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PRENATAL, PERINATAL AND POSTNATAL EXPOSURE TO PESTICIDES AS A CAUSE OF ADHD IN YOUTH OF EL EJIDO

adulthood modification
behavior assessment
affecting parent research diagnosed
combination symptoms impulsivity psychiatric disorder
children studies struggle

increasing attention deficit
develop referring counseling childhood compensate
subjective bias differentiate missed
cortex genuine disorder
neurological disease diagnosis
impulsivity disorder
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struggle
population

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PRESENTATION

The objective of this research is to determine the relationship between exposure to pesticides and the manifestation of the three major traits of Attention Deficit/ Hiperactivity Disorder: inattention, overactivity and deficits in inhibitory response in our immediate surroundings.

The first part of this study is based on a vast theoretical base, which provides the features of the disorder, how it arises and why. The information has been extracted from an extensive bibliography and is the result of a reflection made on it.

The second part is the matrix of the monograph, the core of the research that has been carried out, around which have been shaped the discussion and the conclusions. It is an experiment with teenage participants who have conducted a series of tests and provide a sufficient database to finally obtain the relationship between the selected variables.

The results of this work intend to be a way open to further research.



RESUMEN

Este trabajo se basa en buscar la relación entre la exposición a los plaguicidas, antes y después del nacimiento, y su posible implicación en el desarrollo del Déficit de Atención / Trastorno de Hiperactividad.

Se ha hecho una investigación con un grupo de jóvenes para determinar si tienen los rasgos típicos del TDAH: la impulsividad, la hiperactividad y el déficit de atención. El procedimiento ha consistido de dos pruebas diagnósticas a realizar por los participantes y un cuestionario a realizar por sus madres.

Los resultados no han mostrado una relación entre la exposición a los pesticidas y tales rasgos. Sin embargo, sí se ha demostrado que los sujetos que se muestran más impulsivos y les cuesta más mantener la atención obtienen peores resultados académicos que aquellos que se muestran menos impulsivos y más centrados.



PART ONE: THEORETICAL FRAMEWORK

1. ATTENTION DEFICIT HIPERACTIVITY DISORDER

1.1 Introduction

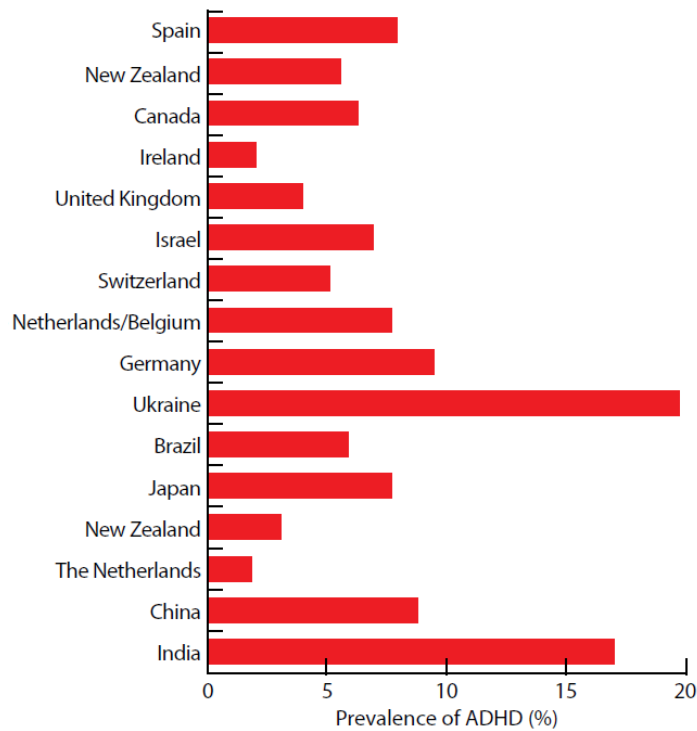
The diagnosis of ADHD is mainly clinical as Dr. Brown says in his book *Attention Deficit Disorder: An unfocused mind in children and adults* (Brown, 2006). This means that there is not a decisive test, whether a questionnaire, a blood test or neuroimaging tests, that is definitive for the diagnosis.

This leads us to think that it is a diffuse disorder difficult to diagnose correctly and adding the factor of its high morbidity makes clear that it is an arduous task for the specialists to diagnose correctly the disorder in question given the wide range of possibilities. In this way, it is easy to attribute the symptoms to other pathologies or diagnose ADHD in nervous people with attention problems.

Even so, inattention, overactivity and deficits in inhibitory response are the defining characteristics of ADHD. Yet they remain today still poorly delineated and are seen as non-specific symptoms of brain damage although it is known that there are different neural subsystems that are involved in these behaviors (Jeffrey et al., 1991).

Precisely these three characteristics will be the protagonists of the work. Although we are still in a very initial stage to determine what exactly are the causes of Attention Deficit Hiperactivity Discorder, is about going ahead with small steps forward to find the real reason of this great problem that affects thousands of children in all countries of the world.

Below is a table with the prevalence of ADHD in some countries of the world. We see that Spain is in the fifth position in this ranking



Source: WHO (WHO, 2012)

1.2 Definition and characteristics

The definition of attention-deficit/hyperactivity disorder (ADHD) has been updated in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) to more accurately characterize the experience of affected adults. This revision is based on nearly two decades of research showing that ADHD, although a disorder that begins in childhood, can continue through adulthood for some people.

Previous editions of DSM did not provide appropriate guidance to clinicians in diagnosing adults with the condition. By adapting criteria for adults, DSM-5 aims to ensure that children with ADHD can continue to get care throughout their lives if needed.

ADHD is characterized by a pattern of behavior, present in multiple settings (e.g., school and home), that can result in performance issues in social, educational, or work settings. As in DSM-IV, symptoms will be divided into two categories of inattention and hyperactivity and impulsivity:

Inattention

- often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities



- often has difficulty sustaining attention in tasks or play activities
- often does not seem to listen when spoken to directly
- often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure of comprehension)
- often has difficulty organizing tasks and activities
- often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)
- often loses things necessary for tasks or activities at school or at home (e.g. toys, pencils, books, assignments)
- is often easily distracted by extraneous stimuli
- is often forgetful in daily activities

Hyperactivity

- often fidgets with hands or feet or squirms in seat
- often leaves seat in classroom or in other situations in which remaining seated is expected
- often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
- often has difficulty playing or engaging in leisure activities quietly
- often talks excessively
- is often 'on the go' or often acts as if 'driven by a motor'

Impulsivity

- often has difficulty awaiting turn in games or group situations
- often blurts out answers to questions before they have been completed
- often interrupts or intrudes on others, e.g. butts into other children's games

Children must have at least six symptoms from either (or both) the inattention group of criteria and the hyperactivity and impulsivity criteria, while older adolescents and adults (over age 17 years) must present with five.

Using DSM-5, several of the individual's ADHD symptoms must be present prior to age 12 years, compared to 7 years as the age of onset in DSM-IV. This change is supported by substantial research published since 1994 that found no clinical differences between children identified by 7 years versus later in terms of course, severity, outcome, or treatment response.



DSM-5 includes no exclusion criteria for people with autism spectrum disorder, since symptoms of both disorders co-occur. However, ADHD symptoms must not occur exclusively during the course of schizophrenia or another psychotic disorder and must not be better explained by another mental disorder, such as a depressive or bipolar disorder, anxiety disorder, dissociative disorder, personality disorder, or substance intoxication or withdrawal. (DSM-V, American Psychiatric Association)

1.3 Symptoms

Often people are unclear when they explain ADHD symptoms. When the parents are asked to describe behaviors that lead them to believe that their son or daughter may have ADHD, they cite noncompliance, emotional immaturity, or unsatisfactory academic progress. Most professionals agree that the primary features of ADHD are: inattention, impulsivity and hyperactivity. (Anastopoulos et al., 2006)

Such symptoms lead others that leave important consequences for the patient's life. Cognitive development is affected and worsens during adolescence although it tends to normalize during the adulthood.

In the academic area, ADHD is devastating. Those affected have significant academic delay and face many difficulties throughout their years of schooling. In the interview with Mrs. Ramoneda (See: Annexes § VII) it was one of the most critical points for her. According to her, academic and social abilities difficulties are in some cases really difficult to repair.

Finally, it is important to know that people with this disorder have a reduced the number of social and personal relationships and it is noteworthy that very often they have low job security and they occupy lower-level jobs. (Benjumea et al., 1998).

1.4 Etiology

- Genetic factors:

There is scientific evidence of the importance of genetics in ADHD. In 20 separate studies, it was found that the heritability of ADHD is 76% (Faraone et al., 2005).



This means that if a child has ADHD, 76% of the cause of ADHD is genetic, that is, does not mean that if a parent has ADHD, there is a 76% chance that your child has ADHD. However, the calculated risk for a child to suffer the disorder if one parent has it is 57%.

Twin studies show a concordance of disorder 50% to 80% in monozygotic compared to 29-33% in dizygotic twins. (Stevenson et al., 1996)

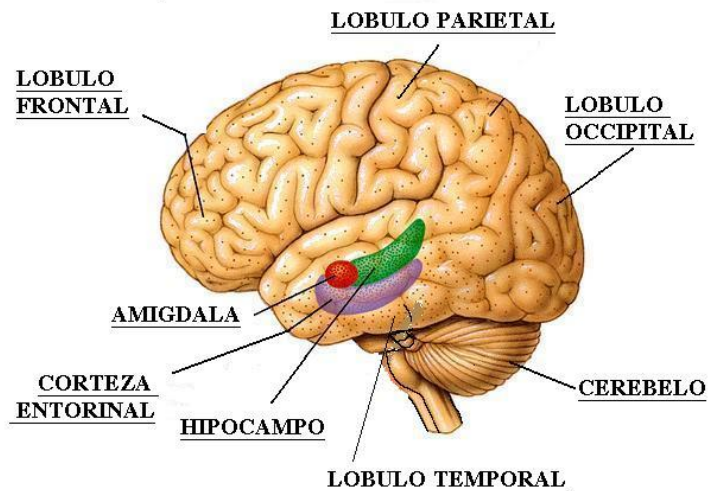
Thus, it seems that much of the variance of hyperactivity-impulsivity trait is due to genetic causes of ADHD.

Furthermore, recent genomic studies demonstrate the genetic complexity of ADHD, which has been associated with markers on chromosomes 4, 5, 6, 8, 11, 16 and 17 (Faraone et al., 2005).

In 2010 was published in the Lancet, an article added more evidence as to that ADHD is not a social construct, it is, something related only to the child's environment and education, but the cause of ADHD is due in large part to specific changes in certain chromosomes that make up the human genome. (Burbach, J.P., 2010)

- Damage/ brain dysfunction

Brain volumetric studies have shown deviations in developing cortical structures in ADHD subjects compared to controls. These studies suggest that ADHD is a disorder of cortical maturation rather than a shift in the development (Shaw et al., 2007) finding significantly lower level volumes of the prefrontal cortex, dorsolateral and regions connected to this, like the caudate nucleus, the globus pallidus, anterior cingulate gyrus and cerebellum (Seidman et al., 2005). Functional neuroimaging studies, especially in adults also consistently involve the prefrontal cortex and the anterior cingulate (Pliszka et al., 2006).



Furthermore, neuroimaging studies also have shown that many people with ADHD use different brain circuits and less efficient for certain cognitive tasks. In fact, although there are only some relevant neuroimaging studies, the results indicate that there are demonstrable differences in the functionality of the brain circuitry of executive function among individuals with and without ADHD syndrome. (Brown, 2006)

- Pre and perinatal factors

There is a number of pre and perinatal risk factors associated with the development of ADHD in childhood. These factors are: consumption of tobacco, alcohol and / or drugs, complications during pregnancy or childbirth, premature delivery and pre-or perinatal exposure to toxics.

It is interesting for this work to explain the findings on the effects of pesticides on the development of human beings and their influence on ADHD. For this reason, there is detailed information about it in section 2 of this first part. (See: Pesticides and Neurodevelopment § 2)



- Social factors

In addition to biological factors has also been widely discussed etiologic weight of social factors. The family atmosphere is naturally which most affects the child in their first years of life and its influence is decisive for the development of the disorder we are studying. The most important features are:

- A poor parenting practices
- Paternal and / or maternal psychopathology
- Low socioeconomic status
- Family psychosocial stress

1.5 Treatment

In 1937 it was accidentally discovered an effective drug for ADHD syndrome when Dr. Charles Bradley sought medication to relieve headaches resulting from lumbar puncture in children with behavioral disorders. The compound amphetamine that developed was not helpful for headaches, but a great improvement was detected in learning, motivation and behavior of individuals. (Brown, 2006)

Stimulant medication has become the most common treatment for Attention Deficit/Hyperactivity Disorder (ADHD) such as Ritalin. This kind of drug helps children to improve their approach to schoolwork, get more focused and organized, think before acting, get along better with others and break fewer rules.

The negative side of this treatment is that the results are temporary and most people with ADHD need extra help. In addition to medication, they can benefit from parent education, family therapy and supportive interventions.

Stimulants are an effective way of managing ADHD symptoms, such as short attention span, impulsive behavior and hyperactivity. They may be used alone or in combination with behavior therapy.

Despite these benefits, some concerns remain. Some worry that medication sends the wrong message, discouraging children and their parents from focusing on building problem-solving skills. (Kazdin, 2000)



2. PESTICIDES AND NEUREDEVELOPMENT

Pesticides are substances produced to control, kill or repel pests. This pest can be any living organism that causes damage or economic loss or to transmit or produce disease.

During the 80s, the massive application of pesticides was considered generally as a revolution in agriculture. Its application became a common practice, as a preventive measure even without any visible attack. Since then, it has been shown that not only harms the environment but is also ultimately ineffective. Where pesticides are used indiscriminately, pest species have become resistant and difficult or impossible to control. However, what most concern are the possible negative effects that could have on human health. The WHO in a study of 2012 noted that pesticides can severely disrupt the endocrine system of people, (WHO, 2012).

Many are also studies linking pesticide exposure with the disorder we are interested for: Attention Deficit/ Hiperactivity Disorder.

The WHO, in the same report mentioned above, incorporates several interesting points about ADHD. First, states that developmental neurotoxicity with negative impacts on brain development is linked with PCBs. Attention Deficit / Hyperactivity Disorder (ADHD) is overrepresented in populations with elevated exposure to organophosphate pesticides. Secondly, it states that pesticides involve a failure of thyroxin during pregnancy. If this failure is moderate is also associated with reduced intelligence quotient, ADHD and even autism in children. (WHO, 2012)

However, the work cites Aguiar (Aguiar et al., 2010) when it says that still remains a significant challenge to identify the possible causes of the increased incidence - either geographical or temporal - and to determine the extent to which environmental factors play a role.

A Spanish study (Roldán et. al., 2006) assessed neuropsychological deficits resulting from acute poisoning over a long period and chronic poisoning in a group exposed to these substances. The results showed that both groups exhibited similar alterations in perception and visuo-motor processing. In case of acutely poisoned subjects, verbal and perceptive learning and recall and constructive abilities were also impaired.



As mention Dr. Plomin and collaborators (Plomin et al., 1994) genetic, environmental, and social factors interacting in complex ways are important determinants of cognitive development and behavior. None alone is sufficient to explain population wide increases in neurodevelopmental abnormalities. Except for single-gene disorders, heredity accounts for, at most, about 50% of the variance of cognitive, behavioral, and personality traits among individuals. This, of course, implies that the other 50% of variability must be due to environmental influences.

Given that the literature, as the examples above, suggests a link between in-utero pesticide exposure and impaired child neurodevelopment, our purpose is to find out what happens in an environment close to us. Data on ADHD are of concern, since the use of Ritalin for this disorder has doubled every 4–7 years since 1971. (Safer et al., 1996)

El Ejido is an area with a large agricultural culture and in that zone it is used more than 1.5 million containers of pesticides each year to control and eliminate pests in greenhouses. (Malato et. al., 2012). With this data, we found that in the area of pesticide exposure is much higher than in other areas where there is no such extension used for agriculture.

Here we have an outline with the classification according to their chemical composition and where are located most commonly used pesticides in El Ejido:

Clasificación	Estructura química	Ejemplos usados ampliamente en El Ejido
Organoclorados	Son compuestos orgánicos que tienen cloro y son considerados muy peligrosos porque permanecen mucho tiempo en el ambiente, se acumulan en los tejidos y producen graves daños en la salud.	Endosulfan
Organofosforados	Son compuestos orgánicos que tienen fósforo. Persisten menos tiempo en el ambiente que los organoclorados, aunque también producen graves daños en la salud del ser humano afectando sobre todo el sistema nervioso central.	Metamidofos



Carbamatos	Son compuestos derivados del Ácido Carbámico y afectan al Sistema Nervioso Central.	Formetanato, Oxamilo, Propamocarb
Piretroides	Son compuestos derivados de la flor del crisantemo y pueden producir lesiones en la piel y las mucosas.	Acrinatrin
Biperidinas	Son compuestos biperidílicos y pueden producir daño en los pulmones.	Pirimetanil

We note that in this town are used pesticides of all types, and organophosphates and carbamates, which are related to nervous system damage, take a significant percentage.

The following table shows the chemical structure of the most commonly used pesticides in El Ejido (Malato et al., 2012)

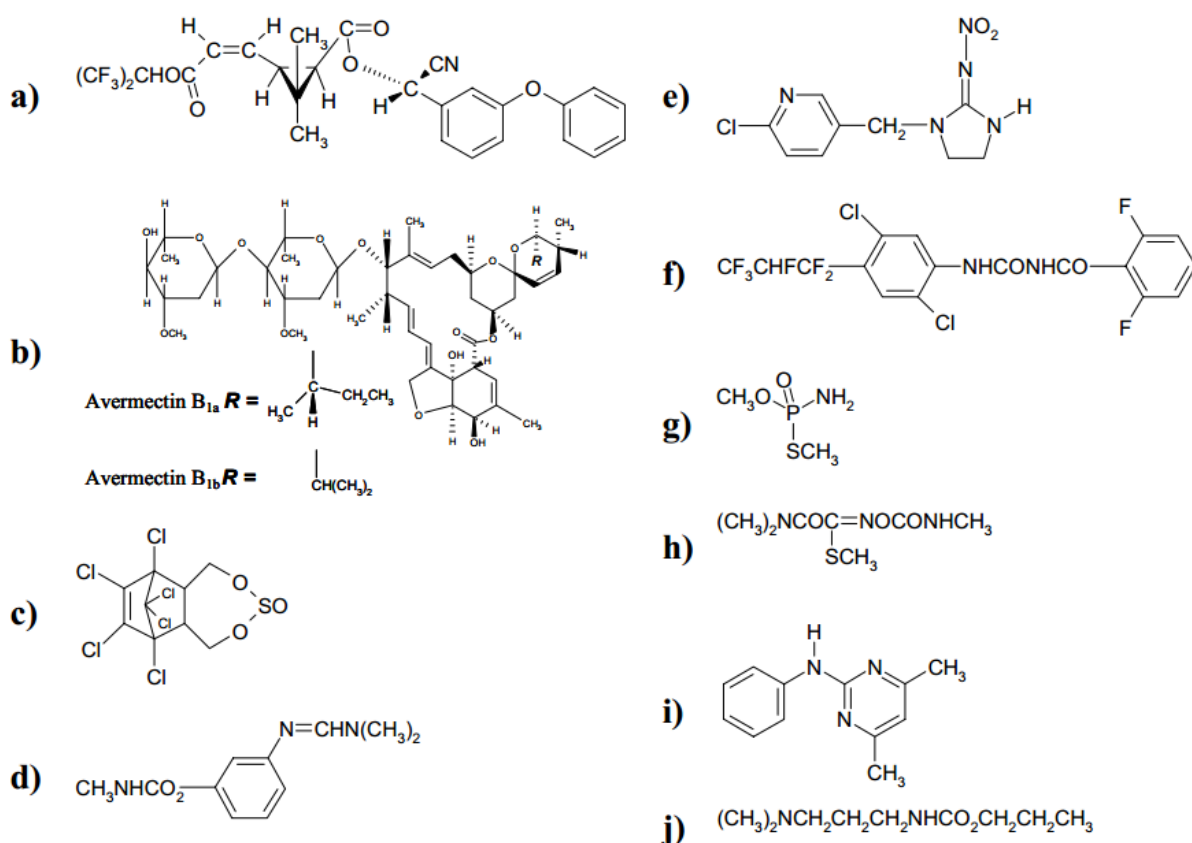


Figura 5. Estructura de los ingredientes activos de los 10 plaguicidas seleccionados: a) Acrinatrin, b) Avermectina B1, c) Endosulfan, d) Formetanato, e) Imidacloprid, f) Lufenuron, g) Metamidofos, h) Oxamilo, i) Pirimetanil, j) Propamocarb.



PART TWO: EXPERIMENTAL WORK

3. EXPERIMENTAL WORK PRESENTATION

3.1 Presentation and justification

Given the relationship that has stood between pesticide exposure and the development of ADHD in humans in this research we wanted to study this relationship in a close environment. El Ejido, is located in the municipality of El Ejido, which has a population of 83,104 inhabitants and a land extent of 250 km² of which 125 km² surface are greenhouses, representing 52% of the total.

There is extensive literature that relates the existence of ADHD with exposure to certain pesticides used in agriculture. Thus, whether perinatal exposure is a risk factor for the development of ADHD should also be a risk factor for the development of some of the features of this disorder, even without developing, that is, depending on levels of prenatal or postnatal exposure will modulate the risk of greater impulsivity, impaired attentional processes, particularly sustained attention, and / or motor hyperactivity.

In El Ejido, being an area with a strong agricultural presence, are used abundantly chemicals to eliminate and / or prevent potential pests affecting cultivated plants.

The present work has some precedents. The following is one of the most similar studies that have been done in this area, which was executed by Sarah Durston (2003). Many images were obtained while scanning the brain of the young participants. They were asked to press a button every time it appeared a picture of a Pokemon in particular and to avoid pressing when it appeared the drawing of another Pokemon. Results were clear; children with ADHD had great difficulty not to press the button on the situation of "avoid pressing it." Also thanks to the scanner was found that children with ADHD showed more immature pattern of brain activation, it is, its activity was more characteristic as patterns of younger children.

3.2 Research objectives

The objective of this research is focused on to what extent exposure to organophosphate pesticides commonly used in agriculture, can influence cognitive disorders or personality variables related to ADHD diagnosis even in the absence thereof.



3.3 Method

- Description of the sample

The sample of this research is 75 young people aged between 14 and 18 years living in the Ejido and students at IES Pablo Ruiz Picasso the same municipality. The group consists of 35 girls and 40 boys and pursuing 3rd, 4th ESO or 1st Baccaalaureate. The respondents belong to a disadvantaged socio-economic sector and typically get low academic results.

To organize tasks, each subject was assigned a number that were labeled with both instruments and questionnaire assessment of mothers. Thus, data are completely confidential, as dictated by *LEY ORGÁNICA 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal*.

- Assessment instruments

Go – No Go Task

The first test is called Go-No Go. This test is used to measure the participants' ability to maintain sustained attention and response control. The participant is required to issue a response to certain stimuli, and hold or inhibit the response to others. Specifically, they should press the space bar when he/she see a blue figure and not do it when those figures of other colors. In this way we can assess impulsivity that show when he/she presses the space bar when they should and when they should not.

Continuous Performance Test

The AX-type continuous performance task (AX-CPT), is a widely used executive processing and cognitive control task first developed in 1956 (Rosvold et al., 1956), that can be manipulated to emphasize specific aspects of response preparation and stimulus expectation.

Commonly this task presents on 500 letters for 400 msec with an interval between stimuli of 600 ms. The subject must respond whenever there is an X preceded by an A. That happens 50 times, but 50 times X appears not preceded by A and 50 times the A not



followed by X. Symptoms of attention deficit are errors of omission (number of undetected AX) and impulsivity is deducted from commission errors (number of times it responds in the absence of an X preceded by an A). It is a classical task in the evaluation of care, often used in research. (Félix, 2006)

- **Comission faults.** It would be the variable corresponding to impulsivity and is the number (percentage) of times the subject pressed the spacer with no target stimulus appeared. A higher percentage of 12.5% would be indicators of impulsivity.

- **Omission faults.** Times the stimulus appears and the subject does not press the spacer. Similarly, percentages above 12.5% are considered as attention deficit. (Díaz, 1999)

This time the test time was reduced to suit the needs of the participating subjects. The 120 trials (a pair of letters each trial) were: 84 AX (letter a followed by the x, target trials), 12 BX (any letter except a and x, followed by the x), 12 AY (letter a followed by any letter other than x or a) and 12 BY (any letter except a and x followed by any letter other than x). Each letter pair 250ms occurs during the interval between stimuli (ISI) of 1100 ms and inter-trial interval (ITI) is 1250 ms. The task lasts 6 minutes.

The manipulations of the task were performed to create conditions that differentially challenged control mechanisms, allowing the evaluation of the specific ERP components. The proportions of each type of trial were varied to create three versions of the original task. In each case, one type of trial is presented most of the time (70%), and the other three types of trials are equiprobable (10% each). (Dias et al., 2003)

Questionnaire

The questionnaire was designed to be completed by the mothers of the respondents. The paper included the different questions about their habits during the pregnancy, their occupation at the time, the activities of their children and their perception of the behavior and personality of their sons or daughters (See: Annexes § V).

It is a questionnaire with 13 questions with dichotomous answers (yes or no). The questions could be classified into 3 blocks: where pregnancy developed, habits and actions during pregnancy (alcohol, tobacco, work) and activities of their child during the first years of life.



In the final part it is asked directly by the behavior of their descendants: if they are nervous people and / or have attention problems, if they have or have had concerns or problems due to the behavior of their child, and finally, if the girl or boy is diagnosed with ADHD.

- Procedure

Participants performed two tasks (Go - No Go) and then they were given a questionnaire to be completed by their mothers. Of all the three assessment tools we have made some tables with the responses and errors (See: Annexes § VI) and then we obtained the results listed below.

3.4 Results

In analyzes in which the independent variable is dichotomous we will apply Student's T to determine the relationship between variables. To apply the Student's T we must first verify the normality assumption and the assumption of equality. If the normality assumption is accomplished, we can apply the Student's t course. If the normality assumption is not accomplished, we cannot apply the Student's T.

To verify the assumption of normality we use the Kolmogorov-Smirnov test, it allows the hypothesis that the sample data come from a normal distribution, and it is usually used for quantitative variables. The null hypothesis means that the data come from a normal distribution and the alternative hypothesis states that the data do not come from a normal distribution.

Supuesto de normalidad:

$H_0 =$ los datos provienen de una distribución normal

$H_1 =$ los datos NO provienen de una distribución normal

Once the normality test is done, we carry out the analysis of Student's T, from which we deduce the relationship between one variable and another.



In the final part of the analysis (Relation Between Marks and Impulsivity and Attention Deficit) it is not followed the guidelines mentioned, since the independent variable is quantitative. For this case we performed Pearson correlation and linear regression to determine how one variable affects another.

- DIFERENCES BETWEEN GENDERS

Comission mistakes:

The data analyzed represent the students' group sex and commission errors made in the two diagnostic tasks (See: Annexes § VI). We want to check if there's a significant difference between the mistakes of one sex and the other.

Kolmogorov-Smirnov test

		Total_Comission_ Impulsivity
N		35
Normal Parameters ^{b,c}	Average	4.0000
	Deviation	3.43854
	Absolute	.186
Extreme Differences	Positive	.186
	Negative	-.122
Z de Kolmogorov-Smirnov		1.098
Asymptotic Sig. (bilateral)		.179

a. Sex = Female

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 1

This is the test of normality for the female gender. The P value (Sig Asympt) is 0.179 and it is greater than 0.05. That is, we have no evidence to reject the null hypothesis, since it is greater than the significance (0.05). Thus the data come from a normal distribution. This means we may well apply the T-test for comparison of the averages.



Kolmogorov-Smirnov test

		Total_Comission_Impulsivity
N		40
Normal Parameters ^{b,c}	Average	4.5250
	Deviation	3.53000
Extreme Differences	Absolute	.116
	Positive	.116
	Negative	-.100
Z de Kolmogorov-Smirnov		.734
Asymptotic Sig. (bilateral)		.655

a. Sex = Male

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 2

In the test of normality for males we also see that P value is greater than 0.05, a fact which indicates that the data also come from a normal distribution.

Estadísticos de grupo

	Sex	N	Media	Desviación típ.	Error típ. de la media
Total_Comission_Impulsivity	Female	35	4,0000	3,43854	,58122
	Male	40	4,5250	3,53000	,55814

Figure 3

The Group Statistics Table (Fig. 3) describes the sample. In this case there are 35 women and 40 men. The first group has committed an average of 4 errors of comission while the second has committed an average of 4,525 errors. Also, it is detailed in this table the standard deviation and standard error of the mean. Between men and women there are no major differences in impulsivity.



Prueba de muestras independientes											
		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						95% Intervalo de confianza para la diferencia	
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error típ. de la diferencia	Inferior	Superior	
Total_Comission_Impulsivity	Se han asumido varianzas iguales	,516	,475	-,650	73	,518	-,52500	,80725	-2,13384	1,08384	
	No se han asumido varianzas iguales			-,652	72,139	,517	-,52500	,80581	-2,13131	1,08131	

Figure 4

In Figure 4 the Levene test reports homogeneity of variances, since the value is greater than 0.05. Bilateral significance in T test indicates that there is no difference between sexes ($0.518 > 0.05$). Then we will compare the means using a nonparametric test to reaffirm the result.

Rangos				
	Sex	N	Rango promedio	Suma de rangos
Total_Comission_Impulsivity	Female	35	36,04	1261,50
	Male	40	39,71	1588,50
	Total	75		

Estadísticos de contraste ^a	
	Total_Comission_Impulsivity
U de Mann-Whitney	631,500
W de Wilcoxon	1261,500
Z	-,732
Sig. asintót. (bilateral)	,464

a. Variable de agrupación: Sex

In the nonparametric test we see that the bilateral asymptotic significance is greater than 0.05 ($0.464 > 0.05$), so now we can say that we found no association between sex and the number of errors of commission in the tests.



Omission mistakes:

We follow the same procedure to affirm whether there are or not significant differences between the average errors of omission and errors men women commission.

Kolmogorov-Smirnov test

		Total_Omission_Attention_Deficit
N		35
Normal Parameters ^{b,c}	Average	16.4571
	Deviation	11.14963
Extreme Differences	Absolute	.116
	Positive	.116
	Negative	-.097
Z de Kolmogorov-Smirnov		.688
Asymptotic Sig. (bilateral)		.731

a. Sex = Female

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 5

This is the test of normality for the female gender. The P value (Sig Asympt) 0.731 is greater than 0.05 that is, we have no evidence to reject the null hypothesis, since it is greater than the significance (0.05). Thus the data come from a normal distribution. This means we may well apply the T-test for comparison of the population average.



Kolmogorov-Smirnov test

		Total_Omission_Attention_Deficit
N		40
Normal Parameters ^{b,c}	Average	21.7750
	Deviation	15.92207
	Absolute	.184
Extreme Differences	Positive	.184
	Negative	-.132
Z de Kolmogorov-Smirnov		1.165
Asymptotic Sig. (bilateral)		.132

a. Sex = Male

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 6

The same goes for the male gender, the P value is 0.132, a fact that leads us to conclude that it is possible to apply the Student's t test.

Estadísticos de grupo

	Sex	N	Media	Desviación típ.	Error típ. de la media
Total_Omission_Attention_Deficit	Female	35	16,4571	11,14963	1,88463
	Male	40	21,7750	15,92207	2,51750

Figure 7

The omissions have been an average of 16,457 for girls and 21,775 for boys. So, it seems to be that the boys have had more inattention problems than girls.



Prueba de muestras independientes

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error típ. de la diferencia	95% Intervalo de confianza para la diferencia	
									Inferior	Superior
Total_Omission_Attention_Deficit	Se han asumido varianzas iguales	5,878	,018	-1,652	73	,103	-5,31786	3,21829	-11,73190	1,09618
	No se han asumido varianzas iguales			-1,691	69,811	,095	-5,31786	3,14478	-11,59022	,95451

Figure 8

In Figure 8 we find the Levene test for equality of variances, in which we find the Fisher statistic (F) and the P value (Sig). In this case the P value was 0.018, the significance is less than 0.05, so in fact there is no homogeneity of variances but we see that the value of T indicates that there are no differences between the sexes. To reaffirm this, we use the nonparametric test: Mann-Whitney.

Rangos

	Sex	N	Rango promedio	Suma de rangos
Total_Omission_Attention_Deficit	Female	35	34,89	1221,00
	Male	40	40,73	1629,00
	Total	75		

Estadísticos de contraste^a

	Total_Omission_Attention_Deficit
U de Mann-Whitney	591,000
W de Wilcoxon	1221,000
Z	-1,158
Sig. asintót. (bilateral)	,247

a. Variable de agrupación: Sex

In this nonparametric test, bilateral asymptotic significance is greater than 0.05 (0.247 > 0.05), so we determined that there is no relationship between sex and committing omission failures.



- **RELATIONSHIP BETWEEN THE PRESENCE OF TOBACCO IN PREGNANCY AND IMPULSIVITY LEVELS AND ATTENTION DEFICIT**

Now we intend to find the relationship between subjects with smoking mothers during pregnancy and their scores on the tasks facing young people who had no presence of smoke during prenatal development. (See: Annexes § VI)

Comission mistakes

Kolmogorov-Smirnov test

		Total_Comission_Impulsivity
N		10
Normal Parameters ^{b,c}	Average	5.7000
	Deviation	3.26769
	Absolute	.185
Extreme Differences	Positive	.185
	Negative	-.159
Z de Kolmogorov-Smirnov		.584
Asymptotic Sig. (bilateral)		.884

a. Tobacco_Pregnancy = Yes

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 9

This is the normality test for students whose mother smoked during pregnancy. The P value (Sig Asympt) is 0.884 and it is greater than 0.05. That is, we have no evidence to reject the null hypothesis, since it is greater than the significance (0.05). Thus the data come from a normal distribution. This means we may well apply the T-test for comparison of the population averages.



Kolmogorov-Smirnov test

		Total_Comission_Impulsivity
N		65
Normal Parameters ^{b,c}	Average	4,0615
	Deviation	3,47705
	Absolute	,139
Extreme Differences	Positive	,139
	Negative	-,121
Z de Kolmogorov-Smirnov		1,119
Asymptotic Sig. (bilateral)		,164

a. Tobacco_Pregnancy = No

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 10

In the test of normality for young people whose mothers did not smoke during pregnancy we also see that P value is greater than 0.05 (0.164), a fact which indicates that the data also come from a normal distribution.

Estadísticos de grupo

Tobacco Pregnancy		N	Media	Desviación típ.	Error típ. de la media
Total_Comission_Impulsivity	Yes	10	5,7000	3,26769	1,03333
	No	65	4,0615	3,47705	,43128

Figure 11

This table describes the situation: 10 people had tobacco toxicity, and 65 who did not. We see that the average is 1.7 commission failures more (impulsivity) in which had toxicity by tobacco.



Prueba de muestras independientes

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error típ. de la diferencia	95% Intervalo de confianza para la diferencia	
									Inferior	Superior
Total_Comission_Impulsivity	Se han asumido varianzas iguales	,000	,984	1,397	73	,167	1,63846	1,17256	-,69845	3,97537
	No se han asumido varianzas iguales			1,463	12,356	,168	1,63846	1,11972	-,79343	4,07036

Figure 12

In this table we find the Levene test, in which we find the Fisher statistic (F) and the P value (Sig). In this case the P value is 0.984, the significance is greater than 0.05, then we have no evidence to reject the null hypothesis, for that reason, equal variances are assumed. The T test determines that the difference between groups is not significant and to compare and assert the result we'll performe the Mann-Whitney test.

Rangos

	Tobacco_Pregnancy	N	Rango promedio	Suma de rangos
Yes		10	48,35	483,50
Total_Comission_Impulsivity No		65	36,41	2366,50
Total		75		

Estadísticos de contraste^a

	Total_Comission_Impulsivity
U de Mann-Whitney	221,500
W de Wilcoxon	2366,500
Z	-1,624
Sig. asintót. (bilateral)	,104

a. Variable de agrupación:
Tobacco_Pregnancy

Thanks to the Mann-Whitney test, we conclude that there is no significant difference between the averages. Then, there is no significant difference between the average commission errors made by participants with a presence of smoke in pregnancy and



commission errors of those who had no such presence. If it were a value below 0.1 it would indicate that there is a trend, but we are at 0.4 points to be below 0.1, so the conclusion is correct.

Omission mistakes

We do the same procedure to find out what happens to the errors of omission.

Kolmogorov-Smirnov test

		Total_Omission_Attention_Deficit
N		10
Normal Parameters ^{b,c}	Average	25,7000
	Deviation	20,12213
Extreme Differences	Absolute	,182
	Positive	,182
	Negative	-,127
Z de Kolmogorov-Smirnov		,577
Asymptotic Sig. (bilateral)		,894

- a. Tobacco_Pregnancy = Yes
- b. Contrast distribution is normal.
- c. Calculated from the data.

Figure 13

The P value of children with presence of tobacco during prenatal formation is 0.894, higher than 0.05. It allows us to apply Student's T.



Kolmogorov-Smirnov test

		Total_Omission_Attention_Deficit
N		65
Normal Parameters ^{b,c}	Average	18,3077
	Deviation	12,82322
	Absolute	,125
Extreme Differences	Positive	,125
	Negative	-,102
Z de Kolmogorov-Smirnov		1,010
Asymptotic Sig. (bilateral)		,260

a. Tobacco_Pregnancy = No

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 14

The same applies to children without the presence of tobacco during prenatal development. The value is greater than 0.05, in this case is 0,260. We perform the Student's T test.

Estadísticos de grupo

		Tobacco_Pregnancy	N	Media	Desviación típ.	Error típ. de la media
Total_Omission_Attention_Deficit	Yes		10	25,7000	20,12213	6,36318
	No		65	18,3077	12,82322	1,59053

Figure 15

The most significant data are the 7,392 points that differ one group from the other. It is clear that subjects with a presence of smoke during pregnancy committed significantly more omission errors than the others.



Prueba de muestras independientes

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error t. de la diferencia	95% Intervalo de confianza para la diferencia	
									Inferior	Superior
Total_Omission_Attention_Deficit	Se han asumido varianzas iguales	5,000	,028	1,562	73	,123	7,39231	4,73223	-2,03902	16,82363
	No se han asumido varianzas iguales			1,127	10,154	,286	7,39231	6,55895	-7,19191	21,97653

Figure 16

The result of the Levene test is a value less than 0.05 so we can conclude that there is no homogeneity of variance, but the T indicates no difference between the groups being the value greater than 0.05 ($0.123 > 0.05$). We check the average's difference using the Mann-Whitney test.

Rangos

	Tobacco_Pregnancy	N	Rango promedio	Suma de rangos
Total_Omission_Attention_Deficit	Yes	10	43,45	434,50
	No	65	37,16	2415,50
	Total	75		

Estadísticos de contraste^a

	Total_Omission_Attention_Deficit
U de Mann-Whitney	270,500
W de Wilcoxon	2415,500
Z	-,850
Sig. asintót. (bilateral)	,395

a. Variable de agrupación: Tobacco_Pregnancy



As seen, the significance is 0.395 so we say that there is no difference between the means and therefore there is no link between having a smoking mother and errors of omission.

- RELATIONSHIP IN SUBJECTS WITH PRENATAL EXPOSURE TO PESTICIDES BECAUSE OF THEIR PRENATAL DEVELOPMENT IN EL EJIDO AND IMPULSIVITY AND ATTENTION DEFICIT LEVELS

Here we propose to relate the site of the pregnancy with the errors committed by participants in the experiment.

Comission mistakes

Kolmogorov-Smirnov test

		Total_Comission_Impulsivity
N		49
Normal Parameters ^{b,c}	Average	4,1429
	Deviation	3,25960
	Absolute	,131
Extreme Differences	Positive	,131
	Negative	-,102
Z de Kolmogorov-Smirnov		,917
Asymptotic Sig. (bilateral)		,370

a. Ejido_Pregnancy = Yes

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 17

The P value authorizes us to apply Student T as it indicates that the data come from a normal distribution.



Kolmogorov-Smirnov test

		Total_Comission_Impulsivity
N		26
Normal Parameters ^{b,c}	Average	4,5385
	Deviation	3,90108
Extreme Differences	Absolute	,162
	Positive	,162
	Negative	-,122
Z de Kolmogorov-Smirnov		,824
Asymptotic Sig. (bilateral)		,505

a. Ejido_Pregnancy = No

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 18

The same is true in the case of participants whose mothers had pregnancy outside of El Ejido.

Estadísticos de grupo

	Ejido Pregnancy	N	Media	Desviación típ.	Error típ. de la media
Total_Comission_Impulsivity	Yes	49	4,1429	3,25960	,46566
	No	26	4,5385	3,90108	,76507

Figure 19

On this occasion the participants whose mother lived in El Ejido are 49 and 26 participants whose mother didn't live in El Ejido during pregnancy. If we look at the averages, we see that there is just a little difference between them.



Prueba de muestras independientes

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error típ. de la diferencia	95% Intervalo de confianza para la diferencia	
									Inferior	Superior
Total_Comission_Impulsivity	Se han asumido varianzas iguales	,147	,703	-,467	73	,642	-,39560	,84741	-2,08448	1,29328
	No se han asumido varianzas iguales			-,442	43,821	,661	-,39560	,89564	-2,20085	1,40964

Figure 20

Figure 20 Gives a Levene Test significance of 0.703 and we conclude that there is homogeneity of variances. In Test T, bilateral significance is very high (0.642), for which thing there is no difference between the two groups. Now we compare the two means to be sure.

Rangos

	Ejido_Pregnancy	N	Rango promedio	Suma de rangos
Total_Comission_Impulsivity	Yes	49	37,47	1836,00
	No	26	39,00	1014,00
	Total	75		

Estadísticos de contraste^a

	Total_Comission_Impulsivity
U de Mann-Whitney	611,000
W de Wilcoxon	1836,000
Z	-,291
Sig. asintót. (bilateral)	,771

a. Variable de agrupación: Ejido_Pregnancy

Mann-Whitney is clear: there is no relationship between the place of gestation and make more commission errors in the tests (0.771 > 0.05).



Omission mistakes

Kolmogorov-Smirnov test

		Total_Omission_Attention_Deficit
N		49
Normal Parameters ^{b,c}	Average	18,4082
	Deviation	14,51998
	Absolute	,150
Extreme Differences	Positive	,150
	Negative	-,129
Z de Kolmogorov-Smirnov		1,052
Asymptotic Sig. (bilateral)		,219

a. Ejido_Pregnancy = Yes

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 21

Kolmogorov-Smirnov test

		Total_Omission_Attention_Deficit
N		26
Normal Parameters ^{b,c}	Average	20,9615
	Deviation	13,28301
	Absolute	,184
Extreme Differences	Positive	,184
	Negative	-,092
Z de Kolmogorov-Smirnov		,939
Asymptotic Sig. (bilateral)		,342

a. Ejido_Pregnancy = No

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 22



The two previous normality tests (Figure 21 and Figure 22) show that the P value (Sig Asympt) is 0.219 and 0.334 respectively and therefore greater than 0.05. For this reason, we have no evidence to reject the hypothesis zero, since the significance is greater than (0.05). Thus the data come from a normal distribution. This means we may well apply the T-test for comparison of means.

Estadísticos de grupo

	Ejido Pregnancy	N	Media	Desviación típ.	Error típ. de la media
Total_Omission_Attention	Yes	49	18,4082	14,51998	2,07428
_Deficit	No	26	20,9615	13,28301	2,60501

Figure 23

We appreciated that the mean numerical difference is only 2.56 points, so it does not seem a big difference. We will check it in the following table.

Prueba de muestras independientes

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error típ. de la diferencia	95% Intervalo de confianza para la diferencia	
									Inferior	Superior
Total_Omission_Attention	Se han asumido varianzas iguales	,071	,791	-,746	73	,458	-2,55338	3,42318	-9,37576	4,26900
_Deficit	No se han asumido varianzas iguales			-,767	55,195	,446	-2,55338	3,32998	-9,22627	4,11952

Figure 24

Indeed we see that the significance is 0.791, a value much greater than 0.05, so it is clear that there is homogeneity of variances. Bilateral significance, with a value of 0.458 confirms that there is no difference between the two groups. Then we will compare the means for the relationship between groups.

Rangos

	Ejido_Pregnancy	N	Rango promedio	Suma de rangos
Total_Omission_Attention	Yes	49	36,03	1765,50
_Deficit	No	26	41,71	1084,50
	Total	75		



Estadísticos de contraste^a

	Total_Omission _Attention_Defi cit
U de Mann-Whitney	540,500
W de Wilcoxon	1765,500
Z	-1,075
Sig. asintót. (bilateral)	,282

a. Variable de agrupación:
Ejido_Pregnancy

Analyzing the results of Mann-Whitman, it is known that there is no relationship between the two groups ($0.282 > 0.05$)

- RELATIONSHIP BETWEEN SUBJECTS POSTNATAL PESTICIDE EXPOSURE THROUGH THEIR VISITS TO GREENHOUSE AND IMPULSIVITY AND ATTENTION DEFICIT LEVELS

In this section we will discover what relationship exists between the visits the subjects did in the first years of life to greenhouses and testing errors Go - No Go and AX.

Comission mistakes

Kolmogorov-Smirnov test

		Total_Comiss ion_Impulsivit y
N		11
Normal Parameters ^{b,c}	Average	4,3636
	Deviation	3,20227
	Absolute	,210
Extreme Differences	Positive	,210
	Negative	-,153
Z de Kolmogorov-Smirnov		,698
Asymptotic Sig. (bilateral)		,715

a. Go_Inside_Greenhouse_Childhood = Yes

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 25



Kolmogorov-Smirnov test

	Total_Comission_Impulsivity	
N	64	
Normal Parameters ^{b,c}	Average	4,2656
	Deviation	3,54223
Extreme Differences	Absolute	,145
	Positive	,145
	Negative	-,114
Z de Kolmogorov-Smirnov	1,160	
Asymptotic Sig. (bilateral)	,135	

a. Go_Inside_Greenhouse_Childhood = No

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 26

The two normality tests performed in this section (Figure 25 and Figure 26) indicate the data come from a normal distribution. This means we may well apply the T-test for comparison of the population means.

Estadísticos de grupo

	Go_Inside_Greenhouse_Childhood	N	Media	Desviación típ.	Error típ. de la media
Total_Comission_Impulsivity	Yes	11	4,3636	3,20227	,96552
	No	64	4,2656	3,54223	,44278

Fig. 27

In this analysis, there are 11 subjects who frequently visited greenhouses in the early years of life. The remaining 64 cases were not ever near or inside the greenhouses. Looking at the averages, the difference is negligible (0.10).



Prueba de muestras independientes

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error tip. de la diferencia	95% Intervalo de confianza para la diferencia	
									Inferior	Superior
Total_Comision_Impulsivity	Se han asumido varianzas iguales	,128	,721	,086	73	,932	,09801	1,14160	-2,17720	2,37323
	No se han asumido varianzas iguales			,092	14,546	,928	,09801	1,06221	-2,17220	2,36822

Figure 28

As sensed in the above table (Figure 28) there is homogeneity of variances (Sig = 0.721) and no significant differences between the two groups (Bilateral Sig = 0.932). Then we will make the Mann-Whitney test to compare means.

Rangos

	Go_Inside_Greenhouse_Childhood	N	Rango promedio	Suma de rangos
Total_Comision_Impulsivity	Yes	11	39,23	431,50
	No	64	37,79	2418,50
	Total	75		

Estadísticos de contraste^a

	Total_Comision_Impulsivity
U de Mann-Whitney	338,500
W de Wilcoxon	2418,500
Z	-,204
Sig. asintót. (bilateral)	,839

a. Variable de agrupación:
Go_Inside_Greenhouse_Childhood

This analysis confirms what we suspected in the table above: there is no relationship between the variables, having visited frequently greenhouses in childhood do not affect to do more or less test failures in this sample.



Omission mistakes

Kolmogorov-Smirnov test

		Total_Omission_Attention_Deficit
N		11
Normal Parameters ^{b,c}	Average	19,4545
	Deviation	14,25036
	Absolute	,220
Extreme Differences	Positive	,220
	Negative	-,191
Z de Kolmogorov-Smirnov		,730
Asymptotic Sig. (bilateral)		,661

a. Go_Inside_Greenhouse_Childhood = Yes

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 29

Kolmogorov-Smirnov test

		Total_Omission_Attention_Deficit
N		64
Normal Parameters ^{b,c}	Average	19,2656
	Deviation	14,14802
	Absolute	,123
Extreme Differences	Positive	,123
	Negative	-,111
Z de Kolmogorov-Smirnov		,980
Asymptotic Sig. (bilateral)		,292

a. Go_Inside_Greenhouse_Childhood = No

b. Contrast distribution is normal.

c. Calculated from the data.



Fig. 30

As in the previous subsection, errors of commission, the results of P value indicate that the data come from a normal distribution. This means we may well apply the T-test for comparison of the population averages.

Estadísticos de grupo

	Go_Inside_Greenhouse_Childhood	N	Media	Desviación típ.	Error típ. de la media
Total_Omission_Attention	Yes	11	19,4545	14,25036	4,29664
_Deficit	No	64	19,2656	14,14802	1,76850

Figure 31

In Figure 31 we see that there is also very little difference between average errors of omission, as only 0.19.

Prueba de muestras independientes

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error típ. de la diferencia	95% Intervalo de confianza para la diferencia	
									Inferior	Superior
Total_Omission_Attention	Se han asumido varianzas iguales	,102	,751	,041	73	,968	,18892	4,62244	-9,02359	9,40143
_Deficit	No se han asumido varianzas iguales			,041	13,613	,968	,18892	4,64637	-9,80318	10,18102

Figure 32

This table makes clear the significance of Levene is greater than 0.05, so it is clear that there is no homogeneity of variances, and T indicates that there are no differences between the groups.

Rangos

	Go_Inside_Greenhouse_Childhood	N	Rango promedio	Suma de rangos
Total_Omission_Attention	Yes	11	39,05	429,50
_Deficit	No	64	37,82	2420,50
	Total	75		



Estadísticos de contraste^a

	Total_Omission_Attention_Deficit
U de Mann-Whitney	340,500
W de Wilcoxon	2420,500
Z	-,172
Sig. asintót. (bilateral)	,863

a. Variable de agrupación:
Go_Inside_Greenhouse_Childhood

Making the nonparametric, we compared the means and we can say that there is no relationship between having gone into greenhouses as a child and the number of mistakes on tests.

- RELATIONSHIP BETWEEN MOTHER'S PERCEPTION OF THEIR CHILD'S BEHAVIOR AND THE RESULTS OF THE TASKS

In this section we aim to find out the relationship between errors of commission and omission committed by the young and the perception of their mothers on their impulsivity or deficit attention.



Comission mistakes

Kolmogorov-Smirnov test

		Total_Comission_Impulsivity
N		30
Normal Parameters ^{b,c}	Average	6,2000
	Deviation	3,46808
	Absolute	,169
Extreme Differences	Positive	,169
	Negative	-,111
Z de Kolmogorov-Smirnov		,923
Asymptotic Sig. (bilateral)		,362

a. Nervous_Attention_ = Yes

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 33

Kolmogorov-Smirnov test

		Total_Comission_Impulsivity
N		45
Normal Parameters ^{b,c}	Average	3,0000
	Deviation	2,86039
	Absolute	,214
Extreme Differences	Positive	,214
	Negative	-,147
Z de Kolmogorov-Smirnov		1,439
Asymptotic Sig. (bilateral)		,032

a. Nervous_Attention_ = No

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 34



Estadísticos de grupo

	Nervous Attention	N	Media	Desviación típ.	Error típ. de la media
Total_Comission_Impulsivity	Yes	30	6,2000	3,46808	,63318
	No	45	3,0000	2,86039	,42640

Figure 35

In this case there are 30 cases whose mothers think they are impulsive and nervous and 45 cases whose mothers do not think that. We see that the difference in mean errors are 3.2 points.

Prueba de muestras independientes

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error típ. de la diferencia	95% Intervalo de confianza para la diferencia	
									Inferior	Superior
Total_Comission_Impulsivity	Se han asumido varianzas iguales	,294	,589	4,357	73	,000	3,20000	,73445	1,73624	4,66376
	No se han asumido varianzas iguales			4,192	53,954	,000	3,20000	,76337	1,66950	4,73050

Figure 36

Figure 36 shows that there is no homogeneity of variances (Sig value) but that there are differences between groups (Sig. bilateral). We will confirm with the nonparametric test.

Rangos

	Nervous_Attention_	N	Rango promedio	Suma de rangos
Total_Comission_Impulsivity	Yes	30	51,07	1532,00
	No	45	29,29	1318,00
	Total	75		



Estadísticos de contraste^a

	Total_Comision_Impulsivity
U de Mann-Whitney	283,000
W de Wilcoxon	1318,000
Z	-4,268
Sig. asintót. (bilateral)	,000

a. Variable de agrupación: Nervous_Attention_

The bilateral asymptotic significance informs us that there is a relationship between the conception of mothers and commission errors they committed, this value is 0.00. Participants whose mothers think they are impulsive and offset, commit more mistakes of commission (impulsivity indicator), than those who are not considered as such.

Omission mistakes

Kolmogorov-Smirnov test

	Total_Omission_Attention_Deficit	
N	30	
Normal Parameters ^{b,c}	Average	27,4000
	Deviation	15,81706
	Absolute	,126
Extreme Differences	Positive	,126
	Negative	-,078
Z de Kolmogorov-Smirnov	,692	
Asymptotic Sig. (bilateral)	,724	

a. Nervous_Attention_ = Yes

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 37



Kolmogorov-Smirnov test

	Total_Omission_Attention_Deficit	
N	45	
Normal Parameters ^{b,c}	Average	13,8889
	Deviation	9,65360
Extreme Differences	Absolute	,151
	Positive	,151
	Negative	-,109
Z de Kolmogorov-Smirnov	1,013	
Asymptotic Sig. (bilateral)	,257	

a. Nervous_Attention_ = No

b. Contrast distribution is normal.

c. Calculated from the data.

Figure 38

The normality tests for errors of omission are those that represent the tables 37 and 38. Both for what their mothers think they are nervous people, and those who do not think their mothers, the P value is 0.724 and 0.257 respectively, which means that we have no evidence to reject the null hypothesis, since it is greater than the significance (0.05). Thus the data come from a normal distribution. This means we may well apply the T-test for comparison of the population means.

Estadísticos de grupo

Nervous Attention		N	Media	Desviación típ.	Error típ. de la media
Total_Omission_Attention_Deficit	Yes	30	27,4000	15,81706	2,88779
	No	45	13,8889	9,65360	1,43907

Figure 39

The most significant of Figure 39 are the 13.51 points difference between the average errors of omission of the group that is considered more nervous, impulsive, and the group which is not considered nervous and impulsive.



Prueba de muestras independientes

		Prueba de Levene para la igualdad de varianzas		Prueba T para la igualdad de medias						
		F	Sig.	t	gl	Sig. (bilateral)	Diferencia de medias	Error tít. de la diferencia	95% Intervalo de confianza para la diferencia	
									Inferior	Superior
Total_Omission_Attention_Deficit	Se han asumido varianzas iguales	9,142	,003	4,596	73	,000	13,51111	2,93974	7,65223	19,36999
	No se han asumido varianzas iguales			4,188	43,427	,000	13,51111	3,22649	7,00612	20,01610

Figure 40

This table shows that the homogeneity of variance is not met (Sig = 0.003) and there is no difference between the two groups. We will see if there is a relationship between them with the nonparametric Mann-Whitman.

Rangos

	Nervous_Attention_	N	Rango promedio	Suma de rangos
Total_Omission_Attention_Deficit	Yes	30	50,17	1505,00
	No	45	29,89	1345,00
	Total	75		

Estadísticos de contraste^a

	Total_Omission_Attention_Deficit
U de Mann-Whitney	310,000
W de Wilcoxon	1345,000
Z	-3,950
Sig. asintót. (bilateral)	,000

a. Variable de agrupación: Nervous_Attention_

As in errors of commission, in errors of omission there is also a very strong (asymptotic significance = 0.000). So in this case we conclude that subjects whose mothers think they are people impulsive and / or attentional problems have committed more omission errors than those participants whose mothers did not have such perception.



ACADEMIC MARKS AND IMPULSIVITY AND DEFICIT ATTENTION

By last we have decided to find out if there is a relationship between academic grades and test scores. Our goal is to know if there is an influence of academic outcomes in the fact to do more or fewer errors on tasks.

Comission mistakes

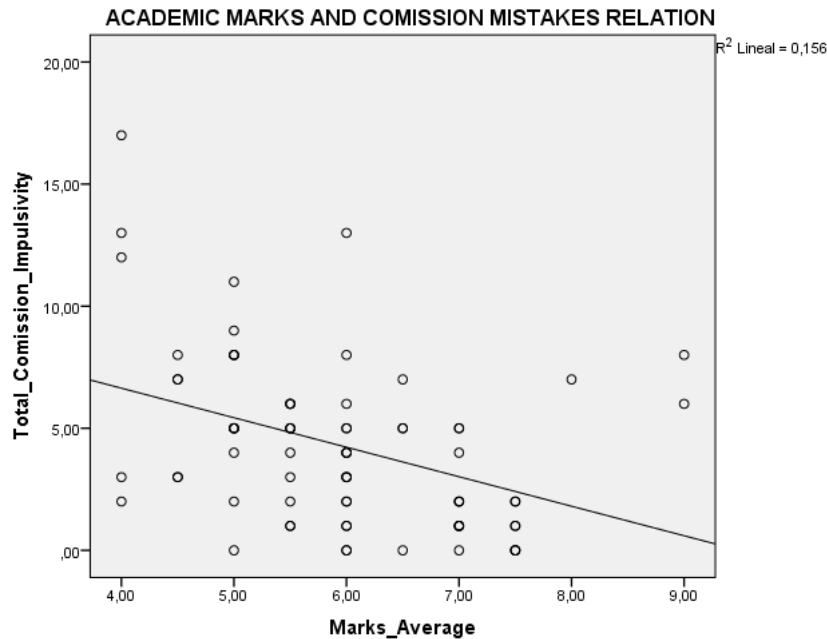


Figure 41

This is the graphical relationship between academic grades and commission errors made by the participating students. We see that the line is descending, thus indicates that it is a negative correlation.

Descriptive Statistics

	Average	Deviation	N
Marks_Average	5,9533	1,13653	75
Total_Comission_Impulsivity	4,2800	3,47407	75

Figure 42

This figure tells us that the average of this group is 5.9533 and they have committed an average of 4.28 errors of commission.



Correlations

		Total_Comission_ Impulsivity	Marks_Average
Correlación de Pearson	Total_Comission_ Impulsivity	1,000	-,395
	Marks_Average	-,395	1,000
Sig. (unilateral)	Total_Comission_ Impulsivity	.	,000
	Marks_Average	,000	.
N	Total_Comission_ Impulsivity	75	75
	Marks_Average	75	75

Figure 43

The correlation indicated is of -0.395. As shown in Figure 44, this is a negative correlation between weak and medium (-0.10 to 0.50)

	NEGATIVE CORRELATION
-1,00	Perfect Negative Correlation
-0,95	Strong Negative Correlation
-0,75	Considerable Negative Correlation
-0,50	Medium Negative Correlation
-0,10	Weak Negative Correlation
0,00	There isn't Negative Correlation

Figure 44

Resumen del modelo

Modelo	R	R cuadrado	R cuadrado corregida	Error típ. de la estimación	Estadísticos de cambio				
					Cambio en R cuadrado	Cambio en F	gl1	gl2	Sig. Cambio en F
1	,395 ^a	,156	,145	3,21280	,156	13,525	1	73	,000

a. Variables predictoras: (Constante), Marks_Average

Figure 45

Data regression gives us a 0,156 square R value. This value is multiplied by 100 and then we know that academic grades influence with 15.6% on the results of the tests for errors of commission.



Omission mistakes

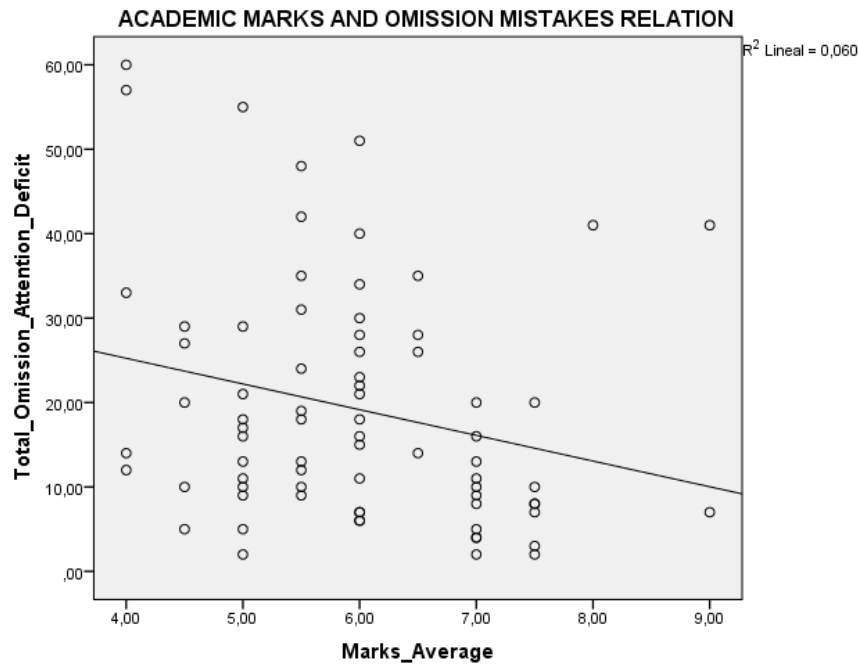


Figure 45

This is the graphical relationship between academic grades and omission errors made by the participating students. We see that the line is descending therefore indicates that it is a negative correlation.

Descriptive Statistics

	Average	Deviation	N
Marks_Average	5,9533	1,13653	75
Total_Omission_Attention_Deficit	19,2933	14,06623	75

Figure 46

Descriptive statistics speaks about 5,953 points of average marks and an average of 19,293 errors of omission.



Correlations

		Total_Omission_Attention_Deficit	Marks_Average
Correlación de Pearson	Total_Omission_Attention_Deficit	1,000	-,246
	Marks_Average	-,246	1,000
Sig. (unilateral)	Total_Omission_Attention_Deficit	.	,017
	Marks_Average	,017	.
N	Total_Omission_Attention_Deficit	75	75
	Marks_Average	75	75

Figure 47

The Pearson correlation of -0.246 has proven, value if we look at Figure 44, that shows that it exists a negative correlation between medium and weak.

Resumen del modelo

Modelo	R	R cuadrado	R cuadrado corregida	Error típ. de la estimación	Estadísticos de cambio				
					Cambio en R cuadrado	Cambio en F	gl1	gl2	Sig. Cambio en F
1	,246 ^a	,060	,048	13,72719	,060	4,701	1	73	,033

a. Variables predictoras: (Constante), Marks_Average

Figure 48

Data regression gives us a 0,060 square R value. When this value is multiplied by 100 indicates that academic grades will influence with 6% in the results of the tests for errors of omission.



3.5 Discussion

The major objective of this work is to verify in a group of people potentially exposed to pesticides in your city if there is a relationship between this exposure and possession of the characteristic features of ADHD.

The procedure was to evaluate these people with two tests (Go - No Go and AX task) to measure their levels of impulsivity and response inhibition and then collect other variables with a questionnaire to the mothers of the participants to analyze all variables using SPSS Statistics Program.

In the first part we are interested in varying the test results by gender of the participants. With regard to errors of commission, values that are associated with impulsivity, both groups have made about the same, only separating them an average of 0.52 points in the case of men. If we talk about the errors of omission the difference is more noticeable. Males fail an average of 5.3179 points higher than the female gender. Although it may seem to be a significant difference, the mean difference was not significant and when we made the comparison non-parametric Mann-Whitney also has confirmed that there is no relationship between variables. Therefore, in our sample, do not influence being male or female in the fact of making more or fewer errors of commission and / or omission.

Secondly, we wanted to determine what relationship exists between the fact of having a mother who smoked during pregnancy and errors in testing. To which errors of commission is concerned, there is little difference in averages between one group and another (1.6385 points). The mean difference is not significant as indicated by the T test and there is no relationship between variables as reflected by the nonparametric Mann-Whitney test with an asymptotic significance greater than 0.05. The same is true about errors of omission. The mean difference is not significant ($0.123 > 0.05$) and there is no relationship between variables ($0.395 > 0.05$). Thus, in this study we couldn't corroborate the theories involving smoking during pregnancy with the development of impulsive or attention deficits in the fetus.

Then we have been interested to know if having had prenatal development in El Ejido was related to a greater number of errors of commission or omission. In this case, neither test had a statistically significant result in the nonparametric test: 0.771 points about commission errors and 0.282 points for errors of omission. Neither group has been more likely to develop attention deficit and / or hyperactivity in these variables.



Subsequently, we analyzed whether there are significant differences between the group visiting in the early years of life greenhouses and the group that did not for errors of commission and omission in the tasks. In any table is represented a statistically significant difference in Mann-Whitney tables being the significances: 0.839 and 0.863 respectively. Therefore it has not influenced, to make more errors or less, the fact to visit greenhouses when they were children in this group of participants.

When we asked mothers about the behavior and personality of their children, as to whether they are people who have concentrating troubles and / or are impulsive, 30 subjects were considered as such and 45 as non-impulsive people without problems of attention. There has been statistically significant relationship with both impulsivity and attention deficit. The nonparametric test confirms what we can guess from looking at the errors in the descriptive statistics of both groups. Mann-Whitney is a significance of 0.00, for this reason, we conclude that there is a relationship between variables. People considered by their mothers nerve have shown more attention deficit and to be more impulsive than the group of non-nervous.

Finally, we wanted to evaluate the correlation between students' academic grades and corresponding errors in the two diagnostic tests. Figures 41 and 45 are clarifying graphs. We see that as the marks go up, the errors of both commission and omission are dropping. Correlation is negative and we can draw the following conclusion: the better the students' grades, the fewer failures they make in tests. Therefore, people with more attention deficit and impulsive tend to get poorer grades than someone with fewer problems and less impulsive temperament.



3.6 Conclusiones

Después de analizar el experimento llegamos a una serie de conclusiones interesantes.

El resultado más relevante es que no hemos encontrado en la muestra del experimento una relación entre la exposición a los pesticidas y las características del TDAH. Por lo que la hipótesis principal de este trabajo queda refutada.

La segunda observación que haremos es que la única diferencia significativa que hemos encontrado entre las medias ha sido cuando hemos preguntado a las madres por el carácter de sus hijos. Los sujetos con mayores déficits de atención e impulsividad son aquellos cuyas madres corroboran lo mismo.

En este caso, tampoco no hemos podido reafirmar el estereotipo de una persona con TDAH, puesto que los hombres de esta población estudiada no se han mostrado estadísticamente más impulsivos y con más déficit de atención que las mujeres. Además, según nuestros resultados, también debemos descartar el tabaco como causa del TDAH.

En definitiva, no hemos encontrado grandes diferencias en el comportamiento del grupo con exposición pre y perinatal a los pesticidas o el tabaco frente al grupo no expuesto.

Cabe destacar que esta investigación también se ha realizado con el propósito de ampliar la gama de la literatura disponible sobre el tema y nos gustaría ser inspiración para futuros trabajos que se propusieran estudiar casos similares. Obviamente, los resultados reflejados en este estudio no configuran un conocimiento universal ya que la muestra ha sido sólo de 75 sujetos. Otra gran debilidad de esta monografía ha sido que las variables independientes han sido todas, salvo las notas académicas, dicotómicas. Este hecho ha impedido la gradación de la exposición por lo que las respuestas han sido totalmente absolutas, sí o no, sin posibilidad de término medio.

Como se ha declarado varias veces en el camino de la investigación sobre el TDAH, todavía queda mucho por investigar y esperamos que habrá muchos descubrimientos futuros sobre las causas exactas de este trastorno.



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ANEXOS

ANNEX I: INSTANCE FOR APPROVAL OF THE PROJECT ADDRESSED TO THE PROVINCIAL OFFICE OF EDUCATION

AL/LA SEÑOR/A DELEGADO/A DE LA DELEGACIÓN DE EDUCACIÓN DE ALMERÍA

Doña Mireia van Leeuwen Bernat, con DNI 41547580-N, con residencia en C/Salazón nº 2 Portal 6 Bajo D, código postal 04711, con teléfono 685371438 y con correo electrónico mireiavl90@gmail.com

EXPONE:

- Que soy alumna del Máster en Salud Mental en la Universidad de Almería.
- Que para la realización del Trabajo de Fin de Máster preciso de hacer unas pruebas informáticas y encuestas a población de Educación Secundaria.
- Que cuento con el consentimiento de mi Tutor del Trabajo de Fin de Máster y del Vicerrectorado de mi Universidad para llevar a cabo dicho estudio.
- Que adjunto con este documento una presentación de mi Trabajo de Fin de Máster para así poder valorar el trabajo que hay pensado y cómo será su ejecución.

SOLICITO:

- Que se me autorice el realizar las pruebas informáticas en los Institutos de Educación Secundaria que así lo consientan.
- Que se me responda a dicha petición con una carta a mi domicilio a fin de poder mostrar vuestro consentimiento en los centros cuando me disponga a hacer el estudio.

Almería, 10 de mayo de 2013

Firma de la solicitante
Mireia van Leeuwen
Bernat

Firma del Vicerrectorado
de la UAL como
consentidor

Firma del Tutor del
Trabajo de Fin de Máster



ANNEX II: PRESENTATION OF THE PROJECT TO THE PROVINCIAL DELEGATION OF EDUCATION

INFORME DEL PROYECTO DE INVESTIGACIÓN DE LA ALUMNA MIREIA VAN LEEUWEN BERNAT PARA EL TRABAJO DE FIN DE MÁSTER DEL MÁSTER EN SALUD MENTAL: INVESTIGACIÓN EN PSICOFARMACOLOGÍA, NEUROTOXICOLOGÍA Y PSIQUIATRÍA DE LA UNIVERSIDAD DE ALMERÍA. CURSO 2012-2013.

Nombre del proyecto

La exposición prenatal a pesticidas como causa del desarrollo de TDAH en jóvenes de El Ejido

Persona responsable de la investigación para el Trabajo de Fin de Máster

Mireia van Leeuwen Bernat

Tutor del Trabajo de Fin de Máster

Fernando Sánchez-Santed

Vicerrectorado que autoriza la realización de la investigación

Vicerrectorado de Investigación, Desarrollo e Innovación.

Vicerrector: José Luis Martínez Vidal

Institución

Universidad de Almería



Ubicación

El trabajo de Investigación “La exposición prenatal a pesticidas como causa del desarrollo de TDAH en jóvenes de El Ejido” se sitúa en el municipio de El Ejido, que tiene una población de 83.104 habitantes y una extensión en terreno de 250 km² de las cuales la superficie de 12.500 hectáreas son construcciones de invernaderos, lo que supone el 52% del total del municipio.

El problema

El Trastorno de Déficit de Atención es un síndrome conductual que afecta entre un 5% y un 10% de la población infanto-juvenil y representa más de un 20% de las consultas de psiquiatría infanto-juvenil.

Existe numerosa literatura científica que relaciona la existencia de este trastorno con la exposición a ciertos pesticidas utilizados en la agricultura, (Eskenazi et al., 2007), (Whyatt et al., 2005). De esta manera, si la exposición perinatal es un factor de riesgo para el desarrollo de TDAH, deberá ser también un factor de riesgo para el desarrollo de algunos de los rasgos distintivos de este trastorno, aun sin llegar a desarrollar; es decir, en función de los niveles de exposición pre o postnatales se modulará el riesgo de mayor impulsividad, alteraciones en procesos atencionales, sobre todo atención sostenida, y/o hiperactividad motora (Kofman et al., 2006)

En El Ejido, al ser una zona con una fuerte presencia agrícola, se utilizan en abundancia los productos químicos comentados a fin de eliminar y/o prevenir las posibles plagas que afectan a las plantas cultivadas.



Necesidades

Es necesario saber hasta qué punto la exposición a organofosforados, los pesticidas más usados en la agricultura, puede influir en la alteración de variables cognitivas o de personalidad relacionadas con el TDAH, aún sin que exista diagnóstico del mismo.

Destinatarios del proyecto

Los destinatarios directos del proyecto, serán 100 alumnos y alumnas de entre 14 y 18 años, habitantes de El Ejido y estudiantes en centros de Educación Secundaria del mismo municipio. Además también serán participantes las madres biológicas de estos alumnos. Los datos de los sujetos serán totalmente confidenciales según dicta la *LEY ORGÁNICA 15/1999 de 13 de diciembre de Protección de Datos de Carácter Personal*.

Objetivos

La investigación se propone averiguar la correlación existente entre los niveles de impulsividad, atención e hiperactividad de los sujetos estudiados con la exposición a pesticidas durante su desarrollo fetal.

Tiempos y etapas de implementación

El proyecto se realizará una vez se dé la autorización pertinente desde la Delegación de Educación de Almería. Tendrá una duración de tres semanas a fin de poder recoger los resultados de todos los participantes que voluntariamente se ofrezcan a colaborar con el proyecto de investigación.

Presupuesto

Esta investigación no conlleva ningún gasto.



Recogida de datos y evaluación

La recogida de datos se realizará a través de dos tareas informáticas a realizar por los alumnos participantes en el proyecto.

La primera prueba se denomina Go-No Go. Este test se utiliza para medir la capacidad de los participantes para mantener una atención sostenida y control de respuesta. Se requiere que el participante emita una respuesta a determinados estímulos y retenga o inhiba la respuesta a otros. Concretamente, deben pulsar la barra espaciadora del teclado cuando aparezca una figura de color azul y no hacerlo cuando aparezcan las figuras de otros colores. De este modo podremos evaluar la impulsividad que muestran al pulsar las teclas tanto cuando deben hacerlo como cuando no deben.

La segunda tarea es la llamada Test de Ejecución de Conners (Rosvold et al., 1956). Esta tarea presenta sucesivamente 500 letras durante 400 mseg con un intervalo entre estímulo de 600 ms. (tiempo total de la tarea: 8 minutos). El sujeto debe responder cada vez que aparece una X precedida por una A. Eso ocurre en 50 ocasiones, pero en otras 50 veces aparece la X no precedida por A y otras 50 ocasiones las A no van seguidas de X. Las medidas de impulsividad son los errores de omisión (número de AX no detectadas) y los de comisión (número de veces que se responde en ausencia de una X precedida por una A). Es una tarea clásica en la evaluación de la atención, utilizada frecuentemente en investigación. (Félix et al., 2003)

Una vez se obtengan los resultados de las dos tareas informáticas se le dará a cada participante un cuestionario para que su madre biológica lo rellene. Éste cuestionario contendrá preguntas en relación a la posible exposición del feto a los pesticidas debido al entorno de la madre o su trabajo. Asimismo, se recogerá



la misma información referida a los tres primeros años de vida.

Seguidamente, con las dos variables obtenidas, se pasará a hacer la valoración de la relación que pueda haber entre los niveles de impulsividad y atención de los menores y la exposición que se produjo durante el embarazo. Éste será la conclusión final de la investigación.

Riesgos a considerar:

No se han encontrado riesgos posibles en relación a este proyecto de investigación.

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ANNEX III: PRESENTATION LETTER ADDRESSED TO IES PABLO RUIZ PICASSO

Prof. Dr. D. Fernando Sánchez Santed
Departamento Psicología
Universidad de Almería
Ctra. de Sacramento, s/n
04120 Almería

Equipo directivo
IES Pablo Ruíz Picasso
Calle la Loma de la Mezquita, 170
04700 El Ejido

Almería, 18 de abril de 2013

Estimado/a Sr./Sra.:

Por la presente me dirijo a usted para comunicarle que una de mis alumnas, Mireia van Leeuwen Bernat, está cursando el Máster en Salud Mental del Departamento de Psicología en la Universidad de Almería y ha centrado su Trabajo Final de Máster en la investigación del TDAH.

A fin de poder llevar a cabo su estudio con el rigor y el conocimiento necesarios, hemos pensado en realizar un estudio sobre la atención y los niveles de impulsividad de algunos de sus alumnos. Con tal fin y para una primera toma de contacto, sería importante que se nos concediera una primera cita. Para ello le adjunto el correo electrónico de la alumna, así como su número de teléfono: mireiavlb@hotmail.com 685 37 14 38.

Agradeciendo de antemano la atención que brinde a esta petición y en espera de su pronta respuesta, le saludo atentamente.

Prof. Dr. D. Fernando Sánchez Santed
Departamento Psicología. UAL



ANNEX IV: INFORMED CONSENT

Don/Doña _____

Padre/madre/tutor del alumno/a _____

Marque con una X

Doy autorización

No doy autorización

Para que mi hijo/a participe en un proyecto de investigación de la Universidad de Almería realizando 2 pruebas informáticas a fin de valorar su nivel de atención y concentración.

Todos los datos serán protegidos por la Ley Orgánica 15/1999, de 13 de diciembre, de Protección de Datos de Carácter Personal.

IES Pablo Ruiz Picasso



ANNEX V: QUESTIONNAIRE FOR THE MOTHERS

CUESTIONARIO A CUMPLIMENTAR POR LA MADRE DEL ALUMNO

Código del alumno/a:

Edad de la madre:

Profesión de la madre:

Fecha de nacimiento de su hijo/a:

Primer mes de embarazo de su hijo/a:

Subraye, por favor, la nota media de su hijo/a: Insuficiente, Suficiente, Bien, Notable, Sobresaliente

Marque con una X la respuesta (sí o no) las siguientes cuestiones:

Pregunta	SÍ	NO
¿Vivía usted en el Ejido o sus alrededores durante el embarazo de su hijo/a?		
¿Consumió usted alcohol de forma habitual durante el embarazo de su hijo/a?		
¿Fumaba usted tabaco de forma habitual durante el embarazo de su hijo/a?		
Durante el embarazo, y/o en los primeros años de su hijo/a, ¿Vivían cerca de invernaderos? Especifique, por favor, la distancia aproximada en Kilómetros del invernadero más próximo a su domicilio:		
¿Trabajaba usted, durante el embarazo, en un invernadero?		
¿Tuvo usted un parto prematuro?		
¿Manipuló usted pesticidas para el invernadero durante el embarazo?		
¿Su hijo, en los primeros años de vida, iba frecuentemente cerca o dentro de algún invernadero?		
¿Jugaba su hijo cerca o dentro de algún invernadero en su infancia?		
¿Ayudaba su hijo, en la medida de sus posibilidades, a alguna tarea dentro o cerca de algún invernadero?		
¿Su hijo/a es una persona nerviosa inquieta y/o que tiene problemas de atención y concentración?		
¿Ha tenido alguna vez preocupación y/o algún problema por el comportamiento nervioso e inquieto y/o por la falta de atención y concentración de su hijo/a?		
¿Ha sido su hijo/a diagnosticado con el Trastorno de Déficit de Atención con o sin Hiperactividad (TDAH)? En caso afirmativo: ¿Se medica su hijo/a para éste trastorno?		

Muchas gracias por su colaboración. Le recordamos que sus datos personales no se publicarán en ningún lugar. Estos resultados sólo nos ayudarán a obtener conclusiones en un proyecto de investigación de la Universidad de Almería. Si tiene cualquier duda puede llamar al 685-37-14-38 o mandar un e-mail a mireiavl90@gmail.com.



ANNEX VI: GLOBAL RESULTS LIST

tfmtabla.sav

...	Participant	Sex	Age	AX_Comission	AX_Omission	AX_Total
1	1,00	1,00	17,00	,00	2,00	2,00
2	2,00	2,00	18,00	2,00	5,00	7,00
3	3,00	2,00	16,00	3,00	2,00	5,00
4	4,00	1,00	16,00	,00	1,00	1,00
5	5,00	1,00	16,00	1,00	3,00	4,00
6	6,00	1,00	18,00	2,00	2,00	4,00
7	7,00	1,00	18,00	,00	,00	,00
8	8,00	2,00	16,00	,00	8,00	8,00
9	9,00	1,00	16,00	,00	15,00	15,00
10	10,00	1,00	16,00	3,00	1,00	4,00
11	11,00	2,00	16,00	6,00	36,00	42,00
12	12,00	1,00	18,00	,00	10,00	10,00
13	13,00	1,00	17,00	3,00	32,00	35,00
14	14,00	1,00	19,00	2,00	10,00	12,00
15	15,00	1,00	16,00	3,00	12,00	15,00
16	16,00	2,00	16,00	5,00	14,00	19,00
17	17,00	2,00	16,00	4,00	38,00	42,00
18	18,00	1,00	15,00	1,00	12,00	13,00
19	19,00	1,00	16,00	,00	3,00	3,00
20	20,00	2,00	16,00	,00	1,00	1,00
21	21,00	2,00	17,00	,00	2,00	2,00
22	22,00	2,00	16,00	1,00	6,00	7,00
23	23,00	2,00	17,00	1,00	6,00	7,00
24	24,00	2,00	17,00	1,00	15,00	16,00
25	25,00	1,00	16,00	2,00	3,00	5,00
26	26,00	2,00	16,00	,00	7,00	7,00
27	27,00	2,00	15,00	4,00	23,00	27,00
28	28,00	2,00	15,00	,00	1,00	1,00
29	29,00	1,00	17,00	9,00	22,00	31,00
30	30,00	2,00	14,00	,00	5,00	5,00
31	31,00	2,00	15,00	1,00	18,00	19,00
32	32,00	2,00	15,00	,00	18,00	18,00
33	33,00	2,00	15,00	6,00	54,00	60,00
34	34,00	2,00	15,00	1,00	17,00	18,00
35	35,00	1,00	15,00	,00	4,00	4,00
36	36,00	1,00	16,00	,00	8,00	8,00
37	37,00	1,00	15,00	,00	,00	,00



tfmtabla.sav

	GoNoGo_Comission	GoNoGo_Omission	GoNoGo_Total	Total_Comission_Impulsivity
1	,00	1,00	1,00	,00
2	2,00	4,00	6,00	4,00
3	2,00	2,00	4,00	5,00
4	,00	1,00	1,00	,00
5	2,00	4,00	6,00	3,00
6	1,00	3,00	4,00	3,00
7	,00	16,00	16,00	,00
8	,00	,00	,00	,00
9	1,00	3,00	4,00	1,00
10	2,00	1,00	3,00	5,00
11	,00	5,00	5,00	6,00
12	2,00	6,00	8,00	2,00
13	3,00	19,00	22,00	6,00
14	2,00	12,00	14,00	4,00
15	4,00	8,00	12,00	7,00
16	1,00	5,00	6,00	6,00
17	4,00	2,00	6,00	8,00
18	,00	4,00	4,00	1,00
19	2,00	1,00	3,00	2,00
20	1,00	6,00	7,00	1,00
21	2,00	6,00	8,00	2,00
22	,00	4,00	4,00	1,00
23	,00	3,00	3,00	1,00
24	,00	5,00	5,00	1,00
25	6,00	4,00	10,00	8,00
26	2,00	1,00	3,00	2,00
27	1,00	3,00	4,00	5,00
28	1,00	4,00	5,00	1,00
29	2,00	7,00	9,00	11,00
30	,00	5,00	5,00	,00
31	3,00	3,00	6,00	4,00
32	3,00	10,00	13,00	3,00
33	2,00	1,00	3,00	8,00
34	3,00	6,00	9,00	4,00
35	4,00	9,00	13,00	4,00
36	2,00	6,00	8,00	2,00
37	2,00	20,00	22,00	2,00



tfmtabla.sav

	Total_Omission_Attention_Deficit	Ejido_Pregnancy	Tobacco_Pregnancy	Work_Greenhouse
1	3,00	1,00	2,00	2,00
2	9,00	1,00	2,00	1,00
3	4,00	1,00	1,00	1,00
4	2,00	1,00	2,00	2,00
5	7,00	1,00	2,00	2,00
6	5,00	1,00	2,00	2,00
7	16,00	2,00	2,00	2,00
8	8,00	1,00	2,00	2,00
9	18,00	1,00	2,00	2,00
10	2,00	1,00	1,00	2,00
11	41,00	2,00	2,00	2,00
12	16,00	2,00	2,00	2,00
13	51,00	1,00	2,00	1,00
14	22,00	1,00	1,00	1,00
15	20,00	1,00	2,00	2,00
16	19,00	1,00	2,00	1,00
17	40,00	1,00	1,00	2,00
18	16,00	1,00	2,00	2,00
19	4,00	1,00	2,00	2,00
20	7,00	1,00	2,00	1,00
21	8,00	2,00	2,00	2,00
22	10,00	1,00	2,00	2,00
23	9,00	1,00	1,00	2,00
24	20,00	1,00	2,00	2,00
25	7,00	2,00	2,00	2,00
26	8,00	1,00	2,00	2,00
27	26,00	2,00	2,00	2,00
28	5,00	1,00	2,00	2,00
29	29,00	1,00	2,00	1,00
30	10,00	1,00	2,00	2,00
31	21,00	1,00	2,00	2,00
32	28,00	1,00	2,00	2,00
33	55,00	1,00	1,00	1,00
34	23,00	2,00	2,00	2,00
35	13,00	2,00	2,00	2,00
36	14,00	2,00	2,00	2,00
37	20,00	1,00	2,00	2,00



tfmtabla.sav

	Go_Inside_ Greenhouse_ _Childhood	Help_Tasks_ Greenhouse_ _Childhood	Nervous_Attention_ _Difficulties	Worries_Behavior	Marks_Average
1	2,00	2,00	2,00	2,00	7,50
2	1,00	1,00	2,00	2,00	5,50
3	2,00	2,00	2,00	2,00	7,00
4	2,00	2,00	2,00	2,00	7,50
5	2,00	2,00	2,00	2,00	6,00
6	2,00	2,00	1,00	2,00	4,50
7	2,00	2,00	2,00	2,00	6,00
8	2,00	2,00	2,00	2,00	7,00
9	2,00	2,00	2,00	2,00	6,00
10	2,00	2,00	2,00	2,00	5,00
11	2,00	2,00	2,00	2,00	9,00
12	2,00	2,00	2,00	2,00	5,00
13	2,00	2,00	1,00	1,00	6,00
14	2,00	2,00	2,00	2,00	6,00
15	1,00	2,00	2,00	2,00	4,50
16	2,00	2,00	1,00	2,00	5,50
17	2,00	2,00	1,00	1,00	6,00
18	2,00	2,00	2,00	2,00	7,00
19	2,00	2,00	2,00	2,00	7,00
20	2,00	2,00	2,00	2,00	7,50
21	2,00	2,00	2,00	2,00	7,50
22	2,00	2,00	2,00	2,00	7,00
23	2,00	2,00	2,00	2,00	7,00
24	2,00	2,00	2,00	2,00	7,50
25	2,00	2,00	2,00	2,00	9,00
26	2,00	2,00	2,00	2,00	7,50
27	2,00	2,00	1,00	1,00	6,00
28	2,00	2,00	2,00	2,00	7,00
29	1,00	2,00	1,00	1,00	5,00
30	2,00	2,00	2,00	2,00	7,50
31	2,00	2,00	1,00	2,00	6,00
32	2,00	2,00	1,00	2,00	6,00
33	1,00	2,00	1,00	2,00	5,00
34	2,00	2,00	2,00	2,00	6,00
35	2,00	2,00	2,00	2,00	7,00
36	2,00	2,00	2,00	2,00	4,00
37	2,00	2,00	2,00	2,00	7,00



tfmtabla.sav

	Participant	Sex	Age	AX_Comission	AX_Omission	AX_Total
38	38,00	2,00	15,00	9,00	59,00	68,00
39	39,00	1,00	14,00	2,00	24,00	26,00
40	40,00	1,00	15,00	3,00	15,00	18,00
41	41,00	1,00	17,00	,00	9,00	9,00
42	42,00	1,00	16,00	,00	1,00	1,00
43	43,00	2,00	15,00	4,00	33,00	37,00
44	44,00	2,00	15,00	4,00	35,00	39,00
45	45,00	1,00	14,00	,00	25,00	25,00
46	46,00	2,00	15,00	1,00	9,00	10,00
47	47,00	2,00	15,00	1,00	2,00	3,00
48	48,00	2,00	15,00	4,00	28,00	32,00
49	49,00	2,00	14,00	,00	1,00	1,00
50	50,00	2,00	14,00	1,00	14,00	15,00
51	51,00	1,00	14,00	13,00	,00	13,00
52	52,00	1,00	14,00	,00	3,00	3,00
53	53,00	2,00	14,00	1,00	3,00	4,00
54	54,00	2,00	17,00	,00	5,00	5,00
55	55,00	1,00	14,00	1,00	2,00	3,00
56	56,00	2,00	14,00	8,00	26,00	34,00
57	57,00	2,00	15,00	1,00	2,00	3,00
58	58,00	1,00	17,00	4,00	10,00	14,00
59	59,00	2,00	15,00	8,00	52,00	60,00
60	60,00	1,00	16,00	,00	,00	,00
61	61,00	1,00	17,00	1,00	16,00	17,00
62	62,00	2,00	16,00	2,00	42,00	44,00
63	63,00	2,00	16,00	3,00	14,00	17,00
64	64,00	1,00	16,00	,00	1,00	1,00
65	65,00	1,00	18,00	1,00	10,00	11,00
66	66,00	2,00	17,00	2,00	6,00	8,00
67	67,00	1,00	16,00	1,00	10,00	11,00
68	68,00	1,00	16,00	,00	9,00	9,00
69	69,00	2,00	16,00	,00	6,00	6,00
70	70,00	1,00	15,00	2,00	8,00	10,00
71	71,00	2,00	16,00	6,00	9,00	15,00
72	72,00	2,00	15,00	1,00	7,00	8,00
73	73,00	2,00	17,00	1,00	2,00	3,00
74	74,00	1,00	16,00	3,00	1,00	4,00



tfmtabla.sav

	GoNoGo_Comission	GoNoGo_Omission	GoNoGo_Total	Total_Comission _Impulsivity
38	4,00	1,00	5,00	13,00
39	3,00	4,00	7,00	5,00
40	5,00	12,00	17,00	8,00
41	1,00	1,00	2,00	1,00
42	2,00	5,00	7,00	2,00
43	1,00	2,00	3,00	5,00
44	2,00	7,00	9,00	6,00
45	5,00	10,00	15,00	5,00
46	,00	25,00	25,00	1,00
47	1,00	10,00	11,00	2,00
48	3,00	1,00	4,00	7,00
49	,00	5,00	5,00	,00
50	4,00	3,00	7,00	5,00
51	4,00	33,00	37,00	17,00
52	5,00	7,00	12,00	5,00
53	2,00	9,00	11,00	3,00
54	,00	13,00	13,00	,00
55	2,00	8,00	10,00	3,00
56	5,00	4,00	9,00	13,00
57	2,00	5,00	7,00	3,00
58	3,00	4,00	7,00	7,00
59	4,00	5,00	9,00	12,00
60	,00	26,00	26,00	,00
61	4,00	8,00	12,00	5,00
62	4,00	6,00	10,00	6,00
63	5,00	7,00	12,00	8,00
64	4,00	10,00	14,00	4,00
65	1,00	1,00	2,00	2,00
66	3,00	3,00	6,00	5,00
67	4,00	8,00	12,00	5,00
68	3,00	22,00	25,00	3,00
69	5,00	5,00	10,00	5,00
70	,00	7,00	7,00	2,00
71	2,00	4,00	6,00	8,00
72	,00	6,00	6,00	1,00
73	8,00	3,00	11,00	9,00
74	2,00	1,00	3,00	5,00



tfmtabla.sav

	Total_Omission_Attention_Deficit	Ejido_Pregnancy	Tobacco_Pregnancy	Work_Greenhouse
38	60,00	1,00	2,00	2,00
39	28,00	1,00	2,00	2,00
40	27,00	1,00	1,00	2,00
41	10,00	2,00	2,00	2,00
42	6,00	2,00	2,00	2,00
43	35,00	2,00	2,00	2,00
44	42,00	2,00	2,00	2,00
45	35,00	1,00	2,00	2,00
46	34,00	2,00	2,00	2,00
47	12,00	1,00	2,00	2,00
48	29,00	1,00	2,00	2,00
49	6,00	1,00	2,00	2,00
50	17,00	1,00	2,00	1,00
51	33,00	2,00	2,00	2,00
52	10,00	2,00	2,00	2,00
53	12,00	2,00	2,00	1,00
54	18,00	1,00	2,00	1,00
55	10,00	1,00	1,00	2,00
56	30,00	2,00	2,00	2,00
57	7,00	2,00	2,00	2,00
58	14,00	1,00	2,00	2,00
59	57,00	1,00	1,00	2,00
60	26,00	2,00	2,00	2,00
61	24,00	1,00	2,00	2,00
62	48,00	2,00	2,00	2,00
63	21,00	2,00	2,00	2,00
64	11,00	1,00	2,00	2,00
65	11,00	2,00	2,00	2,00
66	9,00	1,00	2,00	2,00
67	18,00	1,00	2,00	2,00
68	31,00	1,00	1,00	1,00
69	11,00	1,00	2,00	2,00
70	15,00	1,00	2,00	2,00
71	13,00	1,00	2,00	2,00
72	13,00	2,00	2,00	1,00
73	5,00	1,00	2,00	2,00
74	2,00	2,00	2,00	2,00



tfmtabla.sav

	Go_Inside_ Greenhouse_ _Childhood	Help_Tasks_ Greenhouse_ _Childhood	Nervous_Attention_ _Difficulties	Worries_Behavior	Marks_Average
38	2,00	2,00	1,00	1,00	4,00
39	2,00	2,00	1,00	2,00	6,50
40	2,00	2,00	1,00	2,00	4,50
41	2,00	2,00	2,00	2,00	5,50
42	2,00	2,00	2,00	2,00	6,00
43	2,00	2,00	2,00	2,00	6,50
44	2,00	2,00	1,00	1,00	5,50
45	2,00	2,00	1,00	2,00	5,50
46	2,00	2,00	2,00	2,00	6,00
47	2,00	2,00	2,00	2,00	5,50
48	2,00	2,00	1,00	2,00	4,50
49	2,00	2,00	2,00	2,00	6,00
50	2,00	2,00	1,00	2,00	5,00
51	2,00	2,00	1,00	2,00	4,00
52	1,00	2,00	1,00	2,00	5,00
53	1,00	1,00	1,00	1,00	4,00
54	1,00	1,00	2,00	2,00	5,00
55	1,00	1,00	1,00	2,00	4,50
56	2,00	2,00	2,00	2,00	6,00
57	1,00	1,00	1,00	1,00	6,00
58	2,00	2,00	1,00	1,00	6,50
59	2,00	2,00	1,00	2,00	4,00
60	2,00	2,00	2,00	2,00	6,50
61	2,00	2,00	2,00	2,00	5,50
62	2,00	2,00	1,00	2,00	5,50
63	2,00	2,00	1,00	2,00	5,00
64	2,00	2,00	1,00	2,00	5,00
65	2,00	2,00	2,00	2,00	7,00
66	2,00	2,00	2,00	2,00	5,00
67	2,00	2,00	1,00	2,00	5,50
68	1,00	2,00	2,00	2,00	5,50
69	2,00	2,00	2,00	2,00	6,00
70	2,00	2,00	1,00	2,00	6,00
71	2,00	2,00	2,00	2,00	5,00
72	1,00	2,00	1,00	2,00	5,50
73	2,00	2,00	2,00	2,00	5,00
74	2,00	2,00	2,00	2,00	7,00



tfmtabla.sav

	Participant	Sex	Age	AX_Comission	AX_Omission	AX_Total
75	75,00	2,00	18,00	4,00	40,00	44,00

tfmtabla.sav

	GoNoGo_Comission	GoNoGo_Omission	GoNoGo_Total	Total_Comission_Impulsivity
75	3,00	1,00	4,00	7,00

tfmtabla.sav

	Total_Omission_Attention_Deficit	Ejido_Pregnancy	Tobacco_Pregnancy	Work_Greenhouse
75	41,00	2,00	2,00	2,00

tfmtabla.sav

	Go_Inside_Greenhouse_Childhood	Help_Tasks_Greenhouse_Childhood	Nervous_Attention_Difficulties	Worries_Behavior	Marks_Average
75	2,00	2,00	1,00	1,00	8,00



TABLE KEY

Participant	Number of participant
Sex	Female: 1 Male: 2
Age	Age of the participant
AX_Comission	Comission mistakes on AX Task
AX_Omission	Omission mistakes on AX Task
AX_Total	Total mistakes on AX Task
GoNoGo_Comission	Comission mistakes on Go – No Go Task
GoNoGo_Omission	Omission mistakes on Go – No Go Task
GoNoGo_Total	Total mistakes on Go – No Go Task
Total_Comission_Impulsivity	Total commission mistakes (Impulsivity marker)
Total_Omission_Attention_Deficit	Total omission mistakes (Attention Deficit marker)
Ejido_Pregnancy	If the pregnancy was developed in El Ejido (1: Yes, 2: No)
Tobacco_Pregnancy	If the mother smoked during the pregnancy (1: Yes, 2: No)
Work_Greenhouse	If the mother worked in a greenhouse during the pregnancy (1: Yes, 2: No)
Go_Inside_Greenhouse_Childhood	If her son/daughter usually went to greenhouses as a child (1: Yes, 2: No)
Help_Tasks_Greenhouse_Childhood	If her son/daughter usually help in tasks in greenhouses as a child (1: Yes, 2: No)
Nervous_Attention_Difficulties	If her son/daughter has attention difficulties or is a nervous person (1: Yes, 2: No)
Worries_Behavior	If she is worried about her son/daughter behavior (1: Yes, 2: No)
Marks_Average	Participant's marks average



ANNEX VII: INTERVIEW WITH A MOTHER OF A CHILD WITH ADHD (Pintor, B. 2011)

1. DEMOGRAPHICS

NAME: Esther Diaz Ramoneda

AGE: 37

SEX: Female

LEVEL OF EDUCATION: Higher Education (University or equivalent)

PROFESSION: Housework

MARITAL STATUS: Married

NUMBER OF CHILDREN: 2

2. ATTENTION DEFICIT DISORDER HYPERACTIVITY

2.1. DEFINITION, SUBTYPES AND SYMPTOMS

1) What is ADHD?

A. A disorder characterized by a persistent pattern of inattention and / or hyperactivity / impulsivity that is more frequent and severe than is typically observed in subjects with a similar level of development.

2) What are the subtypes of ADHD that sets the DSM-IV-TR (2002)?

B. Attention Deficit Disorder with Hyperactivity Attention Deficit dominance; Attention Deficit Disorder with Hyperactivity prevalence of hyperactivity and impulsivity Attention Deficit Disorder with Hyperactivity combined.

3) Which set of symptoms that are presented below are identified with subtype Attention Deficit Disorder with Hyperactivity Attention Deficit dominance?

Avoid tasks that require sustained mental effort; being forgetful with daily tasks, difficulty paying attention to details.

4) In ADHD:

It is impact on daily functioning, the intensity and frequency of symptoms for their age and context that determines their dysfunctionality.

5) Which of the following behaviors are associated with ADHD?

Dissocial Disorder, Oppositional-Defiant Disorder, Anxiety Disorder, Specific Learning Disorders, Affective Disorders, Tic Disorders.

6) ADHD:

In 60-70% of cases persists into adolescence and continues into adulthood.

7) ADHD is a disorder that begins:

In early ages

8) Children with ADHD:

A. Often suffer from language disorders, which complicates communication, such as frequent disruptions in spontaneous conversations irrelevant comments; difficulty tacking issues and exchange views; problems to realize, express and adjust the language at issue and the listener.

B. Often are very emotional and sensitive, giving the impression of certain emotional immaturity. They have a low tolerance to frustration and a poor ability to delay immediate gratification, as well as difficulty to plan solutions to everyday problems.

C. The two answers above are true.

9) ADHD is more common in:

A. The male gender.

2.2. Etiology

10) ADHD is caused by a malfunction:

Neurobiological

11) Do you have a neurological basis ADHD? Yes

12) Do you know if proven causal relationship between ADHD and abnormalities in a specific brain region? Yes

13) Which of the following brain regions relate current research ADHD? I had understood that it was in the prefrontal cortex.



- 14) What kind of neurotransmitters have patients with ADHD decreased in certain brain regions? Serotonin and dopamine.
- 15) There are multiple causes of the disorder. At present it is known that has a really importance....: hereditary causes.
- 16) Does your family have a member who shows symptoms of ADHD, who? Yes, mother (me)
- 17) If so, is it diagnosed? Yes
- 2.3. DIAGNOSIS
- 19) How old was your child when he / she started with the symptoms of ADHD?
Less than 3 years
- 20) How old was your son / daughter diagnosed? 3-6
- 21) How long was it between the time they realized that the behavior of their son / daughter could be due to a disorder and definitive diagnosis? More than 1 year
- 22) Which specialist did he/she go first? Psychologist / a
- 23) Which professional do you think that should be the first to detect a possible ADHD? Teacher
- 24) Which of the following are ADHD diagnostic criteria established by the DSM-IV-TR?
A. The symptoms must be present before age 7, given in two or more settings, significantly interfere in the life of the person and not due to other disorders that may have similar symptoms.
- 25) Please indicate the age at which it is advisable to make the diagnosis of ADHD? 6 years
- 2.4. TREATMENT
- 26) Does your son / daughter receive treatment for ADHD? Yes
- 27) In case of positive answer, what treatment receives your son / daughter?
pharmacological
- 28) Which of the following treatments are not used to manage ADHD?
endocrine
- 29) Which of the following drugs are used to treat ADHD? Atomoxetine and Methylphenidate
- 30) Contingency management and technical training in self-instruction are:
Cognitive-Behavioral.
- 31) For a patient with ADHD what kind of treatment does he/she need to get the maximum benefit?
Multimodal
- 32) Do you think families need counseling to improve the management of ADHD?
Yes
- 33) In your opinion, which institutions should make advice to families?
Specific associations of ADHD
- 34) Which is the method considered most appropriate for counseling families about ADHD?
Face training courses
3. CONSEQUENCES
- 35) What does it mean for the family the diagnosis of ADHD in some of its members?
No change
- 36) Has affected the occurrence of ADHD in the relationship?
No remains unchanged
- 37) From the onset of the symptoms of ADHD, have you changed your relationship with your son / daughter?
No



- 38) If you have more sons / daughters, has the relationship between the brothers changed because of ADHD?
No
- 39) Have you ever felt at some point feelings of helplessness, frustration at not understanding the behavior of your son / daughter?
Yes
- 40) Do you think that there's no knowledge enough about ADHD?
Yes, but just because they have not adequately tested or disease and doctors agree.
- 41) Do you believe that a better understanding of ADHD would improve your understanding of your child?
Yes
- 42) Do you think that would be relevant to provide specific ADHD training on families?
Yes
- 43) From a scale of 0-5, where 0 is any value and 5 is much value, how do you consider training activities undertaken for families about ADHD? 5
- 44) If there were training activities on ADHD, do you would go?
Yes, sure.
- 45) Do you participate in your family in any activity related to the acquisition of knowledge about ADHD?
If
- 46) If you do, what kind of training activity performed?
A. Search the Internet.
D. Reading specific material.
- 47) Do you think it is necessary to provide specific training on ADHD education professionals?
Yes
- 48) Are you associated with any association or federation of ADHD?
No
- 50) What advantages do you think would provide specific training for ADHD families?
To understand better the problems of our child so we can correctly perform specific education and care for him. It would also help to better withstand the frustration of the parents regarding the child's behavioral responses.
- 51) Do you think that such training should be provided by the school?
A. Yes, or in psychologists or psychiatrists of Social Security, but they do not have time or inclination.
- 52) What format do you believe that such training should be provided?
A. classroom training
- 53) Expose some suggestions that are important to advance knowledge of ADHD.
It is very important an early detection and follow a correct treatment for the child, so I think that would be very useful to re-educate teachers on this issue, especially those who studied 20 or 30 years ago and have not been updated, they are not ready to detect a student with this condition.