EFFECTS OF CRUDE OIL INGESTION ON PLASMA OSMOREGULATION IN SALT-STRESSED WHITE PEKIN DUCKS (*Anas platyrhynchos*)

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Recent catastrophic oil spills have demonstrated that petroleum hydrocarbons are acutely toxic to sea and shore birds. Moreover, when apparently healthy oiled birds are cleaned and released, few survive suggesting delayed toxic effects. In this regard, Crocker et al. (Environ. Pollut., 7:165-177, 1974) have recently shown that small amounts of ingested crude oil reduce osmoregulatory transport in the intestine of saline-adapted ducklings. To determine if petroleum hydrocarbons affect salt and water balance in white Pekin ducks (*Anas platyrhynchos*), we administered by stomach tube 0.2 ml of Kuwait crude oil (American Petroleum Institute, analyzed standard; single oral dose approximately equivalent to 0.06 ml per kg body weight) and monitored body weight and plasma electrolyte levels both in dosed birds and in paired controls drinking fresh water (FW), 60% sea water (SW) or 100% SW.

As shown in Figure 1, crude oil dosing did not affect osmoregulatory ability in ducks maintained on FW or on 60% SW. In contrast, experiments on 100% SW tended to exhibit greater body weight loss and higher plasma Na levels than controls; plasma K was not affected (not shown).

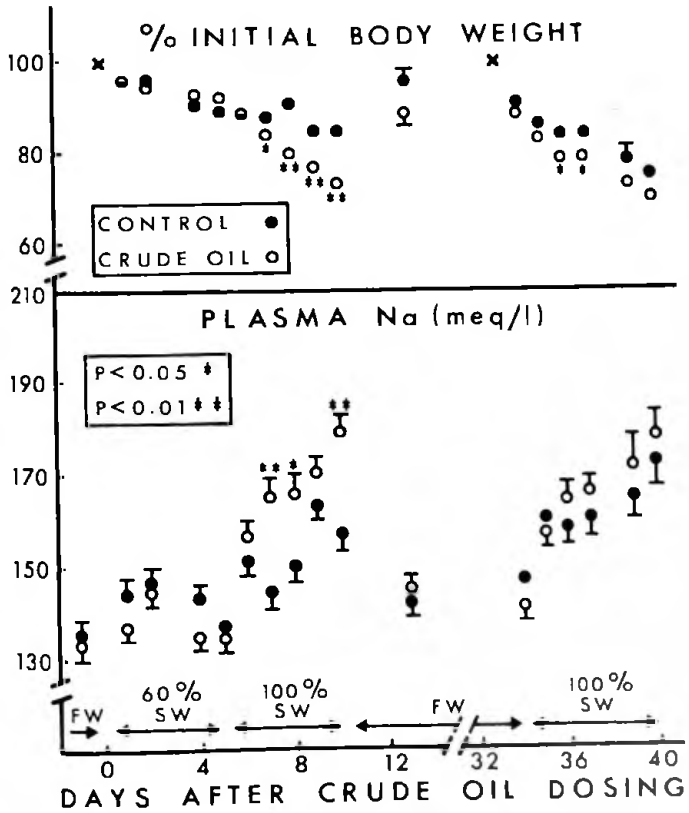

Figure 1. Effect of a single oral dose Kuwait crude oil (0.2 ml) on body weight and plasma Na in white Pekin ducks maintained on FW, 60% SW or 100% SW. Each point represents the mean value derived from 6 birds; when large enough, variability is indicated by SE bars..

These effects persisted even 1 month after dosing (Figure 1). Also, differences between experimentals and controls appeared to be greatest when ducks had access to water of lower salinity, i.e., during heavy rains (Figure 1, days 7, 8 and 10) or after transfer from 100% to 60% SW (additional experiment, not shown). Similar evidence of osmoregulatory impairment was also obtained for ducks dosed with another crude or with either of two refined oils and for herring gulls and black guillemots dosed with crude oil (Miller et al., Fed. Proc., in press, 1977).

The results presented here suggest that petroleum-induced osmoregulatory impairment in marine birds involves both a slightly reduced capacity to obtain solute-free water from 100% SW and a delayed ability to recover when water of lower salinity is available. Our preliminary results suggest that nasal gland Na,K-ATPase is one component of the avian osmoregulatory system that is affected by crude oil.

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IN VIVO RENAL TUBULAR SECRETION OF 2-DEOXY-D-GALACTOSE BY THE WINTER FLOUNDER, *Pseudopleuronectes americanus*

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The renal tubules of the winter flounder, *Pseudopleuronectes americanus*, recently have been shown to possess several distinct carrier-mediated transport systems for sugars at both the peritubular (basal) and luminal (apical) faces of the tubular epithelial cells (J. Gen. Physiol., 62:169-184, 1973; Am. J. Physiol., 231:603-607, 1976). Of particular interest was the observation that free 2-deoxy-D-galactose (2-d-Gal) and perhaps D-galactose (Gal) accumulate within tubular cells to tissue-to-medium concentration ratios (T/M) greater than 1 in vitro (Am. J. Physiol., 231:608-613, 1976). Since the teased tubule preparation exposes only the peritubular face of the tubule to the substrate, this result suggests active peritubular transport of 2-d-Gal into the cell. The ability of Gal to inhibit 2-d-Gal accumulation in vitro (and vice versa) further supported a carrier-mediated peritubular transport mechanism (Am. J. Physiol., 231:608-613, 1976).

Since presentation of substrates in vivo exposes both luminal (via filtration) and peritubular (via peritubular capillaries) faces of the tubular cells, in vivo renal clearance experiments provide a measure of the net transport of that substrate. In conjunction with in vitro data such as that cited above, clearance data permits evaluation of the relative contributions of luminal and peritubular transport to the overall handling of a given substrate (Am. J. Physiol., 231:603-607, 1976). In the studies reported below, we have utilized clearance techniques to evaluate the importance of peritubular transport to net 2-d-Gal excretion in vivo and to examine the specificity of 2-d-Gal transport.

Details of the clearance methods utilized here have been previously reported (Am. J. Physiol., 231:603-607, 1976). Doses of ^{14}C-2-d-Gal and ^{3}H-polyethylene glycol (^{3}H-PEG) were 25 µmol/kg (2 µCi) and 250 mg/kg (5 µCi), respectively. Where used, inhibitor concentrations were 2.5 mmol/kg for Gal and D-glucose and 2.5 µmol/kg for phlorizin. Resulting plasma levels were 5-50 µM 2-d-Gal, 0.5-3 mg/ml PEG, 5-10 mM glucose, and 5-10 µM phlorizin. Total, free, and phosphorylated