychosocial factors like stressful life events, clinical factors like a history of mental illness or psychiatric disorders, maternal alcohol use, bottle feeding, parents educational level, history of brain injury, child age, child sex, being a preterm birth, single parenthood, family socio-economic status, birth order, and problems related to pregnancy and newborns [14–18].

ADHD is a substantial public health concern that has been linked to several negative health outcomes for affected individuals as well as considerable financial consequences for families and society [19]. It is a risk factor for children and adolescents for various mental health illnesses, disastrous behavioral outcomes, academic underachievement, unemployment, poor relationships, committing crimes, and it also persists to adulthood. If ADHD is not detected and treated as soon as possible, it will have a significant cost to society in terms of low academic accomplishment, poor sociability, and vocational underachievement [20, 21]. Children with issues like those associated with ADHD can benefit from early identification and treatment, which can enhance long-term results [19]. For the creation of health policies as well as educational and rehabilitation initiatives, understanding its effect is the crucial step to lessen the burden [22].

Current clinical experts recommend a personalized multimodal approach to treating ADHD, including psychological treatments, medication, and non-pharmacological interventions [23]. Early identification and diagnosis of ADHD in children and adolescents helps to improve academic performance, development, and quality of life in this population [24, 25]. However, many developing countries, including Ethiopia, face challenges due to difficulty in early identification and diagnosis of the problem, teachers lack of knowledge about ADHD, challenges related to stigma, worrying about children's futures, lack of social support, and economic constraints [26, 27]. As a result, there is a pressing need for increased awareness, education, and resources to support early identification and effective management of ADHD in these regions to ensure improved outcomes for affected individuals and their families.

The Southern Nations, Nationalities, and Peoples region in Ethiopia is one of the country's most culturally and ethnically diverse regions. The socio-economic disparities and varying lifestyle factors in this area may influence the prevalence and contributing factors of ADHD among children [28]. However, there is a scarcity of information on the magnitude of ADHD among children in this study area. In addition, prior studies in Ethiopia were conducted far from this area; therefore, variation in the magnitude of the ADHD might be observed. Furthermore, there is a dearth of up-to-date information on the magnitude of ADHD among children aged 6–17 years in Ethiopia at the primary level. Therefore, to account for the above facts, this study aimed to assess the magnitude and risk factors of ADHD among children aged 6–17 years in Arba Minch City, Southern Ethiopia. The findings from this study will help to inform the concerned bodies about the magnitude of ADHD and to identify modifiable risk factors in these culturally diverse communities.

Methods

Study design and study period

A community-based cross-sectional study design was employed among children aged 6 to 17 years old to

determine the prevalence and associated factors of ADHD from April 5 to May 5, 2023.

Study area

The study took place in Arba Minch, the administrative center of the Gamo Zone in the South Nation Nationality People Region (SNNPR) of Ethiopia. Currently, Arba Minch is the capital of both the Gamo Zone and Arba Minch Zuria Woreda. The town is situated at an elevation of 1285 m above sea level, approximately 495 km south of Addis Ababa (the capital of Ethiopia) and 275 km southwest of Hawassa (the regional capital). The town's administration estimates its population to be around 115,639 residents [29]. Based on data from the Arba Minch town health office, the town has two hospitals, two health centers, 11 health posts, and various private clinics serving the community. According to statistics from the 2020/2021 Arba Minch town education office, there are eight government-run and 11 private primary schools. Additionally, the town is home to three private and three public high schools.

Source population

The source populations were all children aged 6–17 years who lived in Arbaminch town, Southern Ethiopia.

Study population

The study populations were children aged 6–17 years who lived in Arbaminch town and were present in the data collection period.

Inclusion and exclusion criteria

The study included all children aged 6–17 years who, along with their parents/caregivers, were present in each household during the data collection period and lived in the town for more than six months. Children aged 6–17 years and those parents or caregivers who had severe illness during the data collection period were excluded from the study ($n = 6$).

Sample size determination

Sample size was determined from prior studies report of Shewa Robit [30] and West Shewa by using different variables as exposure variables for calculating sample size considering the following parameter on Epi Data 7: AOR as the exposure variable, a power level of 80%, and the ratio of exposed to unexposed 1:1. Therefore, by taking a 10% contingency for the non-response rate, the sample size is stated below on Table 1. (Table 1)

The sample size was determined by using the odds ratios of associated factors of ADHD among children aged 6–17 from previous research that was conducted in West Shewa, Ethiopia. The sample size, which was calculated from a family history of mental illness, was 236, which was the largest. Since it was a multistage sampling procedure, population correction was used: $n = 236^{*}2 = 472$. Thus, with a 10% non-respondent rate: $n = 472 + 47 = 520$. Therefore, the final sample size was the maximum = 520.

Sampling procedures and sampling techniques

A multistage sampling method was used for the selection of sampling units. The town had four kifle ketema (refers to a sub-city or district within a larger city), which had eleven kebeles in total with 23,639 households; kebele is the smallest administrative unit in Ethiopia. Out of them, two kifle ketemas, namely Abaya and Sikela, were selected by a simple random sampling technique. All kebeles in the selected kifle ketema were included in the study. The kebeles included were Dil-Fana, Gurba, Menaharya, Kulfo, and Woze kebeles, which had a total of 10,745 households. A total of 4,068 children aged 6 to 17 years were living within the 2,137 households in the selected kebeles. First, children who fulfilled the eligibility criteria were identified and proportionally distributed to each selected kebele. Then, households were coded for having children aged 6–17 years marked and recorded. Finally, by using systematic random sampling techniques, listed households and each eligible child in the selected households were included in the study by selecting the first children, then every 5th child was interviewed, and the final sample included 520. For more than one eligible child available in the selected households, a lottery method was used to select one child, and for those with both parents existing at the time.of data collection, the mother was taken. (Fig. 1)

Variables of the study

Dependent variable

Attention deficit hyperactive disorder (ADHD).

Table 1 Sample size determination to assess the prevalence and associated factors of attention deficit hyperactive disorder among children aged 6–17 in arbaminch town, Gamo zone, Southern Ethiopia, 2023

Variables	Power	CI	AOR	Sample size	Non-response	References
Life time substance use	80%	95%	2.43	224	248	Shewa robit
History of child mental illness	80%	95%	8.45	92	101	
Family history of mental illness	80%	95%	3.6	236	260	West Shewa
Psychosocial stressor	80%	95%	4.32	192	211	

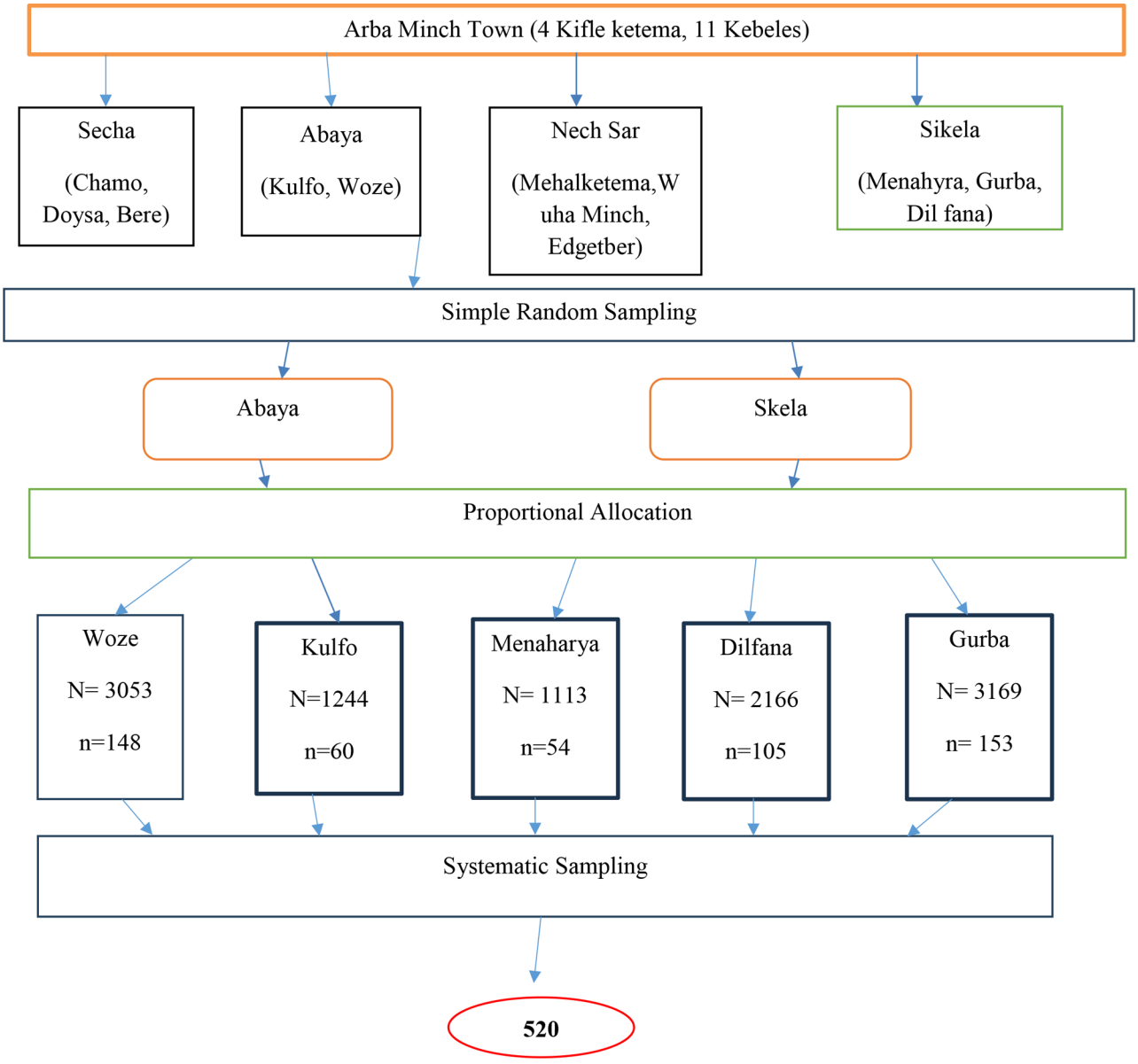

Fig. 1 Schematic presentation of sampling procedure of prevalence and its associated factor of ADHD in children aged 6-17 in Arba Minch town, Southern Ethiopia, 2023

Independent variables

Independent variables were adopted from different prior literatures [12, 31–39].

Socio-demographic factors

Socio-demographic factors include child age, maternal age at the time of pregnancy, sex, religion, parental marital status, parental educational status, family monthly income, and number of household members.

Stressful psychosocial factors: consists of the loss of loved ones, major financial problem (inability to cover daily expenses).

Substance related factors includes use of substances at the time of pregnancy, ever use of substances in the lifetime.

Clinical factors contains a history of a psychiatric disorder for child, family history of mental illness, history of chronic medical/physical illnesses for a child.

Obstetric and neonatal factors consists of any complication during pregnancy, complicated delivery, prematurity/low birth weight/, intrauterine growth retardation.

Operational definitions

Inattention Six or more of the DSM-IV symptoms of inattention that have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level [40, 41].

Hyperactivity-Impulsivity Six or more of the DSM-IV symptoms of hyperactivity-impulsivity that have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly social and academic or occupational activities [40, 41].

Combined ADHD when a child has symptoms that met the criteria of both inattention and hyperactivity-impulsivity equally present [40, 41].

Previous mental illness Information either medically confirmed or subjectively told any of mental health problem manifestation [42].

Psychological stressful life events

The presence of stressful life events explained by the individuals who have experienced one or more of the following stressful life events in the last 6 months: (1) Loss of loved ones: If a family member or someone close to the respondent died within the last 6 months (2) Financial stress: If one lost his/her job or he/she had experience hunger due to lack of money within the last 6 months [42].

Use of substances at conception in this study it is defined as the use of at least one of specified substance (cigarette, alcohol, khat, and other substances) throughout the time of pregnancy of the child being asked [30].

Ever use substances it is defined as use of at least one of specified substance of the following even once in life time (cigarette, alcohol, khat, and other substances) [30].

Data collection tools and procedures

Data was gathered using a validated instrument, specifically a pre-tested structured questionnaire, with parents or caregivers serving as informants. The survey methodology draws on previously published studies [30]. The survey comprised six components: socio-demographic, psychosocial, substance-related, clinical, obstetric, neonatal, and the Vanderbilt ADHD diagnostic parent rating scale. It was translated into Amharic to ensure comprehension by all participants. To identify any potential issues with the data collection instruments and modify the questionnaire as needed, a pre-test was conducted with 5% of the sample size at Edget-ber kebele, a distinct area of the town. This step ensured data completeness, enabled cross-checking and facilitated corrective actions on the questionnaires. The pre-test results were excluded from the final report. Data collection took place over 30 days through interviewer-administered, face-to-face interviews after obtaining consent and assent from participants. Five BSc nurses were hired for data collection, and two BSc psychiatry nurses were appointed as supervisors to oversee daily data collection and check for discrepancies and incompleteness.

The occurrence of ADHD in children aged 6 to 17 was evaluated using the Disruptive Behavior Disorder Rating Scale, adhering to the DSM-IV criteria [43]. The scale comprises 18 items to assess ADHD. The Disruptive Behavior Disorder Rating Scale is a proxy-administered questionnaire (by a parent or teacher) based on the DSM-IV criteria for ADHD. Each symptom is rated on a four-point scale reflecting its frequency and severity: 0 (not at all), 1 (just a little), 2 (frequently), and 3 (very often). For the predominantly inattentive subtype, six or more "often" or "very often" responses on items 1 to 9 are needed. For the mainly hyperactive/impulsive subtype, six or more "often" or "very often" responses on items 10 to 18 are required. The combined subtype needs six or more "often" or "very often" responses from both the inattention and hyperactivity/impulsivity items. Children scoring six or more on these measures were diagnosed with ADHD based on the initial assessment [44].

Data quality assurance

Before data collection commenced, the questionnaire was reviewed for clarity, flow, labeling, and the duration of interviews. The data collection team consisted of five BSc nurses and two BSc psychiatry nurses. The lead investigator conducted a one-day training session for the data collectors and supervisors, covering the administration of the questionnaire, confidentiality, data management, and participant identification methods. All necessary adjustments were made to the translated questionnaire, and data collectors were briefed accordingly. The investigator and supervisors provided regular oversight to ensure accurate data collection. Any incorrectly filled or missing questionnaires were either corrected by the respective data collectors or discarded if correction was not feasible. Data quality was maintained throughout the coding, cleaning, computerization, and analysis stages.

Data processing and analysis

The data was coded, reviewed, and cleaned using Epi Info version 7 before being exported to STATA 14 for analysis. The prevalence of ADHD was presented using descriptive statistics such as frequencies, tables, graphs, mean, and standard deviation. Data was initially input into Epi Info version 7 and later analyzed with STATA version 14. The bivariable analysis examined factors associated with the chi-square analysis outcome, with variables having

Table 2 Socio-demographic factors of the study participants at arbaminch town, Gamo zone, Southern Ethiopia, 2023 ($n=512$)

Variables	Frequency ($n=512$)	Percentage (%)
Age in years		
6–11	368	71.9
12–17	144	28.1
Sex		
Male	291	56.8
Female	221	43.2
Religion		
Protestant	227	44.34
Orthodox	225	43.95
Muslim	43	8.4
Others	17	3.32
Family size		
2–4	180	35.16
5–6	230	44.92
> 7	102	19.9
Mothers' education		
Unable to read and write	37	7.23
Able to read and write	36	7.03
Primary school	88	17.19
Secondary school	144	28.13
Diploma	167	32.62
Degree and above	40	7.8 1
Fathers' education		
Unable to read and write	27	5.27
Able to read and write	23	4.49
Primary school	49	9.57
Secondary school	112	21.88
Diploma	195	38.67
Degree and above	103	20.12
Parental Marital Status		
Married	434	84.77
Divorced	33	6.46
Single/separated/widowed	45	8.69

$p<0.25$ in the bivariable analysis being considered for the multivariable analysis [45]. Adjusted odds ratios from multivariable logistic regression analysis were given, and statistically significant variables to outcome variables were identified at $p<0.05$ with 95% confidence interval. The crude odds ratio and adjusted odds ratio, with their 95% confidence intervals (CI) and p-values less than 0.05, were utilized to report factors independently associated with ADHD.

Ethical clearance

The ethical review committee of the School of Nursing granted ethical clearance and issued a permission letter on behalf of the University of Gondar's Institutional Review Board (IRB) (Ref. No. S/N/159/2015). A support letter from the Arba Minch town health office authorities was obtained and provided to each kebele administrator.

Table 3 Distribution of study participants by psychosocial factors in the past six months at arbaminch town, Gamo zone, Southern Ethiopia, 2023 ($n=512$)

Variables	Frequency	Percentage (%)
Loss of family members	72	14.03
Loss of close friends and relatives	65	12.70
Presence of illness and assault in the family	69	13.48
Major financial stress	100	19.53
Sacked from job	41	8.01
Unemployed	22	4.30

Results

Socio-demographic factors

Out of 520 children, 512 aged 6 to 17 years completed the interview, resulting in a 98.5% response rate. The median age of the children was 9.83 years ± 2.63 months. Approximately 71.9% of the children were between 6 and 11 years old. More than half of the respondents (56.8%) were male. Additionally, 32.6% of parents had attained a secondary level of education, while 38.7% had earned a diploma. (Table 2)

Stressful psychosocial factors

Concerning stressful life events, a quarter (25.39%) of the study participants reported the loss of a loved one, with 72 individuals (14.06%) specifically mentioning the loss of a family member. Additionally, in the past six months, 100 families (19.53%) experienced significant financial stress. (Table 3)

Substance-related factors

Among the 512 mothers in the study, 18.9% reported substance use during pregnancy. The lifetime prevalence of substance use was 22.6%. Additionally, 15.59% of mothers had consumed alcohol, 16.6% had used chat, and 3.13% had used tobacco at some point in their lives. Overall, 22.66% of mothers reported lifetime substance use. (Table 4)

Clinical factors in children and family

The study involved 512 children, of whom 13 (2.54%) had a history of mental health problems and 7 (1.37%) were currently experiencing mental illness. Additionally, 25.3% ($n=130$) of participants reported a family history of mental illness. Among all participants, 34 (6.64%) had known medical or physical conditions.

Neonatal and obstetric factor

Among the study participants, 13.7% of mothers experienced pregnancy-related issues, and 153 women (29.1%) delivered via spontaneous vaginal delivery (SVD). Regarding neonatal variables, 7.2% of children were born

Table 4 Distribution of children by substance related factors of their mothers at arbaminch town, Gamo zone, Southern Ethiopia, 2023 ($n=512$)

Variables	Frequency	Percentage (%)
Substance use during life time		
Yes	116	22.66
No	396	77.34
Alcohol		
Yes	131	25.59
No	390	74.3
Khat chewing		
Yes	86	16.6
No	438	83.4
Tobacco		
Yes	16	3.13
No	509	96.87
Substances use during pregnancy		
Yes		
No	97	18.9
	427	81.1
Alcohol		
Yes	52	10.16
No	473	89.84
Khat chewing		
Yes	43	8.4
No	469	91.6
Tobacco		
Yes	2	0.39
No	510	99.61

Table 5 Distribution of participants by neonatal and obstetric factors at arbaminch town, Gamo zone, Southern Ethiopia, 2023 ($n=512$)

Variables	Frequency	Percentage %
Maternal factors		
Bleeding	16	24.62
Hypertension	23	35.38
Diabetes Mellitus	17	26.15
Others	9	13.85
Mode of delivery		
Spontaneous vaginal delivery	150	29.3
Episiotomy	151	29.49
C/S	98	19.14
Others	113	22.07
Neonatal factors		
Preterm		
Yes	17	3.32
No	495	96.68
Low birth weight		
Yes	36	7.03
No	476	92.97
Cried soon after birth		
Yes	415	81.05
No	97	18.95
Problem with breast feeding		
Yes	115	22.46
No	397	77.54

with low birth weight, and 3.2% were born prematurely. (Table 5)

Prevalence of attention deficit hyperactivity disorder symptoms

According to the study, the overall prevalence of ADHD among children aged 6–17 years was 9.77% (95% CI: 7.47–12.66). Males were more likely to have ADHD than females (58% versus 42%), with a male-to-female ratio of approximately 1.4:1. The prevalence of ADHD was highest among children aged 6 to 11, which was 71.88%. In this study, the proportion of inattentive ADHD was 12% with a slightly higher male ratio of 1.5:1, hyperactivity-impulsivity was 8.19% with a male-female ratio of 1.7:1, and combined type was 19.05% with a male-female ratio of 1.31. (Fig. 2)

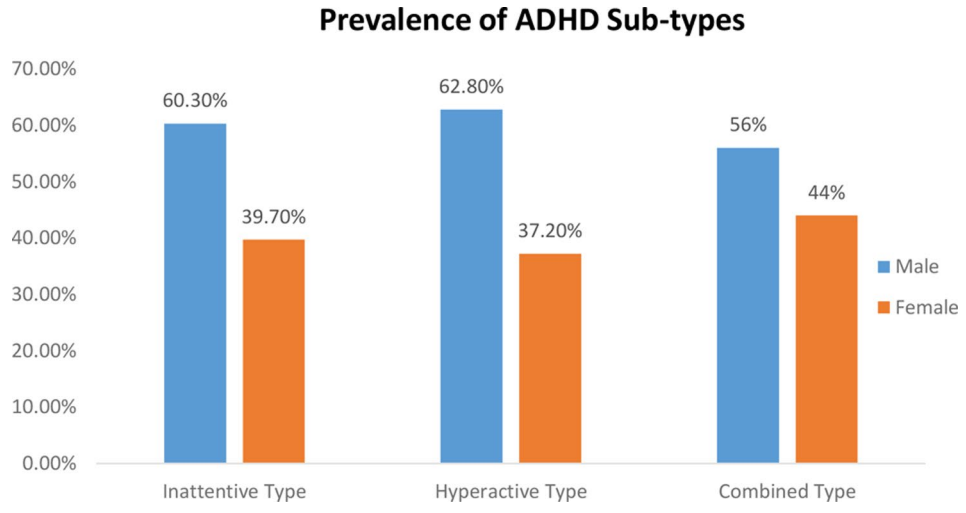

Fig. 2 Prevalence of ADHD subtype by gender in study participants at Arbaminch Town, Gamo Zone, Southern Ethiopia, 2023 ($n=512$)

Table 6 Bi-variable and multivariable logistic regression analysis of factors associated with common mental disorders among children living in arbaminch town, Gamo zone, Southern Ethiopia, 2023 ($n=512$)

Variables	ADHD		COR (95% CI)	AOR (95% CI)
	YES	NO		
Loss of family member				
Yes	13	63	2.23 (1.12–4.42)	1.56 (0.07–3.47)
No	37	399	1	1
Previous child's mental illness				
Yes	6	7	8.86 (2.85–27.53)	**7.11 (1.66–30.41) ****
No	44	455	1	1
Family history of mental illness				
Yes	23	107	2.83 (1.56–5.13)	**2.27 (1.15–4.45) ***
No	27	355	1	1
Substance use during pregnancy				
Chewing khat				
Alcohol drinking	9	34	2.77	0.79 (0.26–2.41)
Never	15	37	4.92 (2.46–9.83)	**3.36 (1.41–7.99) ***
	31	396	1	1
Substance use during lifetime				
Tobacco				
Alcohol	7	9	8.19 (2.91–23.09)	**4.17(1.03–16.89) ***
Khat	20	30	2.11 (1.15–3.86)	0.61 (0.26–1.43)
Never	17	33	2.93 (1.54–5.56)	1.61 (0.57–4.57)
	25	318	1	1
Major financial stress				
Yes	18	82	2.61 (1.39–4.87)	1.46 (0.46–4.63)
No	43	380	1	1
Sacked from job				
Yes	9	32	2.95 (1.32–6.60)	1.22 (0.38–3.87)
No	41	430	1	1
Childs known medical/physical problem				
Yes				
No	10	27	4.36 (1.83–8.92)	2.66 (0.99–7.16)
	41	447	1	1

1.00 = Reference for category (comparator) * = statistically significant (P value < 0.05) **= P value < 0.01

COR = Crude odds ratio AOD = Adjusted odds ratio

Factors associated with ADHD

A bi-variable logistic regression analysis was conducted to explore the associations between ADHD and various socio-demographic, psychosocial, substance use, clinical, neonatal, and obstetric factors. The analysis revealed that loss of family members, major financial stress, job loss, lifetime substance use, substance use during pregnancy, a child's history of mental illness, a family history of mental illness, and a child's known medical or physical problems met the criteria for bivariate analysis (P-value < 0.25). After adjusting for confounding factors, variables with a p-value ≤ 0.25 were included in the multivariable logistic regression analysis. The results indicated that a child's previous mental illness, a family history of mental illness, lifetime maternal substance use, and substance use during conception were significantly associated with ADHD (p-value < 0.05).

Children aged 6–17 years who had previous mental health problems had 7 times (AOR = 7.11, 95% CI: 1.66–30.41) higher chance of developing ADHD as compared to children with no prior mental health problems. Children with parents having a family history of mental illness had 2 times (AOR = 2.27, 95% CI 1.15–4.45) higher odds of developing ADHD as compared to children from families with no history of mental health problems. Children from mothers who used alcohol during their pregnancy had a 3.36 times (AOR = 3.36, 95% CI, 1.41–7.99) higher probability of developing ADHD as compared to children from mothers who had no alcohol use during their pregnancy. Children from parents with lifetime tobacco use had 4 times (AOR = 4.17, 1.03–16.89) higher odds of developing ADHD as compared to children from parents without lifetime tobacco use. (Table 6)

Discussion

ADHD is recognized as a long-term and disabling condition that hampers an individual's daily functioning and performance in educational and occupational settings. This study aimed to assess the prevalence of ADHD among children aged 6 to 17 years and found that 9.7% of children in Arbaminch town were affected by the disorder (95% CI: 7.2, 12.2). This study's finding aligns with the global pooled prevalence of ADHD, which was 7.6% [46]. This finding was also consistent with studies done in Canada (8.6%), Spain (7.7%), Turkey (8%), China (7.5%) [47–50], and Egypt (11.3%) [51]. This study also revealed consistent findings with studies done in Ethiopia, Guji Zone Girja District, which was 7.3% [14], in West Shewa Zone, which was 8.4% [42], and in Southwest Ethiopia around Jimma, which was 9.9% [52]. The observed consistency in the finding may stem from the neurodevelopmental nature of the disorder, with its prevalence primarily dictated by brain function-related factors, rather than socioeconomic, cultural, or environmental

influences. Furthermore, the application of standard diagnostic criteria (DSM) likely contributes to the uniformity of results.

On the contrary, the current study finding was higher than the studies done in Saudi Arabia (5%) [53], Iran 4.4% [54], the rural part of North India (6.3%) [55], Belagavi city of India (5.67%) [56], and Nigeria (4.7%) [57]. The possible explanation for this discrepancy could be the tool used to diagnose ADHD. Accordingly, the above studies used DSM-III criteria, which had a lower estimate of ADHD [58], due to the criteria's focus on hyperactivity and not fully recognizing inattentive type as a distinct diagnosis, whereas the tool we used (DSM-IV) focused on both inattentive, hyperactive, and combined types that might increase the prevalence [58]. Another distinction could be due to the difference in setting, by which a study in Nigeria and India was conducted in a specific institution, a primary school, whereas our study was conducted in the whole community [56, 57].

However, our study was found to be slightly lower than previous studies done in the United States (12.9%), Botswana (12.3%), Burkina Faso (13.7%), and Shewa Robit, Ethiopia (13%) [30, 59–61]. The discrepancy might be explained by the diagnostic tool used for ADHD. Many studies employed the Diagnostic Interview Schedule for Children-IV (DISC-IV), which uses a fully structured interview mainly based on parent or self-reports, likely capturing a broader range of symptoms and thus increasing sensitivity. In contrast, the DSM-IV criteria rely on clinical interpretation and diagnosis, allowing clinicians to exclude certain cases, potentially resulting in lower estimates [28].

The ADHD subtypes varied from study to study due to methodological variations. In contrast to the other research, the frequency of ADHD subtypes in this study showed a different distribution: impulsive/hyperactive 8.19%, inattentive 12%, and the combined 19.05%. This is supported by studies done in Spain [49], Saudi Arabia [53] and Shewa Robit Ethiopia [30] showed higher prevalence of combined type of ADHD. Whereas, the inattentive type of ADHD was observed higher in the global study, Burkina Faso [60], South Africa [62], Botswana [59] and Nigeria [46, 57]. The possible justification for this discrepancy could be due to diagnostic criteria and assessment tools [63].

This study found that children whose mothers had a lifelong history of tobacco smoking were more likely to have ADHD compared to children whose mothers had never smoked. This is consistent with a study conducted in Sapporo, Japan [64]. This occurs because nicotine from maternal smoking crosses the placenta and affects the developing fetal brain, potentially altering its structure and function, which are linked to ADHD symptoms. Additionally, smoking during pregnancy can diminish the oxygen supply to the fetus, affecting brain development and increasing the risk of neurodevelopmental disorders like ADHD [65, 66].

Children from mothers who used alcohol during the child's conception were more likely to develop ADHD as compared to their counterparts. This is supported by the study done in north Indian study [55] and South West Ethiopia [52]. This may clarify why alcohol is frequently identified as a teratogen substance that leads to central nervous system (CNS) dysfunction and impairs the mental development of a fetus. This includes fetal alcohol syndrome, which heightens the risk of neurodevelopmental disorders such as ADHD [67].

Children who have a history of previous mental illness problems were more likely to develop ADHD as compared to children with no history of mental illness. This is in line with other studies done in Western Saudi Arabia [53]. This might be due to the presence of comorbid conditions in children. For example, individuals diagnosed with ADHD often have a higher probability of co-occurring mood disorders like bipolar disorder. Moreover, numerous illnesses share symptoms, making it difficult to distinguish between them [68].

Another important factor was a family history of mental illness. Children with a family history of mental illness had higher odds of having ADHD compared to those without such a family history. Other studies in Japan [64] and in Botswana [69] found similar results as the current study. This is due to the fact that ADHD runs in families, indicating a strong genetic component. Children with a family history of mental disorders are more likely to inherit genetic variations that increase the risk of developing ADHD [70]. Families with a history of mental illness might also share common environmental factors such as stress, parenting styles, and adverse experiences, which can contribute to the development of ADHD in children. Additionally, mental health disorders in parents can cause epigenetic changes in their offspring, influencing gene expression and increasing the risk of ADHD. Moreover, parents with mental health issues may struggle to provide consistent and supportive parenting, which can affect a child's neurodevelopment and elevate the risk of ADHD.

Strength and limitation of the study

The study was community-based, encompassing children of various ages, making it more representative of the entire child population in the study area. A standardized tool was used to determine the prevalence of ADHD. However, tools for measuring some independent variables, such as clinical, neonatal, and obstetric characteristics, were not standardized, posing a risk of recall bias. Some variables also showed social desirability bias.

Conclusion and recommendations

In Arba-Minch city, approximately one in ten children aged 6–17 years develop ADHD, highlighting it as a major public health issue requiring proper intervention. This study identified several risk factors for ADHD in children, including maternal lifetime tobacco use, alcohol consumption during pregnancy, the child's prior history of mental illness, and a family history of mental illness. Therefore, it is crucial to raise awareness among mothers about the dangers of substance use during pregnancy, to promptly identify and address mental health issues in parents, and to ensure that children with mental health problems receive special attention from all relevant authorities and stakeholders. Future research should conduct a community-based longitudinal study to explore the cause-and-effect relationships or temporal correlations between ADHD and its determinants.

Abbreviations

ADHD	Attention Deficit Hyper active Disorder
AOR	Adjusted Odds Ratio
COR	Crude Odds Ratio
ODD	Oppositional Defiant Disorder
CBT	Cognitive Behavior Therapy
DSM	Diagnostic and Statistical Manual for Mental Disorders
SD	Standard deviation

Author contributions

Abigia Samuel: made conceptualization and drafts the original manuscript. Berhan Tekeba: checked the analysis and made substantial contributions in reviewing the design of the study and the draft manuscript. Destaye Guadie: critically reviewed the manuscript for important intellectual content and contributed to the final approval of the version to be submitted.

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Data availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Human ethics and consent to participate.

Before beginning the interview, the purpose, objective, significance, and confidentiality of the study were explained to each eligible participant. We also informed them that there would be no harm if they chose not to participate or decided to withdraw during the data collection process. Finally, participants were asked for their willingness to join the study, and written consent was obtained. Throughout the data collection period, the data collector, investigator, and supervisor adhered to the ethical codes and followed the hospital's rules and regulations. Privacy was maintained during data collection. All participants identified with attention deficit hyperactivity disorder were referred to a psychiatry clinic for further evaluation.

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