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Mortality Effects of Human NPH Insulin (Lansulin N) and Symmetrel (Amantadine Hydrochloride) on German Cockroach: *Blattela germanica* (L.)

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Abstract: Human NPH insulin (Lansulin N) considered as anti-diabetes drug. In addition, symmetrel (amantadine hydrochloride) found as anti-virus and anti-Parkinson drug which the mortality effects of the drugs was the study against *Blattela germanica*. German cockroaches were reared at 25±20°C, 40-50% RH and 14L:10D photoperiod cycle. The concentration of 5, 10, 15, 20 and 25 μL of Human NPH insulin (Lansulin N) and 0.5, 1, 2, 4 and 8% of symmetrel (amantadine hydrochloride) was used. The data were analyzed using SPSS software. $p<0.05$ was considered significant as the difference between groups. Dose of 20 μL of Lansulin N causing death among the 63.34% of the samples in addition, 86.67% of German cockroaches killed after the exposure with 2% dose of the amantadine hydrochloride. There is significant mortality was found between the doses of 2% with comparing to another doses ($p<0.05$). In significant mortality found after exposure with 20 μL of Lansulin N with comparing the other dose ($p<0.05$). The dose of 2% amantadine hydrochloride and 20 μL Lansulin N cause reduces irritability, weakness and eventual death of these cockroaches. The researchers suggested that the appropriate doses of these drugs as a poisoned bait or gel used against the wild strain of *B. germanica* in the future.

Key words: Human NPH insulin, amantadine hydrochloride, *Blattela germanica*, mortality, drugs, weakness

INTRODUCTION

Many people, particularly children's health exposed to infectious diseases that are transmitted by insects, specifically cockroaches and flies annually. Cockroaches have existed >300 million years ago. By now about 3,500 species of cockroaches exist worldwide. This species is a major indoor pest, mainly found in dwellings, homes, apartments, schools, restaurants, stores, hospitals, kitchen, bathroom or other buildings in rural and urban areas. Cockroaches cause allergies and compromised health in humans.

Hypersensitive asthma with inflammation is a chronic disease (Slater *et al*., 2007; Tahernejad, 1995; Douroudgar and Asadi, 2001; Motavalihaghi and Sharif, 2001; Motavalihaghi *et al*., 1998). Some arthropods such as cockroach, house dust mite reported as responsible to allergic airway (Gelber *et al*., 1993; King *et al*., 1998; Sun *et al*., 2001), some other agent reported as fungi, pollen and cat (Bhat *et al*., 2003; Kauffman *et al*., 2000; Ring *et al*., 2000). Cockroaches are also, one of the mechanical vectors to transmission of pathogens to be human (Kinfu and Erko, 2008). Fu *et al*. (2009) reported that the contamination of *B. germanica* by bacterial pathogens significantly not effect due to the amount of infections in the environment (Fu *et al*., 2009).

Some pathogens such as bacteria, protozoan's and viruses have been found on cockroach bodies. Cockroaches are the responsible cause to human psychological stress, gastroenteritis, dysentery, diarrhea, allergic responses, skin rashes, watery eyes, sneezing, congestion of nasal passages and asthma. Rapid adaptation to environment condition and resistance to insecticides found among the species. In addition when gravid German cockroaches are exposed to pesticides will release their egg sacs before their evolution (Mancock and Ross, 1993). Therefore, their control is very important (Wang and Bennett, 2009; Nalyanya *et al*., 2009).

Excessive and irregular application of pesticides has led to resistance of cockroaches to insecticides (Lee *et al*., 1999; Hemingway *et al*., 1993; Schal, 1988; Ladonni, 1993,

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1997; Ladonni and Sadegheyani, 1998; Nasirian *et al*., 2009; Shahi *et al*., 2008). Therefore, developed the new methods to control of the German cockroach are necessary. Some drugs of human disease are the property of insecticide on insects as well as many of these drugs due to the low doses are useful to insect control and there is no toxicity or serious problem to humans. However, some drug such as Warfarin as an anticoagulant drug used for the treatment of vessel and heart problems. Warfarin also is effective even in low doses and used for rodent control while can be dangerous to humans, especially children so the drug is less than the environmental problems need scientific studies.

To study the effect of human drugs on the cockroaches have been conducted (Abolghasemia *et al*., 2011; Cochran, 1985; Gammon, 2008; Hamilton and Schal, 2008). The mechanism of Insulin considered as a reduction in blood glucose (Martindale, 2005). There are two common forms of R and NPH of human insulin (Dieken *et al*., 2002).

Amantadine HCl is an antiviral drug used against influenza A. This drug is also had been effective on the treatment of parkinson's disease (Sweetman, 2009). The aim of this study was to determine the sensitivity of different doses of the human insulin N and amantadine HCl against *Blattela germanica* for use in field conditions to control of this vector in nature as poisoned bait. Researchers study the killing effects of amantadine HCl and human NPH insulin (Lansulin N) at the first and same time on the German cockroach.

MATERIALS AND METHODS

In this study, a new adult cockroaches were placed inside the chamber based on Cochran (1983). The cockroaches were reared at 25±20°C, 40-50% RH and 14L:10D photoperiod cycle. Cockroaches were reared without any restrictions and were free access to water and food. Sensitive strains of *Blattela germanica* Linnaeus (TEH normal) from 1990 until now without exposure to insecticides were kept to the Faculty of Tehran University of Medical Sciences.

So, researchers used this strain for their study. In this study, the adult cockroaches divided as 20 groups contain 30 samples randomly.

The insulin was injected to coelom of the five groups as the dose of 5, 10, 15, 20 and 25 μL using Topical applicator (Bracke *et al*., 1978). Normal saline was administrated as injection as the same dose of treatment. Different doses of the human NPH insulin as well as normal saline injected after their anesthetized with CO_2 gas. In addition, the dose of 0.5, 1, 2, 4 and 8% of amantadine HCl administrated with Pulverized dog food. The similar concentrations of Pulverized dog food without the drug were given to control group. Mortality of cockroaches, treatment and type of mating, egg and capsules production was investigated over a period of 10 days. SPSS software Version 11.5 was used in this study. $p<0.05$ was considered as the significant difference between groups. The tests were accepted when the mortality of the control group was <5% while rejected when >20%. The results were corrected when the mortality of control groups was between 5-20% using Abbot correction.

Statistical analysis: One-way ANOVA tests were used to compare the mortality of *B. germanica* L. between two groups using SPSS Ver. 11.5, state 80 software. $p<0.05$ were considered statistically significant.

RESULTS AND DISCUSSION

The dose of 20 μL of Lansulin N was found more effective than other doses. In this study, doses of 5, 10, 15, 20 and 25 μL of Lansulin N caused 36.67, 33.34, 43.34, 63.34 and 30% mortality among the treatment samples, respectively (Fig. 1). Significant difference was found between the mortality of German cockroaches exposed to dose of 20 μL compared to other doses and control group ($p<0.05$).

The use of amantadine HCl as a dose of 2% was most killing effect than the other doses. The mortality of *B. germanica* was found 16.67, 43.34, 86.67, 40 and 33.34% post feeding of 0.5, 1, 2, 4 and 8% of amantadine HCl, respectively (Fig. 2). There was a significant difference between the dose of 2% and the other dose of amantadine HCl ($p<0.05$). The results of mortality effects of insulin and amantadin HCl shown in Table 1.

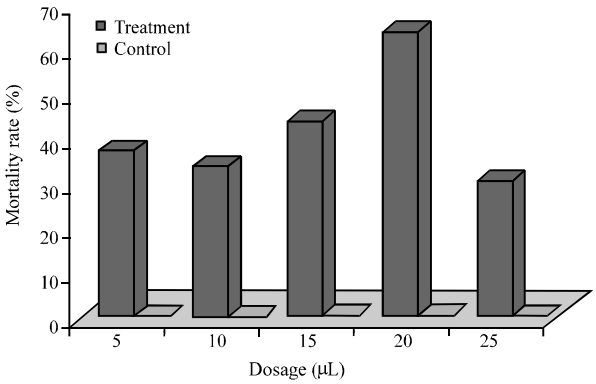

Fig. 1: The mortality of German cockroaches (*B. germanica* L.) exposed to human NPH insulin (Lansulin N) in comparison with the control group

Table 1: The results of different doses of human NPH insulin (Lansulin N) and symmetrel (amantadine hydrochloride) drugs to German cockroaches (*Blattela germanica* L.)

		Treatments			Control		
Drug	Dosage	Live	Dead	Mortality rate (%)	Live	Dead	Mortality rate (%)
Lansulin N	5 μL	19	11	36.67	30	0	0
	10 μL	20	10	33.34	-	-	-
	15 μL	17	13	43.34	-	-	-
	20 μL	6	19	63.34	-	-	-
	25 μL	21	9	30.00	-	-	-
Amantadine HCl	0.5%	15	5	16.67	30	0	0
	1%	17	13	43.34	-	-	-
	2%	4	26	86.67	-	-	-
	4%	18	12	40.00	-	-	-
	8%	20	10	33.34	-	-	-

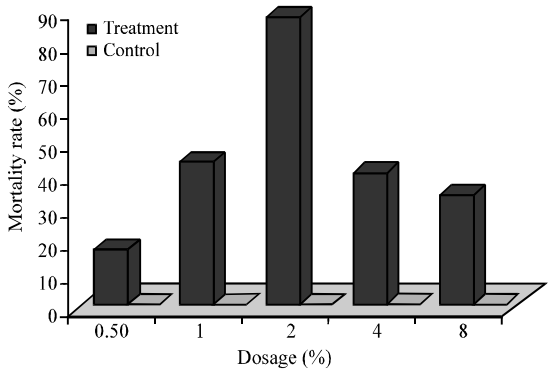

Fig. 2: The mortality of German cockroaches (*B. germanica* L.) exposed to symmetrel (amantadine hydrochloride) in comparison with the control group

In this study, the efficacy of human NPH insulin (Lansulin N) and symmetrel (amantadine hydrochloride) against German cockroaches was the study in the first time simultaneously. Human NPH insulin is intermediate-acting insulin used to control of the blood-sugar level of diabetic illness and injected subcutaneously. It has the longer duration of action than regular insulin (Martindale, 2005). Onset of insulin effect was observed 2 h after injection. The duration of effects was found 18-26 h, its reach to the maximum after 4-12 h (Deckert *et al*., 1982; Kolendorf and Bojsen, 1982).

Half-life of amantadine hydrochloride capsules reported as 2-4 h and is absorbed through the gastrointestinal trunk and as considered as anti-virus and anti-Parkinson's drug (Sweetman, 2009). Results of the study showed that the dose of 20 μL of Lansulin N and 2% amantadine Hcl had more been killing effects on *B. germanica* L. As it was observed the effects of Lansulin N and amantadine HCl as to reduce irritability, mobility, imbalance, lack of transmission of nerve messages and eventually weakness. Disability and death of the treated samples. The samples were intent on drinking the water after post injection of insulin. Present are many reports due to the emergence of resistance to insecticides, particularly organophosphate (Hemingway *et al*., 1993) oreganochlorine and pyrethyroid insecticides (Lee *et al*., 1996; Cochran, 1997; Nasirian *et al*., 2006; Ladonni, 2001; Scott *et al*., 1990; Atkinson *et al*., 1991; Valles and Yu, 1996; Valles, 1999; Valles *et al*., 2000; Wei *et al*., 2001). So, we need to new methods and materials for the control of cockroaches. In parallel, the effectiveness of the human insulin on the German cockroaches has been conducted previously.

Abolghasemia *et al*. (2011) reported that insulin N with a dose of 20 μL caused >70% mortality of *B. germanica* while in contrast, various doses of human insulin R and N+R found no significant mortality compared to control group. There are many reports due to effectiveness of various drugs on cockroaches (Cochran, 1985; Gammon, 2008; Hamilton and Schal, 2008). Nasirian (2008) reported that showed that of imidacloprid gel, bait has more been killing effect than the gel of fipronil against *B. germanica* L. (Nasirian, 2008). Thus, human NPH insulin (Lansulin N) as a dose of 20 μL can be used as bait gel against German cockroaches in the future. Furthermore, insulin is not proven to cause specific organ damage separate from its hypoglycemic or lipogenic effects. No mutagenesis or carcinogenesis has been observed in humans. It also seems to symmetrel (amantadine hydrochloride) dose of 2% as the bait can be used as an insecticide for control of German cockroaches and reduced the resistance and also prevent of damage to the environmental.

CONCLUSION

Low doses of the drugs cause no poisoning and serious problems for humans, especially children so the use of them as bait or as gel formulation can be more effects on *B. germanica* L. Researchers suggested that human NPH insulin and also symmetrel (amantadine hydrochloride) could be utilized in the control of *B. germanica* in the future field.

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