

## **ATTENTION DEFICIT HYPERACTIVITY DISORDER, COMBINED SUBTYPE: PREVALENCE AND ASSOCIATED RISK FACTORS**

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**Abstract-** Attention deficit hyperactivity disorder (ADHD) is a neurobehavioral disorder. Its core symptoms are inattention, hyperactivity and impulsivity. There are three subtypes of ADHD recognized by the DSM-5 manual Diagnostic and Statistical Manual of Mental Disorders (DSM-5), classified by the predominant symptoms: predominantly inattentive, predominantly hyperactive-impulsive, and mixed subtype [1]. Our objective is to establish the frequency of ADHD combined subtype. (ADHD-C) and to study the relationship between mixed type ADHD-C and socio-economic and cultural factors in a population of secondary school pupils. Our study involved 119 pupils (63 boys and 54 girls), aged 12 to 16, from the Sidi Yahia du Gharb city (North-West Region of Morocco). Data were collected using a questionnaire extracted from the (DSM-5). The results of this test show that the prevalence of children with ADHD-C in our sample was 10.08%. This neurobehavioral deficit was more frequent in boys (12.12%) than in girls (7.55%), with a ratio of 1.87. The prevalence of ADHD-C in school-aged children in northwest Morocco is comparable to other regions globally. This information is crucial for enhancing the mental healthcare services available for assessing and treating this form of ADHD-C. As such, it is crucial to increase awareness of ADHD to guarantee that school children receive suitable psychiatric care.

**Keywords:** Prevalence, ADHD, Children, ADHD Combined Subtype, DSM5.

### **1. INTRODUCTION**

Difficulties in learning come in different forms and can be complex disorders. The most familiar types of learning disabilities are dyslexia, dysgraphia, dyscalculia, dysphasia and dyspraxia. Another one is the attention deficit disorder (ADD) with or without hyperactivity (ADHD). ADHD is a neurobiological condition that exists in all countries and among all ethnic groups and is classified as a disorder or a syndrome. People with ADHD experience various problems involving their behavior, such as difficulty concentrating, impulsivity and difficulties in social interaction. The major symptom of ADHD is attention deficit disorder, which is often associated with hyperactivity and impulsivity [1].

These three conditions are linked to a range of other health problems that can impact patients' mental, linguistic, emotional and social development.

Many questions are still unanswered, such as why more children in certain countries are being diagnosed with ADHD. These facts give rise to several questions in medical and educational communities. Aside from frequent academic struggles, young individuals can face behavioral problems (such as conduct disorders, aggression and delinquency) as well as emotional difficulties (such as low self-esteem, anxiety and depression), which can have a severe negative impact on their personal development and social interactions [2].

According to global guidelines, ADHD is regarded as a genuine disorder and must be treated as such when its symptoms pose a disadvantage to the child and lead to sources of suffering in learning at school and/or social relationships [3, 4]. In the last decade, numerous studies focused on ADHD have improved our understanding of this syndrome. Studies involving brain imaging suggest that individuals with ADHD exhibit differences in brain structure. Other studies have revealed that ADHD has a significant genetic basis. Research has provided new insights into the effects of medication on the transmission of dopamine and noradrenaline [2].

This psychological disorder, which is the most prevalent among children is not a novel issue. The conduct and academic performance of a child or adolescent having ADHD are frequently misapprehended by people around them, which includes their family, school and society [5]. The consequences of this disorder on the victim, as well as those around him or her, the harm it does to the child's future and its significant occurrence, all support its inclusion within public health priorities [6].

Nonetheless, comprehending the diagnosis presents a difficulty for practitioners who have received inadequate or no training on the disorder. They frequently face several challenges in responding to queries from families, rendering assistance to affected children and giving appropriate advice. Measuring the prevalence of ADHD universally remains a daunting task, but as per the (DSM-IV-TR.2000) by the American Psychiatric Association

(APA), this disorder affects about 3 to 7% of school-going children. According to Schiaretto, et al. (2013) [7], New Zealand, Germany and Brazil have also reported similar prevalence rates (Barkley, 2006).

Prevalence rates in North America have varied between 2% to 26%, with variations depending on the author. According to Gonon (2010) [8], North American authors most frequently use a 7% to 9% prevalence rate. While in Canada, the rate is between 1 to 3 children per class, as mentioned by the Center for ADD/ADHD Advocacy, Canada (CADDAC) Montreal in 2010, and in the United States, it affects 1 in 20 children (APA, 1994). However, the prevalence of ADHD-C depends on the diagnostic criteria used and the population studied, and is comparable across different countries and cultures [9]. However, in Morocco, there are no official statistical data available on the prevalence of this disorder.

However, little research has investigated this matter among children with ADHD in Morocco. The present study aimed to determine the prevalence of ADHD-C symptoms in a specific group of teenagers (students of Ibn Yassin and Jaber Ibn Hayan secondary schools in the city of Sidi Yahia Gharb) in the northwest region of Morocco. We aimed to identify potential factors linked to symptoms of this subtype of ADHD and ascertain the correlation between ADHD-C and educational challenges.

**2. SUBJECTS AND METHODS**

**2.1. Population**

The study was descriptive and cross-sectional *i*, aiming to determine the prevalence of ADHD-C in the population among schoolchildren, along with the related risk factors. The research was conducted at secondary schools located in the north-west, Morocco, during April and May, 2016. This city is situated 67 km to the north of the capital, Rabat, and has a population of almost 27,030 residents. The town is home to two government colleges that have a combined student body of 3,000. The Institutional Review Board of the Faculty of Science at Ibn Tofail University in Kenitra approved the study.

**2.2. Research Design**

The diagnosis of ADHD-C is presently founded on empirical criteria. defined in internationally recognized classifications (DSM5; ICD 10): the disorders cannot be explained solely by the child's developmental age; they must have begun before the age of 7, have lasted for more than 6 months, and should be detected in at least two different situations (e.g., school and home) with significant impairment in the child's social, academic and leisure behavior [10]. Similarly, questionnaires and evaluation scales (such as the famous "Conners scales") filled out by the patient (adolescent or adult), his or her parents or teachers distinguish very well between groups (people with combined ADHD subtype versus people without this subtype), but for a given patient their reliability is insufficient. In fact, the DSM is the most commonly used medical tool for detecting ADHD [2]. In Canada, the US and other nations, the DSM-V criteria are used to assess a child's behavior and determine if the child has ADHD and which subtype [2].

**2.3. Setting**

Our research work deals with the problem of combined ADHD subtype and its impact on the learning of school children in Morocco. In this country, the repercussions of this disorder on the patient and his or her entourage, the negative impact on the child's future and its significant frequency (around 10% of the general population), justify its inclusion in the framework of public health priorities, and require treatment, when the symptoms that characterize it constitute a handicap for the child and therefore a source of suffering, whether in his or her schooling and/or social relations with the long-term risk of deleterious repercussions on the whole of life (professional failure, social disintegration, additive behaviors).

**2.4. Type of Study and Participants**

Our study, which was a horizontal, randomized prospective study, involved 119 students (63 boys and 54 girls) who had not received any drug treatment, who had no somatic pathology, and follow their studies at middle schools in the city of Sidi Yahia Gharb in Morocco. The study focused on school pupils aged six to twelve years old. Proportional allocation was used to select an equal sample fraction of children in Table 1.

Table 1. Distribution of students by school level

Level	Girls	Boys	Total
The 1st year of secondary school	20	43	43
The 2nd year of secondary school	17	25	42
The 3rd year of secondary school	17	17	34
Total	54	65	119

**2.5. Data Sources/Measurement**

We asked an important question: how does having ADHD-C affect the mental abilities of young people, and to what extent is there a connection between having ADHD-C and encountering educational difficulties in a particular group of teenagers in Morocco.

This question represents the backbone of our research and several guidelines emerge from it, namely:

- To investigate the prevalence of ADHD-C in a particular cohort of students attending secondary school in the North-West Region of Morocco.
- Examines the correlation between this subtype and socio-economic and cultural factors in schoolchildren.

**2.6. Sampling Tool**

The diagnostic manual used for this purpose is the DSM-V. It provides a complete clinical description of various disorders.

- To establish this study, we distributed two questionnaires to the teachers working with these students, asking them to read it carefully and fill in the appropriate boxes for each question.
- He hardly pays attention to details; he makes mistakes of inattention.
- He's having trouble getting his attention.
- There appears to be a lack of attentiveness when he is.
- They are not in accordance with instructions and do not perform tasks (without being in opposition). They have difficulty planning and organizing their work or activities.

- Avoids or reluctantly performs certain tasks, especially if they require sustained mental effort.
- He misplaces the items required for his work or activities. They are easily side-tracked by external distractions.
- There is frequent forgetfulness in day-to-day life.

The affected individual must have at least six symptoms of inattention repeatedly and to an unsuitable level, and incomparable with the normal level of development for age.

**2.7. Statistical Tools and Variable**

The data collected were entered on an Excel support, after filtration we transposed this matrix on an SPSS (Statistical Package for the Social Sciences) support for a later analysis. Quantitative variables were expressed as mean ± standard deviation and qualitative variables as frequency. Tests applied for the decision are: Khi-two test, Pearson correlation and logistic regression, at an error of 5%.

**3. RESULTS**

**3.1. Characteristics of Study Population**

The sample we gathered shows that the pupils' mean age is. 14.27±0.11 years, (min=11 years and a max=17 years). This distribution meets the requirements of Gaussian applications (asymmetry coefficient = -0.138 ±0.222). 36.1% the school children (n=43) are in the first year of college, 35.3% (n=42) in the second year and 29%(n=34) in the third year of college. The distribution of pupils according to their weight is shown in Table 2. 44.5% (n=53) of these pupils have a weight between 40 and 50 Kg, 25.2% (n=30) have a weight between 50 and 60 Kg and 30% (n=36) have a weight less than 40 Kg. The Pearson correlation (0.421; p<0.000) revealed a strong link between age and weight. However, 98.3% (n=117) of these children are born without any complications by lower and 1.7% (n=2) of caesarean section.

Table 2. Sociodemographic characteristics of study population (n=119)

Variable	Modality	N	Percent
Age (mean±sd)	14.27±0.11 years (min=11 years and a max=17 years)	119	
Sex	Boys	66	55.46%
	Girls	53	44.54%
Educational level.	first year of secondary school (The 1st year)	43	36.13%
	The 2nd year of secondary school	42	35.29%
	The 3rd year of secondary school	34	28.57%
Weith (kg)	30-40	25	21.01%
	40-50	53	44.54%
	50-60	30	25.21%
	60-70	10	8.40%
	70-80	1	0.84%
Parents' function	Free function	89	7.79%
	Public function level 1	22	18.49%
	Public function level 2	4	3.36%
School failure	No	82	68.91%
	Yes	37	31.09%

SD: Standard Deviation

In addition, 83% (n=99) come from urban areas and 17% (n=20) only from rural areas. Nevertheless, 63% (n=74) of these pupils come from households with a low

socio-economic level, 35% (n=41) with an average socio-economic level and only 6% (n=4) from wealthy families. 7.6% (n=6) of the students surveyed had divorced parents and 95.8% (n=113) were women in households. According to the number of years repeated, the distribution of secondary students indicates that 26.9% (n=32) fail (one year repeated) and 4.2% (n=5) lose two years. Nevertheless, the distribution of the averages acquired in the first semester shows that 60% (n=71) of these pupils had averaged between 10 and 15 of which 36.97% (n=44) are male and 22.69% (n=27) are female, 29% (n=35) with averages between 5 and 10 compared to 9% (n=11) where the average displayed is less than 5/20 and only 2% (n=2) of supposedly excellent pupils (score>1).

**3.2. Behavioral History**

Table 3 shows the results of the antecedents of the pupils surveyed. In fact, 37.82% stated that they had a history of ADHD. While 13.45% had no writing or reading difficulties. However, 42.02% had anxiety disorders and 27.73% suffered from chronic illnesses. In addition, 21.85% said they had difficulty sleeping. However, 89.08% said they consumed products high in sugar (sweets). On the other hand, 47.06% did not eat breakfast regularly. However, 33.61% of the pupils surveyed often consult the internet and play video games.

Table 3. Behavioral history of study population

Behavior	modality	effective	percent
History of ADHD	No	74	62.18%
	Yes	45	37.82%
Writing/reading difficulties	Yes	16	13.45%
	No	103	86.55%
Fear and phobia	Yes	50	42.02%
	No	69	57.98%
Taking medication	Yes	3	2.52%
	No	116	97.48%
Chronic disease	Yes	33	27.73%
	No	86	72.27%
Number of hours of sleep	<8	80	67.23%
	>8	39	32.77%
Sleeping difficulties	Yes	26	21.85%
	No	93	78.15%
Consumption of sweets	Yes	106	89.08%
	No	13	10.92%
Taking breakfast	Yes	63	52.94%
	No	56	47.06%
Source of pollution	Near	99	83.19%
	Far	20	16.81%
Internet and video game addiction	Yes	40	33.61%
	No	79	66.39%

**3.3. Prevalence of ADHD**

The prevalence of the ADHD-C in the town of Sidi Yahia Gharb among school-age children was 10.08%, bearing in mind that the prevalence of student inattention ADHD type is 9.24%, while prevalence of Hyperactivity-impulsivity ADHD type is 6.72% in Table 4.

Table 4. Prevalence of ADAH type of study population

ADHD type	Total no. with disorder	Prevalence
Inattention	90.76%	9.24%
Hyperactivity-impulsivity	93.28%	6.72%
Combined	89.92%	10.08%

3.4. Determining Factors of ADHD-C

Table 5 shows the results for the combined symptoms of intentional and hyperactive/impulsive deficits. The prevalence of combined symptoms was 10.08%. This disorder occurs more frequently in boys (12.12%) than in girls (7.55%). These excessive activities affect almost all school levels. These children generally have an average weight of between 50 and 60 kg. The chi2 test showed a significant association between combined ADHD and

sleep difficulties ( $\chi^2=3.07$ ;  $p<0.05$ ): 15 out of 20. 18.91% of students showing signs of ADHD-C required 7 to 8 hours of sleep. However, 11.32% of children with this type of ADHD reported eating sugary foods. The analysis permitted the classification of intentionality hyperactive/impulsive children as those who possess a family history of this condition. Additionally, these children endure chronic conditions and dedicate extensive time engaging with online media and video game.

Table 5. Study of the link between socioeconomic and cultural factors and combined ADHD subtype (ADHD-c)

Variable	Modality	ADHD-C Yes	ADHD- C No	Khi-Deux	P-value	Prevalence
Sex	Boys	8	58	0.68	0.41	12.12%
	Girls	4	49			7.55%
Parents' function	Free function	10	79	1.79	0.41	11.23%
	Public function level 1	1	21			4.54%
	Public function level 2	1	3			25%
School failure	No	10	72	1.30	0.05	12.19%
	Yes	2	35			5.40%
History of ADHD	No	7	67	0.084	0.77	9.46%
	Yes	5	40			11.11%
Fear and phobia	Yes	7	43	0.002	0.96	14%
	No	5	64			7.25%
Taking medication	Yes	0	3	0.34	0.56	0%
	No	12	104			10.34%
Chronic disease	Yes	3	30	0.05	0.82	9.09%
	No	9	77			10.46%
Sleeping difficulties	Yes	5	21	3.07	0.05	19.23%
	No	7	86			7.53%
Sweets consumption	Yes	12	94	1.64	0.20	11.32%
	No	0	13			0%
Taking breakfast	Yes	6	57	0.046	0.83	9.52%
	No	6	50			12%
Internet and video game addiction	Yes	5	35	0.39	0.53	12.5%
	No	7	72			8.86%

ADHD-C: Combined ADHD subtype

4. DISCUSSION

The aim of this study was to determine the occurrence of ADHD-C symptoms in Moroccan schoolchildren., as well as the risk factors likely associated. A cross-sectional descriptive study using simple random sampling selected 119 students aged 6 to 12, and 300 reports were obtained from teachers. The prevalence rates of the predominantly inattentive type, the predominantly hyperactive type, and the combined type were 9.24%, 6.72% and 10.08%, respectively. These results are identical to studies in Vietnam and Saudi Arabia [11]. On the other hand, according to the DSM-V criteria, these prevalence of ADHD-C among schoolchildren is much higher than that calculated in other countries. [11, 12].

The prevalence of schoolchildren diagnosed with ADHD-C in our study was 10.08%, in line with rates found in Europe [13], and Latin America by several studies [14, 15]. So, according to previous studies, in Spain the prevalence of ADHD-C would be 3-14% in children aged 8-15 years in Valencia [13], 4-6% in children aged 6-15 years in Seville [23] and 1% in children aged 6-8 years in Navarre [16]. Similarly, Real, Bartoli et al (2017), reported that the incidence of the combined subtype of ADHD-C in a sample of children in Europe was comparable across countries, and mean impairment scores for primary and secondary symptoms differed and were higher in Italy and

the UK [17], while other studies conducted in Asia [11], Africa [18], and Arab countries [11, 19] appeared very comparable to these findings.

However, in the United States, according to a national survey of parents conducted from 2016 to 2019, millions of children have been diagnosed with ADHD, with an estimated number of 6 million (9.8%) children aged 3 to 17 ever diagnosed with ADHD, this figure covers 3.3 million individuals, with 13% being children aged 12 to 17. Boys (13%) are diagnosed with ADHD more frequently than girls (6%) [20]. In the same way, in our study, this ADHD-C had a higher prevalence amongst boys compared to girls. This matches the results of a study done in the United States by the American Psychiatry Association [2] and in Africa by Ayano, et al. (2020) [18]. Similar findings were seen in multiple European studies, including Cortese et al. (2013) and Setyawan, et al. (2017) [21], as well as a previous study conducted in Riyadh, Saudi Arabia [19, 22].

According to this article, the data also demonstrated a significant correlation between the diagnosis's prevalence and socio-economic status. Similarly, Pillai, Patel, et al. (2008) [23]., and Russell et al (2016) [24], approved that people from lower socioeconomic backgrounds have a prevalence of 6.4%, those from middle levels have 5%, and those from higher levels have 3.2%. In this context we found that children with ADHD-C whose parents work in

lower-level jobs have a prevalence rate of 25%. In addition, 11.23% of the fathers of these children work in non-paid activities and 12.12% live near a source of pollution [24].

In terms of genetic inheritance, ADHD-C affects both sexes and he is thought to be a highly heritable condition of neurodevelopmental origin [25]. In fact, 11.11% of the students with ADHD-C who participated in this survey reported that there was at least one family member who also had ADHD-C, indicating that genetics contribute significantly to the development of ADHD. Research into identical twins has demonstrated that if one twin experiences ADHD, there is an 80% likelihood that their co-twin will also be affected by the condition [17, 18]. In addition, in the majority of cases, at least one family member has ADHD. Several genes associated with ADHD have been identified, but genetics alone cannot fully explain the condition [26].

Comorbid disorders are often associated with ADHD, the most common being: oppositional defiant disorder, sleep disorders, social and emotional problems, speech and language disorders, bipolar or obsessive-compulsive disorders, motor disorders and learning difficulties [20]. In a longitudinal study comprising 208 children diagnosed with ADHD, Dalsgaard et al (2001) found that learning difficulties were present in 60% of the children in their sample. It should be emphasized that children whose ADHD is predominantly inattentive are significantly more likely to have learning difficulties than children whose ADHD is predominantly hyperactive/impulsive or mixed. [27]. In our research, out of 16 respondents who reported having reading and writing difficulties, one student had ADHD-C, and 25.56% of these students had at least average grades. These findings are consistent with Miller, et al. (2001) research, [28] indicating that 25% to 40% of children with ADHD-C received a diagnosis have reading

difficulties and 15% to 35% of children diagnosed with reading difficulties have this syndrome. In both cases, attentional components may be affected at different levels.

Psycho-educational support is therefore often essential (Charlebois, 2000). It should be noted that these children are frequently unable to succeed in school, or are at risk of struggling, despite generally possessing intellectual functioning that falls within or surpasses the norm [29]. Another consequence of the disorder is that interpersonal relationships are often problematic, even leading to rejection by peers. In addition, these behavioral problems in ADHD-C children often poison the teacher-child relationship. According to Gomes, Hilary, et al. (2012), these children have a number of weaknesses, poor selective attention, difficulty in following a task, and a degree of disorganization similar to the inattention found in ADHD without hyperactivity [30].

In addition, the differential diagnosis of children with ADHD may also include mental, emotional, behavioral, or conduct problems, depression disorders, autism spectrum disorders, central auditory disorders, dysphasia, drug addiction and anxiety disorders, as they can present as primary or secondary manifestations of ADHD-C. Figure 1 [20]. However, anxiety disorders affect 14% of children with ADHD, whereas 37.48% of children who are considered hyperactive need 7 to 8 hours to get enough sleep and 19.23% find it extremely difficult to sleep. Nevertheless, M. Lemelin, T. Boukhris, et al. (2019) [31]. mention that 25% of children with ADHD also suffer from depression and/or anxiety. As pointed out by Maric, Bexkens and Bogels, (2018), anxiety may be a protective factor for certain types of attentional tasks. The results show that the ADHD children in the study who were anxious seemed to be more attentive than the other children in the study.

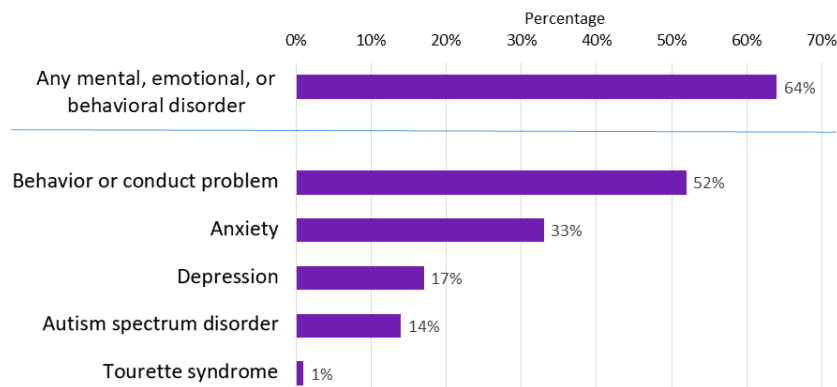


Figure 1. Percent of children with ADHD who had at least one other disorder [20]

The symptomatic triad (inattention/hyperactivity/impulsivity) may also reflect family, environmental and medical problems. In terms of health, 9.09% of the ADHD-C students had a chronic illness, and none of the ill students confirmed the use of tranquilizers or a treatment designed for this purpose. In addition, 12.5% of the ADHD-C students showed a very strong attachment to the use of the Internet and video. This addiction of video games and the Internet can be offset by the introduction of information and communication technology (ICTE) in the

teaching-learning process among school children in school systems [32].

Ultimately, the increase in the prevalence of ADHD-C may affect children's social life and success at school, and we need to make families aware of this condition so that it can be diagnosed and treated early. The study possesses several constraints that could influence the interpretation of findings. [19] Firstly, a larger study population would provide more meaningful results.

Second, we used a self-administered questionnaire translated from English into French and Arabic, which may have led to misunderstandings of questions. Thirdly, our study was used for selection purposes only and this research was conducted as part of a university course. Finally, questionnaire was only distributed to teachers; it should rather be completed by parents and teachers.

### 5. CONCLUSION

Our initial investigation into the inattention, hyperactivity, and impulsive behavior of schoolchildren suggest that ADHD-C could be a possible issue among Moroccan children. There appears to be a modest prevalence of ADHD-C among schools in the northwest region of Morocco. The study also identified a range of socioeconomic factors that are significantly linked to the development of this syndrome. These factors encompass low socioeconomic status and the parents' level of education. Our findings might provide a reference for further research on ADHD-C in Morocco, considering the lack of related studies to date. Future investigations should involve large randomized samples from all regions of the country to enable generalization of the outcomes. Furthermore, these findings should aid in creating health programmers that increase awareness among parents, educators, policymakers, school nurses, and healthcare practitioners about ADHD, specifically regarding its indicators, symptoms, causes and repercussions.; and essentially provide assistance to affected children and, if necessary, guide them towards appropriate interventions. Finally, this research is among the early efforts to assess ADHD in Moroccan pupils. The provided incidence indicates that ADHD is more prevalent in Moroccan schoolchildren compared to other regions of the globe.

### NOMENCLATURES

#### 1. Acronyms

DSM5 Diagnostic and Statistical Manual of Mental Disorders by the American Psychiatric Association (APA), fifth edition  
 DSM-IV-TR Diagnostic and Statistical Manual of Mental Disorders, Text Revision by the American Psychiatric Association (APA), fourth edition (2000)  
 APA American Psychiatric Association  
 ADHD Attention-Deficit/Hyperactivity Disorder  
 ADHD-C Attention-Deficit/Hyperactivity Disorder Combined Subtype  
 CADDAC Centre for ADHD Awareness, Canada

#### 2. Symbols / Parameters

\*: significant difference  
*sig*: significant  
*t*: test student  
*SD*: Standard Deviation

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