The Effect of Natural Falling and Dipping of House Fly (Musca domestica) on the Microbial Contamination of Water and Milk: A Short Communication Report

Baeshen N.A.¹, Elsharawy N.T.³,⁴ Baeshen N.N.³, Baeshen M.N.³,*

¹Department of Biological Sciences, Faculty of Science, King Abdulaziz University, Jeddah, Saudi Arabia
²Department of Microbiology, Faculty of Agriculture, Ain Shams University, Cairo, Egypt
³University of Jeddah, Department of Biology, College of Science, Jeddah, Saudi Arabia
⁴Department of Food Hygiene, Faculty of Veterinary Medicine, New Valley University, Egypt

*Corresponding Author: mnbaeshen@uj.edu.sa

Nabih Abdulrahman Baeshen, nbaeshen@kau.edu.sa
Nagwa Thabet Elsharawy, ntelsharawy@uj.edu.sa
Nseebh Nabih Baeshen, nnbaeshen@uj.edu.sa
Mohammed Nabih Baeshen, mnbaeshen@uj.edu.sa

Abstract

Background: The study describes the comparison of different microbial load results of natural falling and dipping of the house fly (Musca domestica) in water and milk to investigate the possibilities of preventing the effect of the transferred pathogens from the house fly to our sources by pointing out the existence of antimicrobial factors within the house fly.

Methods: Samples of house fly were collected from Jeddah and Makkah (Makkah region) and were directly transferred to the laboratory. Each house fly was packed in sterile test tubes. Each tube was opened oppositely to a larger test tube containing 10 ml of sterile tap water, and sterile water at pH 4.0 in other similar series of treatments to represent the reactions of stomach fluids. Later, the house flies were left for 20 seconds after reaching the water surface, and then cultured on different microbial media to evaluate the microbial load of the natural falling of the house fly. To evaluate the complete dipping of house flies in the water, two methods were tested by one complete dip for the flies for 20 seconds, and three times complete dipping for 20 seconds in water before evaluating the microbial load. The same methods were achieved on milk in a series of experiments and the microbial load was evaluated after the
incubation at room temperature for three hours.

**Results:** It was found that dipping treatments of house flies gave lower microbial contamination in water at pH 4.0 than neutral pH. The lower microbial load was also observed when dipping the house flies three times in water as compared to once dipping and natural falling treatments. It was also found that the complete dipping of house flies’ treatments in milk will reduce the microbial contamination as compared to natural falling treatments.

**Conclusion:** The observed results support the presence of antimicrobial factors on the house fly.

**Contributions to the literature**

- This report summarizes the study made by *(Baeshin et al., 1990)* to point out the precedence of exploring the results of the study.

- The study describes the effect of the natural falling and dipping of the house fly in water and milk on both pathogenic and non-pathogenic microorganisms.

- The results suggest the existence of antimicrobial agents on the house fly, which opens the doors of the exploration of promising antimicrobial agents to serve in food hygiene and other public health categories.

**Keywords:** *house fly, falling, dipping, antimicrobial, milk, water.*

**Background**

House flies may carry non-pathogenic or pathogenic microorganisms and may also possess and transfer many antimicrobial factors that act against many of these microorganisms in addition to many enzymes that can affect the pathogenic microorganisms. Studies of the microorganisms on the wings of the house fly, as well as effect of dipping the house flies in edible liquids for human consumption such as milk and water need to be conducted as we preceded in this area *(Baeshin et al., 1990).* Recently, a study was demonstrated on the molecular levels by *(Sudong et al., 2021)* to pinpoint the nature and structure of some antimicrobial factors within house fly known as...
antimicrobial peptides (AMPs), which has a significant role of such molecular diversity in the housefly antimicrobial immune systems.

According to Food and Drug Administration (FDA), house flies and other pests may transport about 25% of foodborne infections which are reported annually such as Enterohemorrhagic colitis, shigellosis, salmonellosis, and cholera (Olsen et al., 2001).

House flies may acquire food borne microorganisms from the residues of infected persons such as vomitus, stools, and body. On the other hand, house fly disseminated microorganisms through; direct contact, feces, and mouth secretions (Baeshin et al., 1990; Mead et al., 1999).

In the present article, we are aiming to summarize our previous findings of the effect of dipping the house fly in consumable liquids and the existence of antimicrobial factors in the house fly.

**Material and Methods**

**Samples collection**

Samples of house fly (*Musca domestica*) were collected from Jeddah and Makkah and were directly transferred to the laboratory to compare between the natural falling and dipping of house fly in water and milk. Each house fly was packed in sterile test tubes.

**Natural falling and dipping experiments in water**

The sterile tubes containing the house flies were opened oppositely to larger sterile test tubes containing 10 ml sterile water and started dropping one by one of the house flies. The tubes were left for 20 seconds before culturing on different microbial media. The experiments were applied in two different methods; the first method was by using the same house flies in the natural falling and dipping treatments, and the second method was by using different house flies in each treatment of dipping and natural falling. The dipping treatments were also divided into two methods; the first method was by one complete dip for the flies for 20 seconds, and the second method was by three times complete dipping for 20 seconds in water.
The microbial load of the contaminated water was determined directly after falling or dipping by incubation of 15, 30, 45 and 60 minutes at room temperature on nutrient agar to determine the total microbial flora. Non-haemolytic and haemolytic flora were determined on blood agar. The experiments were applied in neutral sterile tap water and sterile water at pH 4.0.

**Natural falling and dipping experiments in milk**

Another series of natural falling and dipping experiments of house flies were carried out on sterile milk and the microbial load was determined after incubation at room temperature for 3 hours.

**Results and Discussion**

**Natural falling and dipping in water**

The obtained data showed in table (1) which declared the comparison between natural falling and dipping once and triple for 60 minutes. The results evident showed that natural falling resulted in higher contamination than dipping. Thus, when the fly was tested by dipping it will carry less amount of microbial flora. This may explain the higher counts observed in natural falling treatments. On the other hand, as presented in table (2), the results declared that after dipping or falling in sterile water for separated house flies in each treatment, the triple dipping treatment gave lower counts in microbial load than those reported for natural falling and once dipping samples. This indicates the remarkable effect of dipping when compared to natural falling as the house fly was washed in the surface water from most of the microorganisms and antimicrobial factors in the natural falling treatment, and still showed lower microbial counts after the dipping treatments. Also, the incubations time at room temperature before culturing was shown to be effective as the long period of incubation allows the reaction between microorganisms and microbial factors to happen and subsequently the reduction of the microbial count. Furthermore, the once and triple dipping in sterile water at pH 4.0 showed generally lower counts than the natural falling treatments, which indicates that the antimicrobial factors were still effective at pH 4.0.
Natural falling and dipping in milk

Our findings show that the falling of house fly in sterile milk had a higher contamination level than the insects dipping which refers to the presence of some antimicrobial agents on the surface of house fly which descending in water, during dipping treatments as illustrated in table (3). More remarkable findings were noticed in the means of bacterial counts after the dipping and falling treatments at different incubation periods as presented in table (4), which declared that dipping treatments gave a considerably lower value. Although milk is an excellent medium for the proliferation of almost all microorganisms, the obtained results pointed out a progressive decline in different microbial counts after falling or dipping treatment, and this supports the suggestion of the presence of antimicrobial agents on the house fly. Some previous studies (Atta, 2014) pointed out similar results, which revealed that all media cultivated with right-wing extract were free of bacterial and fungal growth, however, the left-wing had bacterial and fungal growth. This would conclude that the right fly wing is a new antibiotic revolution that needs more investigation in order to discover other antibiotics from the right fly wing. Recently, (Sudong et al., 2021) unveiled the nature of some antimicrobial agents on the house fly at the molecular level. Therefore, it is worthwhile to investigate more in this field seeking for potentially now antimicrobial factors and antibiotics.
| Incubation Period (min) | pH of Water | Total Microbial Flora | Non-Haemolytic Bacteria | Haemolytic Bacteria |
|------------------------|-------------|-----------------------|-------------------------|--------------------|
|                        | Natural     | Dipping once          | Dipping three           | Natural            | Dipping once | Natural | Dipping three |
|                        | falling     |                       |                         | falling            | once         | falling  | three        |
| 0                      | 7.0 (Natural)| 1950                  | 1530                    | 2625               | 2700         | 735      | 978          | 750 | 105 | 68 | 1350 | 849 |
| 15                     | 1288        | 3120                  | 1827                    | 1343               | 311          | 288      | 776          | 567 | 63  | 93 | 524  | 734 |
| 30                     | 1144        | 2083                  | 1291                    | 1036               | 184          | 256      | 612          | 510 | 44  | 32 | 543  | 288 |
| 45                     | 297         | 450                   | 1131                    | 1338               | 68           | 108      | 507          | 390 | 14  | 23 | 324  | 418 |
| 60                     | -           | -                     | 729                     | 1034               | -            | -        | 297          | 278 | -   | -  | 432  | 368 |
| 0                      | 4.0         | 1575                  | 525                     | 3900               | 4200         | 135      | 38           | 1260 | 405 | 293 | 375  | 75  | 780 |
| 15                     | 1163        | 334                   | 3626                    | 1850               | 242          | 138      | 575          | 851 | 127 | 92  | -    | 161 |
| 30                     | 192         | 144                   | 4556                    | 1632               | 180          | 60       | 320          | -    | 72  | 120 | 40   | 32  |
| 45                     | 77          | 54                    | 1922                    | 1016               | 41           | 23       | 180          | 249 | 32  | 20  | 80   | 8   |
| 60                     | 50          | 30                    | 1342                    | 1854               | 20           | 12       | 38           | 54   | 20  | 10  | 8    | 8   |

Table 1: Effect of natural falling and dipping of house fly in sterile water on counts of total bacterial flora, non-haemolytic and haemolytic microorganisms (mean of five replicates – counts/ml). (Baeshin et al., 1990).

| Incubation Period (min) | pH of water | Total microbial flora | Non-Haemolytic bacteria | Haemolytic bacteria |
|------------------------|-------------|-----------------------|-------------------------|--------------------|
|                        | Natural     | Dipping once          | Dipping three           | Natural            | Dipping once | Natural | Dipping three |
|                        | falling     |                       |                         | falling            | once         | falling  | three        |
| 0                      | 7.0 (Natural)| 360                   | 1340                    | 510                | 340          | 710      | 180          | 40  | 110 | 80 |
| 15                     | 512         | 1112                  | 376                     | 168                | 592          | 240      | 79           | 32  | 64  |
| 30                     | 240         | 450                   | 96                      | 216                | 234          | 96       | 30           | 42  | 8   |
| 45                     | 192         | 450                   | 96                      | 104                | 348          | 16       | 8            | 52  | 8   |
| 60                     | 84          | 232                   | 30                      | 42                 | 148          | 10       | 10           | 2   | 8   |
| 0                      | 4.0         | 3399                  | 2100                    | 3699               | 2700         | 2100     | 2499         | 949 | 949 | 499 |
| 15                     | 4927        | 2089                  | 3168                    | 199                | 1275         | -        | 439          | -   | 660 |
| 30                     | 3039        | 2089                  | 1215                    | 1177               | 912          | 1368     | 342          | 417 | 351 |
| 45                     | 864         | 591                   | 2928                    | 1471               | 1440         | 1248     | 639          | 430 | 824 |
| 60                     | -           | 909                   | 1377                    | 1507               | -            | 850      | 259          | -   | 273 |

Table 2: Effect of natural falling and dipping of separate house flies in sterile water on counts of total microbial flora, non-haemolytic and haemolytic microorganisms (mean of five replicates – counts/ml). (Baeshin et al., 1990).
### Table 3: Counts of total microbial flora, non-haemolytic and haemolytic microorganisms as influenced by falling and dipping of house flies in sterile milk, counts/ml (17 samples). (Baeshin et al., 1990)

| Microflora                  | Falling | Dipping |
|----------------------------|---------|---------|
|                            | Total   | Mean    | Total   | Mean    |
| Total microbial flora       | 13440   | 790.6   | 2805    | 165.0   |
| Non-haemolytic microorganisms | 12910  | 759.4   | 4250    | 250.0   |
| Haemolytic microorganisms   | 3790    | 222.9   | 715     | 42.1    |

### Table 4: Effect of incubation period on the counts of different microorganisms in contaminated milk with natural falling and dipping house flies (counts/ml). (Baeshin et al., 1990)

| Microflora                  | Falling | Dipping |
|----------------------------|---------|---------|
|                            | Incubation period (hr) | Incubation period (hr) |
|                            | 0   | 1   | 2   | 3   | 0   | 1   | 2   | 3   |
| Total Microflora            |     |     |     |     |     |     |     |     |
| 1- Total                    | 366 | 462 | 520 | 842 | 264 | 220 | 380 | 584 |
| 2- Mean                     | 366 | 462 | 520 | 842 | 264 | 220 | 380 | 584 |
| Non-haemolytic bacteria     |     |     |     |     |     |     |     |     |
| 1- Total                    | 4180| 3520| 3620| 4640| 3020| 2740| 3600| 3360|
| 2- Mean                     | 418 | 352 | 362 | 464 | 302 | 274 | 360 | 336 |
| Haemolytic bacteria         |     |     |     |     |     |     |     |     |
| 1- Total                    | 800 | 720 | 2480| 1360| 440 | 640 | 1520| 1080|
| 2- Mean                     | 80  | 72  | 248 | 136 | 44  | 64  | 152 | 108 |

**Conclusion**

The observed results support the presence of antimicrobial agents on the house fly, which is a promising research field that might open the doors for the discovery of novel promising antimicrobial agents that may serve particularly in food science and generally in the fields of medicine, pharmaceuticals, and public health.
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