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## Working conditions and persistent symptoms in agricultural workers exposed to pesticides

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## Background

- Every year, thousands of laborers migrate from the place of origin to the northeast of the country to work in agricultural companies.
- In these, they are exposed to the daily exhaustive use of organophosphate pesticides from their childhood to the end of the working life.



## Background

- The pesticides that are applied with more frequency and amount belong to the organophosphate group.
- The health repercussions caused by these substances that have been mainly reported in literature are acute intoxications and neurobehavioral effects
- Even more, some authors have referred the presence of chronic or persistent symptoms in laborers exposed to these substances, who present cholinesterase levels considered as "normal".



## General objective

To determine the prevalence of persistent symptoms, their relation with erythrocyte cholinesterase, and working conditions in a group of agricultural laborers.



## Research Questions

- Which is the association between persistent symptoms and erythrocyte cholinesterase in a group of laborers exposed to organophosphate pesticides?
- Is there an association between the working conditions of the laborers and the prevalence of persistent symptoms?



## Hypothesis

The presence of symptoms produced by the exposure of organophosphate pesticides is a constant phenomenon which is possible to identify and it is not accompanied by a decrease of cholinesterase enough to be considered as an acute intoxication  
The prevalence of persistent symptoms is related with the working conditions.



## Methods

- An analytic transversal study was performed with 172 laborers from an agricultural company in Mexico.
- Inclusion criteria: agricultural laborers, both genders, any age, hired for any type of work, working at the time of the interview.
- Exclusion criteria: hemorrhage antecedents for the previous 6 months and women with their menstrual period at the time of the cholinesterase determination



## Methods

The sample was conveniently integrated, for all laborers met the inclusion criteria

The concentration of erythrocyte cholinesterase was performed with the Magnotti field method, which quantitatively determines cholinesterase, hemoglobin, and cholinesterase adjusted to hemoglobin levels



## Methods

A questionnaire was applied to record the socio-demographic and working conditions, habits during their performance, and the presence of 19 symptoms related with intoxication by organophosphates

As persistent symptoms were defined those which the laborers presented in a repetitive, intermittent, or continuous manner for 15 days prior to the interview

They were also asked about the presence of other diseases to rule out the association with the established symptoms

The questionnaire was previously validated. The analysis of the information was performed with the SPSS statistical package



## Results

- 87% were males
- 75% were between 15 and 31 years old
- 36% came from the state of Guerrero, 24% from Sinaloa and 19% from Oaxaca.
- 31 % were illiterate and only 18 % had completed elementary education level
- 71% traveled with their family



## Results

### Working conditions

- The median in migrating time was 3 years
- 25% had 5 years or more and 13% had 10 or more years migrating
- 30% started their working life at age 10 or younger
- 49% were cutters and general helpers
- 25% were mixers and applicators
- 19% were only applicators
- 7% were supervisors



## Working conditions

- 74% mentions that pesticides were daily used in their area of work
- Only 20% used complete personal protection equipment
- 38% declared eating at their working station
- The mean of working hours was of 48 hours per week. 21% worked 51 to 60 hours a week
- 15% worked extra hours per week



## Working conditions

- 63% referred that the lapse when they re-entered after applying the pesticides was of 5 to 10 minutes
- 42% referred having no break during the work day.
- 19% smoked while working
- 99% referred bathing at the end of the work day, although 22% did it from 2 to 4 hours after and 8% bathe at the watering canal
- 25% changed their clothes every 2 to 7 days



## Health-sickness situation

- The prevalence of persistent symptoms was of 63.4 for every 100 laborers
- From the general population, 19.8% had from one to three symptoms
- 23.3% had between four and nine
- 19.2% referred having more than ten
- The most frequent were: headache -26 x 100, tiredness or weakness -20.9x 100, and water eyes -20.3x 100.



## Prevalence of persistent symptoms in agricultural laborers\*

Symptoms	Number	Prevalence
Headache	46	26.7
Tiredness or weakness	36	20.9
Watery eyes	35	20.3
Stomach pain	30	17.4
Lack of appetite	25	14.5
Dizziness or vertigo	24	14
Muscle pain	24	14
Phlegm	19	11
Nervousness	19	11
Chest pain	18	10.5
Blurry sight	18	10.5
Cramps	17	9.9
Shaking hands or body	17	9.9
Tingle	15	8.7
Respiratory distress	13	7.6
Vomit or nausea	11	6.4
Sweating	11	6.4
Diarrhea	7	4.1
Salivation	5	2.9
Total symptoms	390	

(\*) Per 100 laborers each)

## Results

### Referred morbidity

- 6% of the laborers referred having presented respiratory infections during the last 15 days
- 1.2% chickenpox
- 1.2% gastroenteritis
- 3.5% diverse, chronic conditions, such as hypertension and diabetes, among others
- There was no statistically significant associations between the referred diseases and the presence of the symptoms in the interviewed



## Results

### Cholinesterase levels

- The averages of cholinesterase and adjusted cholinesterase were within normal ranges
- Cholinesterase: 3.6901,  $\pm$  .6519 U/ml
- Hemoglobin: 11.1121  $\pm$  1.8968 g/dl
- Adjusted cholinesterase to hemoglobin level: 32.9855  $\pm$  7.0867 U/g
- In 65.1% of all the laborers anemia was detected



### Relation among persistent symptoms, gender, age, and working

- Prevalence of symptoms was associated with gender; women presented a higher amount of symptoms,  $p=0.04$
- Age was not associated with the presence of symptoms but it was associated with a higher number of symptoms,  $p=0.01$
- Working conditions associated with the prevalence and number of persistent symptoms:
  - Increased migratory time  $p=0.04$
  - Frequency of application  $p<0.001$
  - Job performed  $p=0.006$
- Cutters and general helpers presented more frequency and a higher number of symptoms



## Relation between persistent symptoms and working conditions

- There was also an association between persistent symptoms and:
  - Lesser time of re-entering the field after the application of pesticides,  $p=0.02$
  - Higher number of working hours per week,  $p=0.03$
  - Lack of breaks during the working day,  $p=0.03$
  - Lack of equipment for personal protection  $p=0.01$
  - Place where they ate,  $p=0.006$
  - More time elapsed to bathe after the working day,  $p=0.002$
  - Less frequency in changing clothes,  $p=0.02$



## Relation among persistent symptoms, work performed, and anemia

- An association between anemia and gender was found,  $p<0.0001$ . All women had anemia
- Job:  $p=0.02$ . Cutters and general helpers had a higher prevalence of anemia
- An association was also found with the presence of symptoms,  $p=0.03$
- However, this association was not found with the number of symptoms presented



## Relation between persistent symptoms and cholinesterase levels

- No statistically significant association was found between the prevalence of persistent symptoms and cholinesterase, hemoglobin, nor cholinesterase adjusted to hemoglobin levels



## Discussion

- Poor living and working conditions of agricultural laborers are similar to those reported in other studies
- Extreme poverty, high percentage of illiteracy and low schooling, long working hours, child labor, intense use of pesticides with manual equipment, lack of personal protection equipment in most of the laborers, not complying with established waiting times to re-enter the fields, and food intake in the working area stand out, among others.

## Discussion

- Prevalence of persistent symptoms was higher to that referred in other studies<sup>3</sup>
- In this research, the type of symptoms most frequently reported agree with the symptoms found in other researches (9,19,20)
- Prevalence of symptoms was strongly associated with the worse working conditions and gender

## Discussion

- Cholinesterase levels were found within normal limits when compared both with reference values and those found in other researches
- Similar to other studies, there was no association found between cholinesterase levels and the prevalence of persistent symptoms. Other studies have reported that this enzyme is not a reliable biologic indicator in mild or moderated intoxications<sup>20-22,32,33</sup>

## Discussion

- Anemia prevalence was three times in the total study population and five times higher in women, than the one reported in the national health survey
- Anemia could cause the referred symptoms. However, anemia and other symptoms may be caused mainly by the exposure to pesticides
- Several researches have found an association between the exposure to pesticides and aplastic anaemia<sup>39-41</sup>
- Differences in health alterations according to gender evidence conditions of social disadvantage for women, which has been previously referred to<sup>4,42-44</sup>

## Conclusions

- The working conditions of these laborers favor a higher exposure to pesticides; example of this are the associations found between the presence and number of persistent symptoms with the worst working conditions
- In this study, as well as in others, no association between persistent symptoms and cholinesterase levels was found<sup>5</sup>
- In this sense, it is essential to perform other studies to identify daily signs and symptoms in exposed laborers who do not seek medical attention, for these might be sentinel events to avoid lethal intoxications and serious long-term effects



¡Thank you very much

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