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ORIGINAL ARTICLE

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Prevalence of ADHD and identification of risk factors in a child population in the province of Skhirat-Témara

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Abstract

ADHD is a chronic neurodevelopmental disorder that affects between 5.9% and 7.1% of school-age children and adolescents. Children with ADHD touch everything, make noise, are always fiddling with something in their hands, are unable to wait their turn, forget and lose their things, and have unexplained mood swings. These symptoms are likely to fluctuate over time and vary in intensity, depending on the child's profile and the expression of the disorder, as well as on the environment in which he or she lives.

This work reports on research carried out in a Moroccan context (town of Temara) on schoolchildren aged 9 to 12 (284 participants) to assess the prevalence of ADHD and determine risk factors for attentional function using the CONNERS questionnaire and a self-administered questionnaire of socio-demographic data.

The results of our study revealed that 28% of the participants suffered from attention disorders. About the relationship between cognitive and socio-demographic parameters, the results of the study showed that consanguinity was a risk factor (increased the risk of ADHD by 4%) in our population, with the addition of the number of siblings having a significant and positive correlation (p <0.05; Pearson = 0.126) with the CONNERS test score, meaning that as family size increases, so do ADHD symptoms.

In conclusion, the management of ADHD requires coordination between therapists (combining medication with neurocognitive approaches), schools and parents. Prevention, early detection and management of risk factors, including parental consanguinity and family size, should be incorporated alongside community awareness-raising. It is also important to explain the condition to the child to help them become aware of their problems.

Introduction

Attention Deficit Disorder with or without Hyperactivity (ADHD) is a complex neurodevelopmental syndrome that affects around 5% of children worldwide, according to a systematic review by (Polanczyk *et al.* 2007). The disorder is characterised by marked inattention, hyperactivity, and impulsivity beyond what is usually observed at a similar level of development. These symptoms can have a significant impact on the academic, social and family functioning of the individuals affected. (American Psychiatric Association 2000). ADHD is defined as a behavioural disorder of neurobiological origin, causing difficulties with concentration, impulsivity, and psychomotor hyperactivity.

ADHD is not confined to childhood; it often persists into adulthood, affecting around 2.5% of the world's adult population (Faraone *et al.* 2006). This persistence of symptoms into adulthood highlights the need for early identification and intervention to mitigate the long-term effects on personal and professional development. The consequences of ADHD include higher school drop-out rates, difficulties in interpersonal relationships, and increased susceptibility to substance use disorders (Barkley 2003). The symptoms of ADHD are likely to fluctuate over time and vary in intensity, depending on the child's profile and the environment in which he or she lives.

In addition, ADHD is associated with a significant economic burden, not only for the families affected but also for public health systems. Direct costs include medical and therapeutic expenses, while indirect costs include lost productivity and the impact on educational services (Doshi *et al.* 2012). This reality underlines the importance of effective diagnostic and treatment strategies, based on a thorough understanding of the disorder and its manifestations.

The DSM-5 (Guelfi *et al.* 2023) defines ADHD as a disorder involving concentration problems associated with impulsivity and psychomotor hyperactivity, classifying ADHD into three types: predominantly "attention deficit", predominantly "hyperactivity/impulsivity", and mixed type.

Recent research has highlighted the heterogeneous nature of ADHD, with significant variations in symptom presentation and functional impact (Nigg *et al.* 2002). This variability poses challenges for diagnosis and treatment, requiring personalised approaches based on a comprehensive assessment of each case.

Numerous studies have explored the risk factors, neurobiological mechanisms, and treatment strategies for ADHD. Research indicates a strong genetic component, with heritability estimated at around 70-80 (Faraone *et al.* 2005). Brain imaging studies have revealed abnormalities in brain regions associated with impulse control and attention, notably the prefrontal cortex and striatum (Shaw *et al.* 2007).

Treatment approaches often combine pharmacological and behavioural interventions. Stimulants such as methylphenidate and amphetamines are widely used and are effective in reducing ADHD symptoms symptoms (Swanson *et al.* 2008). However, there is growing recognition of the importance of psychosocial interventions, such as behaviour therapy, to address the behavioural and emotional aspects of the disorder (Sonuga-Barke *et al.* 2013). In sum, ADHD represents a multidimensional challenge that requires an integrated approach to optimise the well-being of affected individuals and their integration into society.

There are several possible explanations for ADHD. Family difficulties are often the cause of psychological problems, but this is not always the case. Difficulties at birth or genetic factors could be to blame. In all cases, a psychological assessment of the child is carried out to identify a cause or aggravating factors.

In Morocco, the prevalence of ADHD in children is still poorly known, with few studies dealing with it (Rouim *et al.* 2017) and further research is needed to better understand the disorder and its consequences in the Moroccan context.

Our study aimed to assess the prevalence of ADHD in schoolchildren aged 9 to 12 in the province of Skhirat-Temara and to determine the impact of this disorder on attentional functions.

Materials and methods

Type, duration and location of study

This was a cross-sectional (descriptive) study carried out on pupils between CE4 and CE6 aged between 9 and 12 in public primary schools in the town of Temara. The study lasted 4 months.

The participants

Our research sample consists of (n = 287) pupils between CE4 and CE6 in two state primary schools in the town of Temara, aged between 9 and 12.

Pupils over or under the age range for this study were excluded, as were children with visual problems.

Data collection tools

The short Conners questionnaire for parents

Created by Keith CONNERS, the Conners test is a grid to be completed and is used in the context of screening for attention disorders to determine the child's behaviour and interpersonal skills.

The questionnaire is to be completed by the parents of a child as part of a screening process for attention deficit disorder. It is valid for people aged between 6 and 18. Each item is given 0 to 3 points. A score above 15 may be considered pathological. These scales are the second most widely used in Europe, after the DSM, for diagnosing ADHD, according to a study carried out in 2013 (Hodgkins *et al.* 2013).

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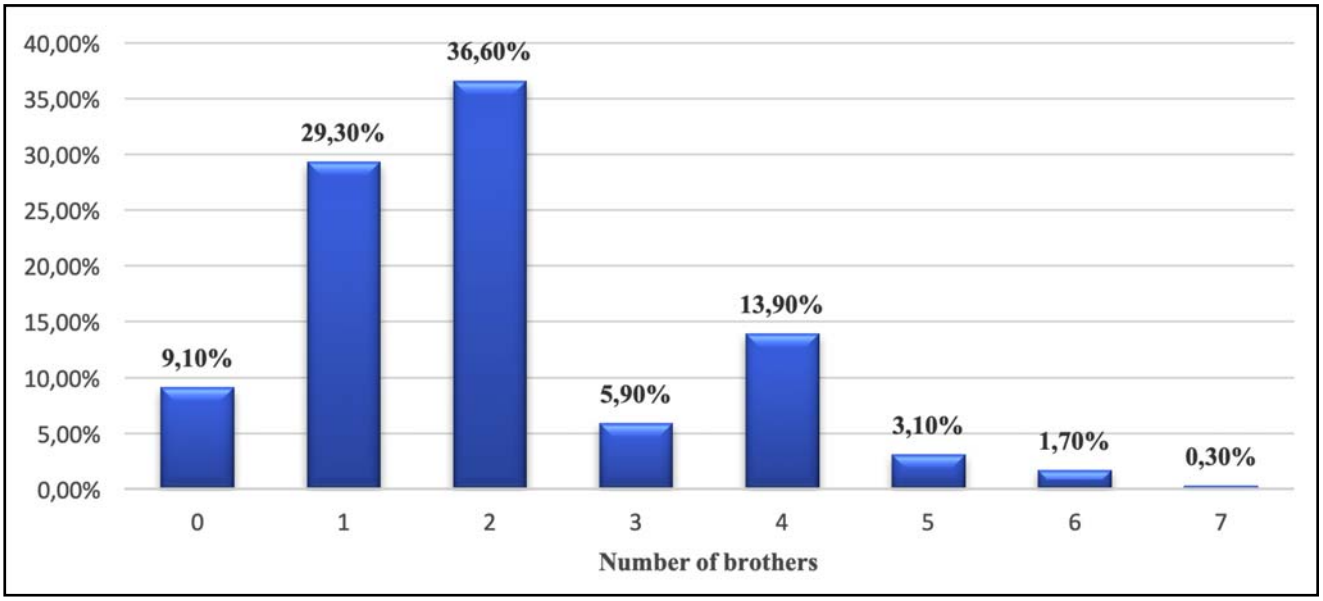

Fig. 1. Breakdown of pupils by number of siblings

Self-questionnaires for parents

A self-questionnaire was sent to the pupils' parents to collect socio-demographic data such as the number of brothers, height, weight, breakfast intake and consanguinity.

Statistical analysis

- Descriptive statistics: results were expressed as mean ± standard deviation.
- Analytical statistics: the Student's T test was used to compare the mean scores of the different variables with gender and age groups.
- Pearson's coefficient was used to assess the relationship between the sore of conners and age, consanguinity, number of brothers and BMI.

Results

Socio-demographic characteristic

Our sample consisted of 287 pupils, 155 of whom were girls (54%) and 132 boys (46%). The results reveal an age distribution as follows: 53% of pupils are aged between 9 and 10, while 47% are aged between 11 and 12.

Number of brothers and sisters

The results presented in Figure 3 show that 9.10% of students have no siblings, 29.30% have only one sibling, 36.60% have 2 siblings, 5.90% have a sibling group of 4, 13.90% have a sibling group of 5, 3.10% have 5 siblings, 1.70% have 6 siblings and finally 0.30% of the population have a sibling group of 8.

Breakfast

The graph above shows that 86.10% of pupils eat breakfast in the morning, while 13.90% do not. In our population, parental consanguinity exists in 45.60% of pupils and is absent in 54.40% of pupils' parents.

Breakdown od students by level of IMC

The results presented in the figure above show that 26.80% of pupils are thin, 70% are normal, 2.80% are overweight and 0.40% are obese, bearing in mind that the average for the population studied is 18.81 ± 2.80.

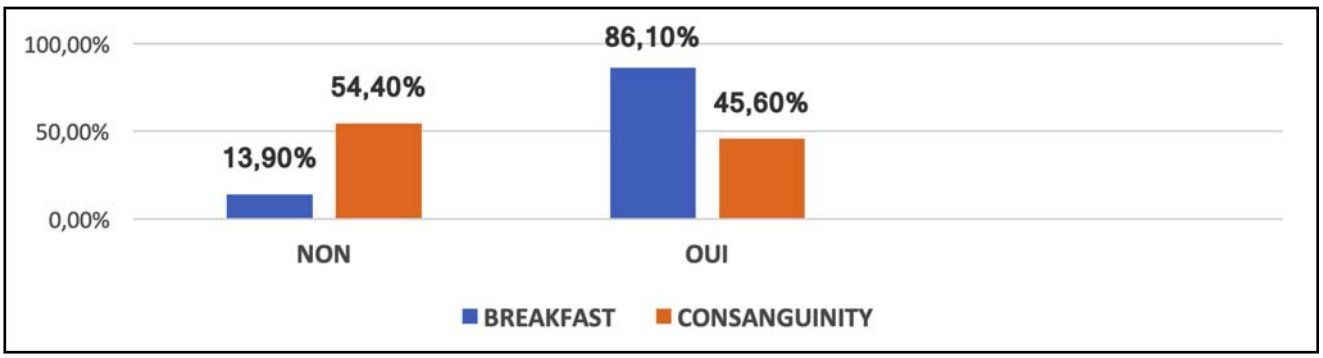

Fig. 2. Breakfast consumption and parental consanguinity

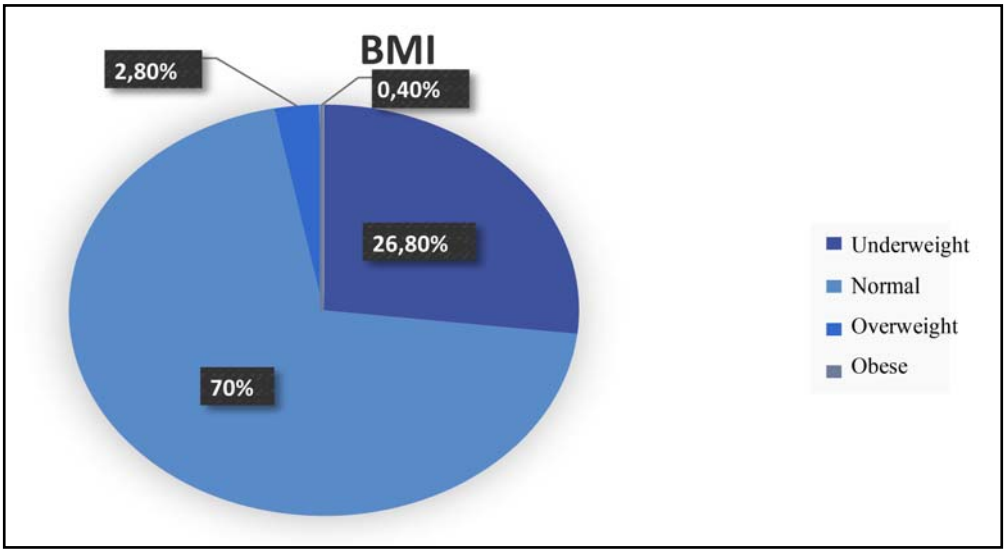

Fig. 3. BMI level

Cognitive characteristics

Conners

The figure above shows that 71.78% of the population had a non-pathological result, and the remaining 28.22% had a pathological result.

Pathological results by age group and sex

The results in the table above show that 50.63% of the [9-10] age group had pathological results, compared with 49.36% of the [11-12] age group.

The results in Table 5 show that boys have more pathological results (51.89%) than girls (48.10%).

According to the t-test, all results showed no significant difference between girls and boys in CONNERS test scores (p = 0.344; Girls: 10.5 ± 5.852; Boys: 10.80 ± 5.803),

According to the t-test, all the results showed no significant difference between the two age groups in terms of CONNERS test scores (p = 0.866; [9-10] years: 10.51 ± 6.030; [11-12] years: 10.39 ± 5.663).

Correlations between age, consanguinity, number of brothers, BMI and conners

The results of the correlation between the sociodemographic and cognitive variables show a negative and significant correlation was observed between consanguinity and the total score of the CONNERS test ($p \leq 0.05$). A significant correlation was also found between CONNERS test scores and the number of brothers ($p \leq 0.05$).

Discussion

People with ADHD have difficulty concentrating, paying attention, and completing even the most complex tasks. They often have difficulty staying in place, waiting their turn and frequently act impulsively. The aim of the study is therefore to assess the prevalence of ADHD in schoolchildren aged 9 to 12 in the town of Temara and to determine the risk factors for attentional function.

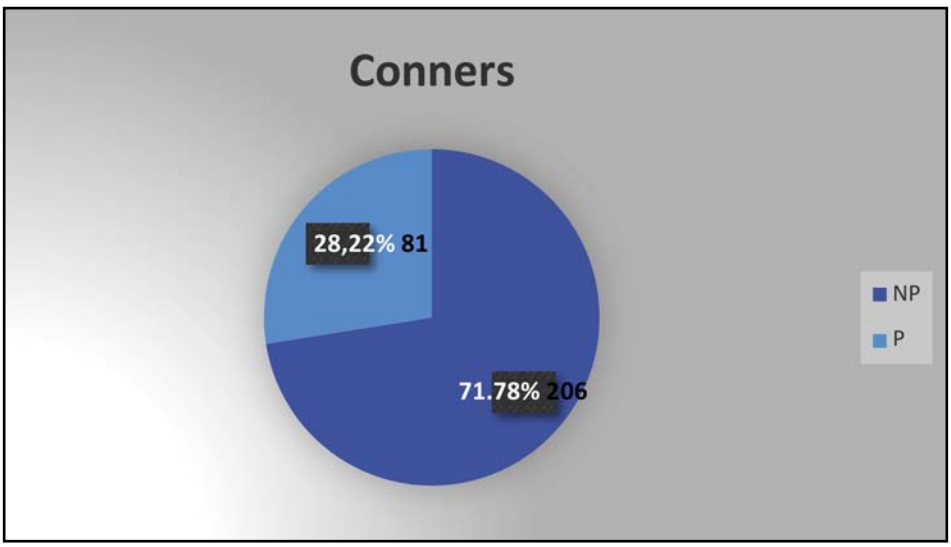

Fig. 4. Conners score

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Tab. 1. Percentages of pathological results by age group and sex

	Gender		Age range	
	Boy	**Girl**	**[9-10] years**	**[11-12] years**
Means scores conners	10.80±5.803	10.5±5.852	10.51±6.030	10.39±5.663
Percentage	51,89%	48,10%	50,63%	49,36%
p value	0.344		0.866	

Tab. 2. Correlations between age, consanguinity, number of brothers, BMI and conners.

		CONNERS score
AGE	Correlation Coefficient	-,028
	Sig (bilateral)	,639
Consanguinity	Correlation Coefficient	-,337
	Sig (bilateral)	,000
No. of brothers	Correlation Coefficient	,126
	Sig (bilateral)	,033
BMI	Correlation Coefficient	-,010
	Sig (bilateral)	,866

According to the literature, several tests have been used to assess attention. The CONNERS questionnaire, an abbreviated version for parents, is used to screen for attention disorders to determine the child's behaviour and interpersonal skills. (Conners *et al.* 2011).

Several studies have used this test to assess the function of attention. These include a study (Krieger & Amador-Campos 2021) which aimed to compare the performance of processing speed (PRS) and attention measures in children (8-12 years) and adolescents with attention deficit hyperactivity disorder. The 10-item CONNERS has been used as a diagnostic tool for ADHD in clinically referred children in the assessment of attention deficit hyperactivity disorder (Charach *et al.* 2009).

The results of the present study showed that 72% of the participants had no symptoms of ADHD, while the remaining 28% suffered from attention disorders, with an average of 1.28 ±0.44. These results are considered very high if we compare them with the results obtained by other authors, including (Thomas *et al.* 2015) who concluded that ADHD affects between 5.9% and 7.1% of school-age children and adolescents.

Statistical analysis was carried out using the T-test to determine whether there was a significant difference between the two age groups and the sex of the participants. It turned out that all the results showed no significant difference neither between girls and boys nor between the two age groups (9-10), (11,12), which is in discord with a study that found that boys had a higher prevalence of ADHD than girls, about three times more likely to have ADHD (Farahat *et al.* 2014). A study, showed; using the Stroop interference test; a strong relationship between the overall sex ratio and performance on the test score compared to normal control subjects. A higher proportion of males in the overall sample was associated with poorer functioning in the ADHD group compared with the control group. Overall, these results suggest that females with ADHD perform better than males in terms of attention, as indicated by this test. In short, there is a gender difference in attentional dysfunction. However, further research is needed to corroborate this result (Bálint *et al.* 2009).

According to the results of the correlation between the sociodemographic and cognitive parameters, we found that there was a significant and negative correlation between the parents' consanguinity and the total score of the CONNERS test, which means that the parents' consanguinity has a negative impact on the scores of the CONNERS test. We can therefore say that parental consanguinity is a risk factor in the appearance of ADHD symptoms in their children. These findings are consistent with numerous studies that have addressed the relationship between parental consanguinity and ADHD, which have found that consanguineous marriage is a significant risk factor for ADHD in offspring, with over three-quarters of all ADHD patients screening positive for parental consanguinity (Ansari *et al.* 2019; Jairoun *et al.* 2024; Schermerhorn *et al.* 2012) also that consanguinity between parents was particularly high in children with ADHD (Rajput *et al.* 2022). Another study found that consanguinity was about one and a half times more likely to lead to ADHD, which was in agreement with a Jordanian study that found that the prevalence of ADHD was 34.8% among consanguineous families. (Nafi & Shaheen 2011).

The impact of parental consanguinity on offspring can be explained by the hypothesis that ADHD is

a mixture of genetic and environmental factors. However, the pathophysiology is unclear at present, although the results of various types of neuroimaging techniques suggest that there are differences between individuals with and without ADHD in the brain, such as finer regions of the cortex (Cortese & Castellanos 2012). However, changes in environmental conditions can play a role in the onset of ADHD symptoms in children. Taking the number of siblings as an example, the results of the present study showed that there was a significant and positive correlation between CONNERS test scores and the number of siblings ($p = 0.033$; Pearson = 0.126), which means that children with a high number of siblings have more ADHD symptoms. These results confirm the conclusions of another study (Farahat *et al.* 2014) which found that children growing up in families of more than four people were about one and a half times more likely to develop ADHD, which is consistent with a study that reported that the larger the family size, the higher the prevalence of ADHD, confirming its role in the development of the disorder (Khan *et al.* 2023).

The large size of the family explains various psychological problems. They may be among the factors contributing to ADHD because of the impact on interpersonal relationships between family members (Ali *et al.* 2008). It should be borne in mind that the communication culture and social factors of the family play an important role and function in the formation of integrative and intrapersonal relationships. Further cross-cultural studies are needed to investigate the relationship between family problems and their contribution to psychological disorders and ADHD (Pheula *et al.* 2011).

Analysis of the results of the correlation between BMI and cognitive test scores yielded no significant correlation, meaning that BMI does not affect ADHD in our study, which is inconsistent with findings from other studies that have found that overweight and obese young people with ADHD have specific psychopathological and psychopathological characteristics compared with non-overweight and obese young people. (Porfirio *et al.* 2022) and others whose results vary considerably with age and sex, since in boys, ADHD seems to be a general risk factor for being overweight (Zhu *et al.* 2024). They are more often overweight, especially from the age of 10. In girls, ADHD appears to be a risk factor for overweight and obesity, particularly in the 10-12 age group. (Yato *et al.* 2019).

The common hypothesis and that the association between ADHD symptoms and measures of obesity, such as BMI, may reflect shared underlying abnormalities in neural dopaminergic pathways mediating impulse control, reward sensitivity, appetite and satiety (Castaneda *et al.* 2016). For example, people with ADHD symptoms may have a reward deficiency syndrome, due to low levels of tonic dopamine in the prefrontal cortex. The prefrontal cortex is associated with working memory and is thought to contribute to the reasons why people with ADHD have problems maintaining attention during tasks (Comings & Blum 2000). Thus, food-related increases in dopamine in people with ADHD may be experienced as rewarding and could be enhanced if they correct relative dopamine deficiencies in the prefrontal cortex (Comings & Blum 2000; Volkow *et al.* 2003).

Conclusion

ADHD is a chronic neurodevelopmental disorder affecting between 5.9% and 7.1% of school-age children and adolescents. The extent of the manifestations and consequences associated with ADHD at school calls for interventions to help children with the disorder adapt at school. The symptoms of ADHD are likely to fluctuate over time and vary in intensity, depending on the child's profile, the expression of the disorder and the environment in which the child lives.

There are several hypotheses explaining ADHD, with genetics and the environment considered to be important risk factors. In the present study, the relationship between sociodemographic and cognitive parameters, i.e., the parameters of the participants' attentional function, was taken into consideration. This study showed that parental consanguinity is a risk factor for the appearance of ADHD symptoms in the offspring (increases the risk by 4%). This study also showed a significant correlation between family size and ADHD symptoms. Children growing up in large families are more likely to develop this disorder.

Treating ADHD requires coordination between therapists (either through medication or cognitive-behavioural approaches), the school and the parents. It is also important to explain the condition to the child, to help them become aware of their problems and regain their self-confidence, rather than punishing them, marginalising them and making them feel different or inferior to their peers.

Despite the existence of a considerable number of studies, research is still needed to better target the causes, perfect screening methods and find new avenues of treatment to improve the lives of children and adults with this disorder.

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