Comparison of Two Hydration Gel Products for Use in Shipping of Guinea Pigs

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Introduction

Provision of feed and water to research animals in transit is both a regulatory requirement and a welfare requirement (1). Historically, shippers have used potatoes and other vegetables, as well as water-soaked feed to provide moisture for rodents during transit. The first description of a canned sterile shipping diet appeared in 1967 (2). Since that time, many commercial sterile water replacement products have emerged. Among them, flavored or unflavored gel products have gained in popularity in the laboratory animal industry due to their long shelf life and ease of use. Guinea pigs are generally considered to adapt poorly to changes in food presentation and to novel food items, unless exposed to such items at a young age. The goal of this study was to investigate preference of guinea pigs for two different water replacement gels that differed primarily based on sweetener content. The preference and consumption of two commercially available gel products, one with and one without the sweetener high fructose corn syrup (HFCS), were compared in guinea pigs. In addition, the study further evaluated the effect of the sweetener ingredient on palatability to this species.

Material and Methods

Animals

Fifty-two male Hartley guinea pigs (Crl:HA) weighing 330 – 400 grams were used. They were produced and raised in a barrier production room that was maintained at 21 ± 1°C with a relative humidity of 60 ± 5% and a 12/12 hour light/dark cycle. Animals accessed standard guinea pig diet and water *ad libitum*.

Experimental Design

Within the production room, thirty-six animals were randomly selected from the stock colony and assigned into two groups with 18 animals in each group. A third group of 10 animals that served as control was sent directly from the production area to a procedure room for terminal bleeding. The animals in groups one and two were individually identified. Each group was packed according to standard shipping practice, which includes a supply of hard diet and transport gel, with 6 animals per crate. Group one was provided with unsweetened gel (Hydrogel™, ClearH$_2$O®, Portland, ME). Group two was packed with HFCS-sweetened gel (Transgel™, Charles River, Wilmington, MA). Both groups were then shipped via truck to a remote facility overnight and held in the crate at the facility for a total of three days to mimic a trans-continental shipment before evaluation. During clinical evaluation, the body weights of the animals were recorded. Consumption of both gel products was recorded by weighing the remaining gel products. At the end of the evaluation, animals were euthanized with CO_2. Blood samples were collected and submitted to a pathology lab for clinical chemistry and CBC analysis. Follow-up flavor preference testing was performed by providing 6 singly housed male guinea pigs with both water and HFCS-flavored water and the consumption of both fluids was monitored daily for 5 days.

Statistical Analysis

The body weight changes, consumptions of gel products, and water/flavored water were assessed using two-tailed t-test. The changes of CBC and blood chemistry perimeters were analyzed using one-way ANOVA and two-tailed t-test. Differences were considered to be significant when *P* was less than 0.05.

Results

In the group that was supplied with unsweetened gel, the animals consumed 95.5% of supplied gel. On average, a guinea pig consumed 52 grams each day. In contrast, the consumption of HFCS-sweetened gel was only 61.1%. Animals in this group consumed only 34 grams per day per guinea pig (Figure 1). The average body weight losses were only 2.7% for those animals that were supplied with unsweetened gel. However, animals supplied with sweetened gel lost 23% of their original weight (Figure 2). The body weight loss of animals in the latter group was statistically significant (P<0.05).

Figure 1: Consumption of Gel Per Crate

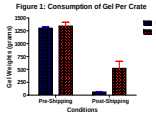
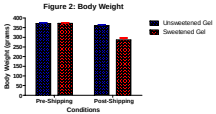


Figure 2: Body Weight



Blood hematocrit values were 53.17 ± 1.55% and 58.83 ± 1.12% for the unsweetened gel group and the sweetened gel group, respectively. The difference between the two groups was statistically significant (P<0.05). Comparing with the control value of 46.53 ± 1.75%, animals in both test groups showed significantly (P<0.05) higher hematocrit values (Figure 3).
As shown in Figure 4, the serum sodium values were 144.3 ± 3.62 meq/l, 149 ± 5.84 meq/l, and 155.9 ± 6.85 meq/l for the control group, the unsweetened group, and the sweetened group, respectively. The difference among the groups was statistically significant (P<0.05).

Figure 3: Hematocrit Values

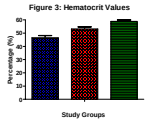
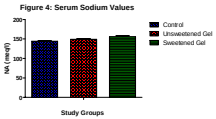


Figure 4: Serum Sodium Values



In this study, the serum chloride value (113.8 ± 2.70g/dl) from animals in the unsweetened gel group was similar to the value (113.1 ± 3.14g/dl) of the control group (Figure 5). However, the value (120.6 ± 4.41g/dl) from animals in the sweetened gel group was significantly higher (P<0.05). The total protein value for the animals in the control group was 5.31 ± 0.54, and the values for the animals in the unsweetened gel group and sweetened gel group were 6.22 ± 0.59 and 6.96 ± 1.11, respectively (Figure 6). The difference among the groups was statistically significant (P<0.05).

Figure 5: Serum Chloride Values

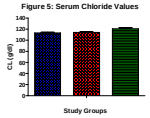
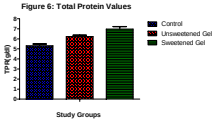


Figure 6: Total Protein Values



The control serum albumin value (3.54 ± 0.37g/dl) was less than both treatment groups at 3.99 ± 0.19 g/dl and 4.25 ± 0.47g/dl for the animals in the unsweetened gel group and sweetened gel group, respectively (Figure 7). The difference among groups was statistically significant (P<0.05). The result of the water preference follow-up study suggested that animals consumed approximately 20% more unflavored water than water sweetened with HFCS, although the difference was not statistically significant (Figure 8).

Figure 7: Serum Albumin Values

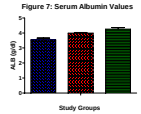
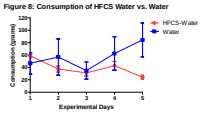


Figure 8: Consumption of HFCS Water vs. Water



Discussion

The results of this study indicated that guinea pigs consumed 34.4% more gel product when shipped with unsweetened gel than when shipped with HFCS-sweetened gel, although the difference of consumption was not statistically significant (P=0.0982). As unsweetened gel products remained within the corners of the gel pouches, and thus were difficult for animals to consume, the authors theorize that animals may have consumed more gel if presented differently. Clinically, the animals in the unsweetened gel group were brighter and showed a cleaner hair coat when unpacked from shipping crates. This observation supported the decreased weight loss seen in animals supplied with the unsweetened gel.
The parameters of clinical chemistry and CBC indicated that animals supplied with both gel types were somewhat clinically dehydrated. However, the significantly elevated values of hematocrit, sodium, chloride, albumin, and total protein in animals that were provided with sweetened gel suggested that animals provided with unsweetened gel were better hydrated after being shipped.

To further explore the apparent preference of guinea pigs for unsweetened gel, a follow-up study comparing consumptions of HFCS-flavored water and regular water was performed. The results of the study suggested that animals consumed more regular water than the flavored water, although results were not statistically significant. The finding suggests that guinea pigs may find HFCS unpalatable. When provided access to water flavored with additional sweeteners, we observed that this species prefers the sweeteners sucralose and molasses over plain water.
The results of this study indicated that Crl:HA guinea pigs provided with an unsweetened hydration gel consumed greater amounts of gel, showed reduced body weight loss, and decreased clinical pathologic indicators of dehydration than animals provided with a HFCS sweetened gel product. In addition, the apparent preference for the unsweetened gel over the sweetened gel may have been due to decreased preference, or aversion, for HFCS.

Acknowledgement

We extend special thanks to ClearH$_2$O®, Inc., for their generosity in providing test hydration gel products.

References

1. Foster, C.H.L., Trexler, P.C., and Rumsey, G. "A canned sterile shipping diet for small laboratory rodents," *Laboratory Animal Care.* **17(4)**, 400 (1967).
2. National Research Council, *Guide for the Care and Use of Laboratory Animals.* (National Academy Press, Washington,DC, 1996).