Victoria's Secret Bombshell Perfume's Effectiveness as *Aedes aegypti* (Linnaeus) (Diptera: Culicidae) Mosquito Repellent

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Abstract: Mosquitoes spread many vector-borne diseases that pose risks to human health. Different repellents have been formulated to prevent host and vector interactions. In this experiment, Victoria's Secret Bombshell perfume was evaluated as a repellent of *Aedes aegypti* (Linnaeus) (Diptera: Culicidae) by comparing it to DEET (N, N-Diethyl-meta-toluamide). The mean number of bites on arms wearing DEET, perfume, and nothing was determined and compared with one another. DEET was observed to prevent the most *Aedes aegypti* bites whereas the perfume did not prevent as many but did prevent more than the arms with nothing on.

Keywords: DEET, mosquito repellent, *Aedes aegypti*, perfume

The *Aedes aegypti* (Linnaeus) (Diptera: Culicidae) is a species of mosquito that vectors different parasites and viruses. These mosquitoes can spread yellow fever, dengue fever, chikungunya, Zika fever, along with other disease-causing agents. *Aedes aegypti* originated in Africa but is now seen all around the world in tropical or in subtropical regions, including Texas (Peper et al., 2017, Clements et al., 2018). *A. aegypti* was responsible for multiple virus outbreaks in Texas including the Zika virus outbreak in 2016 and the chikungunya outbreak in 2015 (Le Van, 2020).

Mosquitoes are attracted to many different bodily scents including lactic acid, octenol, and carbon dioxide which is how they find their hosts (source). Mosquito repellents have been used since World War II as a means to avoid the harmful effects mosquitos have on human health by blocking the insect's sense of smell, making it harder for the mosquito to find its victim (Xu et al., 2019). Recent studies have suggested there may be perfumes that can have a similar effect on mosquitoes as a repellent does (source). The perfume being tested for its mosquito-repellent effects is the Victoria's Secret Bombshell perfume. This is a popular perfume that is used by women of all ages (source). In this experiment, the repelling effects of the Victoria's Secret Bombshell perfume on *Aedes aegypti* will be compared with marketed mosquito repellent containing DEET, which is the most common active

ingredient in insect repellents. It is hypothesized that if the Bombshell perfume is used in place of the OFF Deep Woods Insect repellent, then it will be successful in preventing bites from *Aedes aegypti*.

Materials and Methods

OFF Deep Woods Insect Repellent VIII (S.C. Johnson & Son, Inc., Racine, WI.), and Bombshell perfume (Victoria's Secret, Palo Alto, CA.) were used to conduct the research. Four individuals were selected to participate as test subjects in three experiment replicates. Both arms of each individual were placed into a sealed case of *Aedes aegypti* mosquitoes three times wearing insect spray, 3 times wearing perfume, and 3 times wearing nothing. Each case of *Aedes aegypti* contained 15 mosquitoes per arm.

Each time, the individual left their exposed arm either with the treatment or without in the case for 10 minutes. The number of bites each individual received while wearing OFF, perfume, or nothing was averaged and compared to the other participants. The same procedure was used for the second and third replicate of the experiment. The arms wearing nothing acted as the control group and the data was compared to that of the perfume and OFF sprays in order to analyze the degree of mosquito repulsion.

Results

In all three experiment replicates, consistent observations of bite averages were seen for arms wearing DEET, perfume, and nothing. It was observed that arms wearing DEET consistently received the fewest bites for participants 1, 2, 3, and 4 for all three replicates (Fig 1., Table 1.)

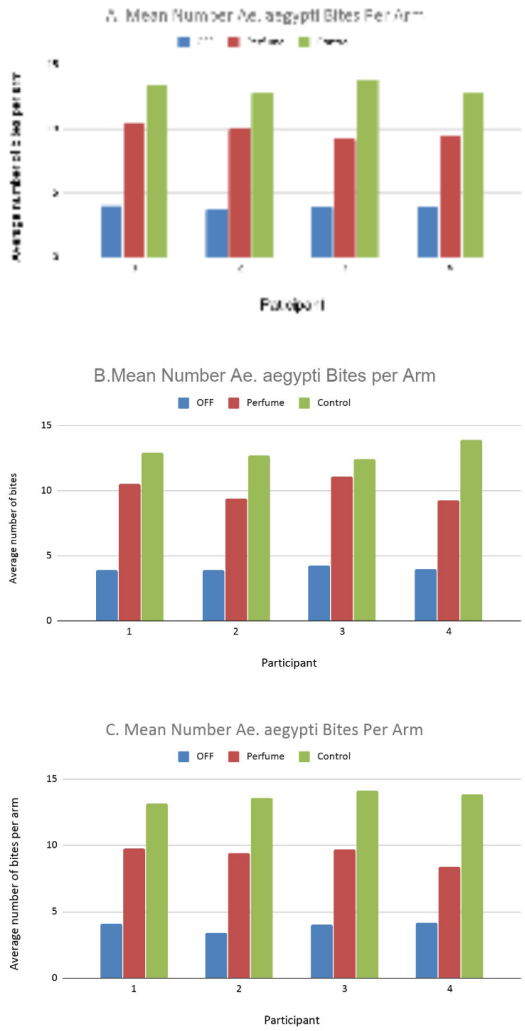

Figure 1: Average *A. aegypti* Bites per arm exposed to DEET, perfume, and control

Compared to perfume and nothing, the arms wearing the DEET received 3.95 bites on average versus 9.73 with perfume and 13.29 with nothing (Table 1.) These observational trends are shown and compared in Figure 1.

This illustrates the average number of *Aedes aegypti* bites received per arm wearing DEET, perfume, and nothing. Graphs A, B,

and C refer to experiment replicates 1, 2, and 3 respectively. All graphs are separated into 4 sections referring to the bite averages for the 4 participants.

Replicate	Participant	OFF	Perfume	Control
1	1	4.00	10.54	13.42
	2	3.75	10.04	12.81
	3	3.93	9.27	13.91
	4	3.87	9.48	12.80
2	1	3.93	10.49	12.89
	2	3.91	9.36	12.71
	3	4.27	11.06	12.39
	4	4.00	9.26	13.86
3	1	4.14	9.77	13.13
	2	3.40	9.41	13.57
	3	4.00	9.68	14.13
	4	4.16	8.42	13.84
Average		3.95	9.73	13.29

Table 1. Average of *Aedes aegypti* Bites for Participants

The raw data collected for the experiment are summarized in Table 1. This table shows the average number of bites that each participant received from *A. aegypti* wearing DEET, perfume, and nothing for each experiment replicate. The data for all trials of each substance worn was averaged and can be found at the bottom of the table.

Discussion

From the trends seen in the data, it can be concluded that the OFF insect repellent (DEET) prevented the most bites from *Aedes aegypti* mosquitoes. Although not as effective, Victoria's Secret Bombshell perfume consistently showed fewer bites on arms compared to those wearing nothing. In comparison to the control data, wearing the perfume prevented 3-4 bites on average (Fig. 1). This supports the hypothesis that Victoria's Secret Bombshell perfume works successfully as a mosquito repellent. However, compared to control data, wearing the OFF insect repellent prevented 9-10 bites and was the most effective repellent tested of *Aedes aegypti* mosquitoes (Fig. 1). The active ingredient responsible for the repelling effects in OFF is known as DEET. Although the way DEET works is not entirely known, research shows it acts on mosquitoes' smell and taste, (Xu et al., 2019). The results of DEET, seen in Figure 1 and Table 1, show fewer bites because the DEET interfered with the *Aedes aegypti*'s taste and olfactory receptors. This observed prevention of bites from wearing perfume and DEET reflects their effectiveness in repelling the *Aedes aegypti* mosquitoes.

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