Original Article

EVALUATION OF TOXICITY DUE TO COMMERCIAL PESTICIDES IN FEMALE WORKERS

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ABSTRACT:

Objective: To see the agricultural sprays hazards in female workers at Multan.

Settings: Cotton research station, government of Punjab, Multan.

Main outcomes measure: Age, work experience, physical health, marital status, fertility, menstrual status, number of offspring, number of abortion, blood choline esterase level, reproductive hormonal assay.

Results: The overall age of the 38 participants included in the study was in the range of 12-50 years. Most of the participants enjoyed good physical health. The overall toxicity determined through the reproductive hormonal assay was 18.42%; with 22.22% in the married group and 9.09% in the unmarried group. Eleven participants were in follicular phase of menstrual cycle, two were in luteal state, five were in mid cycle, six were pregnant, six participants had menopause, one had lactational amenorrhea while seven were poisoning cases with no infertility case. The blood plasma level of AChE of 7.8% participants were on safe side, 42.86% were in alarming situation while 52.63% participants were in dangerous condition.

Conclusion: Agricultural pesticides are the endocrine disrupting chemicals which poses a health threat, particularly to the sensitive gender, frequent farm workers and onward into their children.

KEY WORDS: Female workers; agricultural pesticides; reproductive system.

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INTRODUCTION

According to WHO estimate[1], approximately 3 million acute poisoning and 220,000 fatal cases have been reported annually around the world and majority of them belong to developing countries. Rauf et al, 2002,[2] have reported 64% cases with fatal ratio of male to female of 1.7 due to acute poisoning by chemicals spray. Inayatulla and Hasseb 1996 [3] have comprehensively reviewed the acute poisoning due to Sprays in Pakistan. Woo et al, 1996,[4] has reported most of the pesticides as potent carcinogenic, teratogenic, mutagenic and cause multiple health impairments. Since the data on the chronic effect of these chemical needs a lot of advance instrumentation and verification, there is no adequate information on slow poisoning associated with agricultural sprays in Pakistan. The chronic effects of pesticides are determined biologically by the Acetyle Choline

Esterase (AChE) activity in blood (Masud and Baig, 1991,[5] or by pesticides residue findings in human milk, blood and urine (Krawinkel et al, 1989.[6] Olive, 2001,[7] has reported low level of testosterone and T lymphocytes in the pesticides applicators while Fredrick et al, 1993,[8] have shown that women exposed to the pesticides have babies with lower birth weight and smaller skull circumference. Therefore, in such perspective of pesticides as endocrine disrupting chemicals, this study was hypothesized to evaluate the chronic effects in the sensitive gender due to currently applied agricultural pesticides in Multan region in Pakistan.

PATIENTS AND METHODS

Based on the minimum work experience, female workers as daily wage labour or independent weed collectors for house animals at the cotton station Multan were contacted through field assistant by our female colleague. The information and data regarding physical health and description of each individual participant was collected through oral interview in Local/Sareiki language. The samples were taken randomly at morning during the cotton picking in the month of November 1999. Blood was taken from antecubital veins into plain tubes. The biological activity of AChE was measured by by colorimetry according to Jauhiainem et al, 1992,[9] using the acetyle thiocholine Iodide (Sigma Chemical Co.) as substrate. The activity of AChE measured as µ mole thiolecholine/min/ml of blood was calculated as percent from the control group value and results were calculated as mean of three replicates. The reproductive hormonal essay was done on the "Immulite® system of Abbot Inc., USA.

RESULTS

The age of overall participants was in the range of 12-50 years. However, 60% were in the range of 25-40 years of age and they were all married. The physical health impairments were noted through observations or narration of each individual participant interviewed and results are shown in table-I. Most of the par-

Table-I: Results of interviews of participants narrated a single complain or having two or more than two simultaneous complaints in a victim

Organ/Effect parameter (*)	*Single problem narrated*		*Multiple impairment*	
	No of victims	*% Age*	*Two or more problems altogether in a victim*	*Victim's % Age*
Eye (dryness; inflammation; watering; sleeplessness; sight weakness, etc)	25	66	2	34.21
Respiratory system	17	45	3	13.16
Dermatological system (nail distortion; skin damage dryness/inflammation etc.	17	45	4	02.13
General health (vertigo; weakness)	34	89	5	0
Gastrointestinal tract (nausea; dislikes; appetite)	3	7	6	0
Allergic system (laziness; sleeplessness; frequent headache, etc)	0	0	7	0
Any other (hearing, speaking, nasal problem,hair etc)	13	34		

(*) = In parentheses are health indications implicating the observations/question asked about the condition of a typical organ effected as per formatted questionnaire

ticipants enjoyed good physical health but participants having work experience of 10 years or more had narrated single or multiple physical health impairments. Approximately 50% had calculated AChE activity of 34.42%; approximately 40% had AChE activity of 72.59% while only 8% had activity of 87.94% as compared with control group value of 100% as shown in Table-II. The menstrual status was noted both through the LH (Lutropin, lutenizing hormone), FSH (follicle stimulating hormone), PG (progestrone) and Estradiol values determined by instruments and verbal statement of each individual participant interviewed. Only 5% participants had ambiguous menstrual status while 95% were easily classified as follicular, luteal, mid cycle, pregnant, menopause or victim. Out of 38, eleven participants were unmarried and 27 were married. Out of eleven unmarried participants, one was pre pubertal and another one had delayed puberty. The overall toxicity % age determined by hormonal assay was 18.42%. The toxicity within the married group of participants was 22.22% while 9.09% in the unmarried participants group as shown in Table-III. Out of overall seven poisoning cases, 33.33% had oligomenorrhea, 33.33% had secondary amenorrhea, 16.67% had early menopause while 16.67% had heavy menses situation. We found

Table-II: AChE activity in blood plasma of participants

	AChE leve µmole thiolecholine/ minute/ml	*% calculated*	*% decreased*	*consequence status*
Control group participants (14)	4.56	100		Normal status
Workers group Participants (38)	[a] 1.98	34.42	56.58	Dangerous situation
	[b] 3.33	72.59	27.41	Alarming condition
	[c] 4.01	87.94	12.06	Safe side

all the ChE measurements were done in triplicate; a=20 participants, b= 15 participants, c= 3 participants

Table-III: Reproductive Hormonal Assay of found victims

Age (yrs)	Experience (yrs)	Off-spring	Abor-tion	LH	FSH	PG	Estra diol	Last menstrual period (told)	Toxicity Detected (% Age)
35	20-25	1	2	31.8	107	0.1	OSL	No period for last 5 years	early meno-pause (16.67)
25	10-12	0	0	02.6	12.3	0.1	42.2	30th may (whole month of may,4th day	heavy mences (16.67)
30	10-15	6	0	06.9	13.0	0.2	OSL	no period, 6 months gap	secondary amenorrhea (33.33)
20	10-12	2	0	01.7	11.0	0.4	10.7	10th March irregular, 3- months gap	olegomen-orrhea(33.33)
34	13-14	2	0	44.3	146	0.1	OSL	April, 2-months gap 8 months gap	olegomen-orrhea
28	14	3	0	02.6	08.3	0.2	OSL		secondary-amenorrhea
14	8	unma rried	0	02.7	09.0	0.5	3.96	period not started	delayed puberty (16.67)

* OSL= Off scale low

* Overall Toxicity = 18.42%; toxicity within the married group = 22.22%; and toxicity within unmarried group = 9.09%

Table-IV: Normal range of LH; FSH; PG level in blood during various menstrual status

Menstrual Status	*LH (mIU/ml)*	*FSH (mIU/ml)*	*PG (ng/ml)*	*Estradiol (pg/ml)*
Follicular Phase	1.1 – 12.0	2.8 – 11.3	0.0 – 1.5	ND – 160
Mid Cycle	17 – 77	5.8 – 21.0	–	- – -
Luteal phase	0.1 – 15	1.2 – 9.0	2.3 – 25	27 – 246
Postmenopausal	11 – 44	21.7 – 153	0 – 0.7	ND – 30
Mid Luteal Phase			3.5 – 25	
Oral Contraceptive			0 – 0.4	
Pregnant Female				
1stTrimester			8.1 – 42	
2ndTrimester			15 – 130	
3rdTrimester			49 – 227	

Source = (Harrison's Principles of Internal Medicine, 1994)

no case of infertility as is similarly reported by Parveen Kumar et al, (1994 [10]) but 16.67% had delayed puberty and all the toxicity results were compiled in the context of Table-IV.

DISCUSSION

Initially 50 female workers were contacted for the study but later on 12 did not participate due to unknown reasons. All the participants were grouped according to their age into Group-1 (10-15 years), Group-2 (16-25 years), Group-3 (26-35 years), Group-4 (36-45 years) and Group-5 (> 45 years). According to our observations, female agricultural workers in Multan are generally bystanders, which mean that such group of population enters into sprayed farm as field force not as pesticide applicator. So they are silent or invisible farmers. They are frequently seen in farms with their children and work most of the hours of day throughout the year. Further, they were seen working entirely manually with uncovered hands, head and bare feet in summer season. Our observations are approximately similar to that noted by Nasira Habib, 1996.[11] Thus, this supports the idea that whole body of field worker lashes with sprayed plants in the field. And polluted farm may be one of the preliminary causes of their health impairment. Further, Table-I shows that 50% had shown multiple health impairments. But no effect was noted onward into their children as similarly reported by Pigali et al, 1982.[12]

This is well known fact[5] that Organophosphorus and Carbamates pesticides act on central nervous system by impairing the acetyle Choline esterase (AChE) and its activity in blood indicates health status of the participant / patient / victim. Out of total 38 participants, approximately 50% had acetyle choline level below 100%. And 40% were in alarming state while only 8% were on the safe side. Our results are close to the study by Rehman 1982,[13] where 50% of the workers associated with aerial spray department in Pakistan, possessed low enzymatic activity of acetyle choline. Moreover, our findings offer lot of hope than the situation reported by Masud and Baig, 1991,[5] where only 1% was out of dangerous situation, 74% were in the alarming situation while 50% were in dangerous condition. The variations can be better understood by the time of sampling and methodology followed, and the fact that synthesis of acetyle choline re-occurs naturally within 24-72 hours as the hurdle is defused.

Both the LH and FSH are secreted through the ß cells of anterior pituitary. LH causes ovulation and its serum level is very useful in diagnoses and treatment of infertility in women while FSH initiates growth and development of ovarian follicle and is required for normal sexual function. Further, estradiol is secreted

by ovarian follicle and placenta. Its rising level is good indicator of pregnancy while PG level plays key role at puberty. Table-II shows the normal required range of LH, FSH, PG and estradiol. We found minor changes in LH and FSH values in unmarried participants and in some cases the differences were in the opposite direction to that expected. These findings are contrary to our study in the case of married participants but are similar to the findings of Larsen et al, 1998,[14] that use of pesticides by Danish farmers is not the likely cause of short-term effects to the semen quality and reproductive hormones. The PG and Estradiol contents of overall participants were markedly decreased in some cases and significantly increased in other cases. Both the hormonal assay determination and verbal statement of each individual interviewed gave 7 poisoning cases out of the total 38 participants. Out of 7 victims, only 14.29% was unmarried as compared to 85.71% married victims. Among the married 6 victims, 16.67% narrated multiple abortions and had work experience of 20 years or more. Further, 83.33% toxicity cases having work experience of 10 25 years belonged to age group G_3 (26 35 years) while 16.67% belonged to age group G_2. This implicates that poisoning is related to more frequent exposure in the field.

CONCLUSION

We conclude that currently used pesticides could influence the reproductive system in the sensitive farm workers. However, in depth study and monitoring of each individual participant's history is very essential to exclude other causes.

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