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EFFECT OF NICKEL NITRATE ON RENAL FUNCTIONS OF ALBINO RAT

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Abstract

The purpose of this research was to investigate the absorption of nickel nitrate in rats using a renal approach at nickel concentrations of 400, 800, 1600, 3200, and 6400 mg/kg body weight using the renal technique. When nickel concentrations are less than 100 mg/kg body weight, active transport and facilitated diffusion play a critical role in the renal absorption of nickel. Because of saturation of the carriers at greater concentrations, the absorption rate would be reduced at higher concentrations. The distribution of nickel absorbed was investigated by the use of a 100 mg Ni/kg body weight solution administered over a period of 1 to 14 days. The liver is the organ that absorbs the most nickel nitrate, both in terms of concentration and quantity, followed by the kidney. It was discovered that 10% of the original concentration had crossed through the intestinal barrier after 14 days of collection when all of the collected organs (renal function) and blood were tested, but not the liver, after 14 days of collection..

Keywords: Nickel nitrate, renal absorption, nickel distribution, rat

Introduction

To better understand metal ion absorption from the kidney, which is becoming more important as heavy metals accumulate in water and food, it is crucial to do further research. Nickel (Ni) is a first-row transition metal that may be found in abundance in the natural environment. There have been several research conducted on the effects of nickel when it comes into contact with the skin or respiratory products after inhaling nickel-containing dust particles. Only a few studies have looked at the absorption of this element via the kidneys.

Our laboratory investigations on nickel absorption in vivo and by the everted renal sacs in response to oral and intraperitoneal nickel administration. The first form of experiment is time-consuming, but the second permits simply the research of isolated organs to be carried out on them. These considerations prompted us to experiment with an orally administered dosage on renal function in order to investigate the absorption of nickel by the rat's kidney. There are various benefits to using this method. At the outset, the target organ is kept within its natural environment in order to maintain blood and lymph circulation and, as a result, to prevent the cellular damage that is often seen in in vitro research. First and foremost, the equipment required for this experiment is affordable, and the procedure itself is straightforward to carry out. Typical nickel conservation ranges are found in human diets and drinking water, and they are as follows

:Material and Methods

Animals

For each experiment, twenty-five male albino rats of the Wistar strain weighing 400 +50 g were utilised in groups of five, with each group consisting of five animals. For at least one week before to the experiment, the animals were kept in iron cages in a normal temperature room maintained at 22-23 0C with a 12 hour light dark cycle in a normal temperature environment. Food and drink were made available on a first-come, first-served basis.

Designing Using Experimentation

For the experiment, 25 male albino rats (Rattus norvegicus) weighing 100–150 g were chosen from an inbred colony maintained under the supervision of the ethical committee of the zoology department at Dr. B.R. Ambedkar University Agra. The rats were selected under the direction of the ethical committee of the zoology department at Dr. B.R. Ambedkar University Agra. In polypropylene cages 45 cm by 27 cm by 15 cm in size, they were housed at a temperature of 28°C and under a photoperiod of 12 hours each day in the laboratory. The rats were fed a regular pellet diet (Golden feed, New Delhi) and were allowed to drink unlimited amounts of water. Nickel absorption in the kidney of the rat

Following the absorption of nickel solution into the rat kidney, the concentration of nickel measured in the effluent was permitted to observe the progress of the nickel solution.

To investigate the distribution of nickel in the body, researchers collected samples from numerous cells and organs, including renal cells from the kidneys, serum urea, serum uric acid, serum creatinine, and plasma nickel.

The Determination of Nickel

The tissues were treated with concentrated nitric acid to dissolve any mineral material, and the blood was initially diluted 1:2 with 0.9 percent saline before being injected into the tissues. An atomic emission spectrometer was used to determine the quantity of nickel in the sample.

Examining the Data Statistical Analysis

The mean and standard deviation (mean and SD) are used to represent the results. Five rats are used in each experimental group. The Bartlett test was performed to determine whether or not the variances were homogeneous. The analysis of nickel at various concentrations was utilised to make comparisons between groups; the Fisher test was applied in situations where the ANOVA revealed statistically significant differences between groups. The findings of the organs were compared using the t-test for students to see how they compared. The null hypothesis was rejected with a p-value of less than 0.05.

Results

Before and after the insertion of the orthodontic equipment, descriptive statistics of renal nickel concentrations were calculated according to gender.

Before and after the appliances were installed, there was a statistically significant difference (p.05) in the quantity of nickel excreted by the rats. The student t-test (paired t-test) revealed that there was a statistically significant difference between the two periods under consideration.

Following the placement of the orthodontic equipment, researchers discovered an increase in urine excretion. There were no statistically significant variations in renal nickel nitrate levels between the groups before and after the orthodontic appliances were placed, according to the results of the study. It is evident from the data that individual responses are very variable.

Discussion

Nickel is a transition metal that is both hard and ductile in nature. It occurs most often in conjunction with sulphur and iron in pentlanding with sulphur in millerite, with arsenic in the mineral nickel lime, and with arsenic and sulphur in nickel glance. It also occurs in association with sulphur and iron in pentlanding with sulphur in millerite (Nestle et al., 2002). The characteristics of nickel, as well as its dispersion in the environment, have been summarised by the United States Agency for Toxic Substances and Disease Registry (ATSDR) (ATSDR). In a broad range of metallurgical processes, such as electroplating and alloy manufacture, nickel is also used, as is the case with nickel cadmium battery technology. There is evidence to imply that nickel may be an important trace element for mammals, according to some researchers.

The median fatal dosage of nickel nitrate was determined to be 1705 mg/kg body weight. Changes in morphological parameters, such as body weight, kidney weight, and relative kidney weight, were seen in the experimental animals. Following acute and sub-acute treatment with nickel nitrate, it has been discovered that the body weight, kidney weight, and relative renal weight have all reduced. This has been attributed to the toxic action of nickel nitrate on tissues, which has resulted in kidney cell atrophy.

Table 1 : Percentage mortality of albino rats after nickel nitrate treatment

Dose (mg/kg b.wt.)	Number of rats	Treatment period (in days)	Mortality number	Mortality percentage
400	5	14	0	0.00
800	5	14	1	20.00
1600	5	14	2	40.00
3200	5	14	4	80.00
6400	5	14	5	100.00

Table 2 : Calculator for LD_{50} determination for albino rat against nickel nitrate

Dose in mg/kgb.wt.	No. of rats 'N'	% Mor.	log dose 'x'	Empirical probit	Expected probit 'Y'	Working probit 'y'	Weighting coefficient 'n'	Weight w = n x N	wx	wy	wxy	wx^2	wy^2
400	5	0.00	2.6	-	-	-	-	-	-	-	-	-	-
800	5	20.00	2.9	4.16	4.09	4.160	0.471	2.35	6.81	9.77	28.35	17.76	40.66
1600	5	40.00	3.2	4.75	4.85	4.747	0.627	3.13	10.01	14.85	47.54	4732.05	70.53
3200	5	80.00	3.5	5.84	5.51	5.808	0.581	2.90	10.15	16.84	58.95	35.52	97.82
6400	5	100.0	3.8	0.00	6.10	6.723	0.405	2.02	7.67	13.58	51.60	29.16	91.54
								Σw = 10.4	wx = 34.64	Σwy = 186.44	Σwxy = 186.44	Σwx^2= 116.49	Σwy^2 = 300.55

Table 3 : LD_{50} value, variance and fiducial limits of nickel nitrate for albino rat

Experimental Animal	Compound	Regression equation	LD_{50} (in mg/kg b.wt.)	Variance	Fiducial limits
Albino rat (*Rattus norvegicus*)	Nickel nitrate	Y=5.29+2.77 (m-3.33)	1705	0.06	m1 = (+) 3.6137 m2 = (-) 3.5862

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