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BIO-435

Endocrine abstract

The endocrine system controls numerous physiological processes in the human body through hormones. Three distinct processes were examined in this lab: metabolism, hormone replacement therapy, and blood glucose levels. The purpose of these experiments was to better understand these processes and see what effects the metabolic rate, to understand the relationship between optical density and glucose, as well as to see the effects that different hormones have on bone density. Each experiment was done using PhysioEx computer software. To test metabolic rate, a control rat, a thyroidectomized rat (thyroid removed), and a hypophysectomized rat (pituitary gland removed) were used. A baseline metabolic rate and O₂ consumption rate were recorded along with palpitation results for each rat. These measurements were recorded again when thyroxine, TSH (thyroid stimulating hormone), and propylthiouracil was injected into the rats. The metabolic rates and O₂ consumption rates were highest when thyroxine was injected in the rats and lowest when propylthiouracil was used. These results can be seen in Table 1 along with whether masses were found on the treated rats. No masses were found on the thyroidectomized rat because a mass could not form as the rat had to working thyroid. Masses were found on the control rate when TSH and propylthiouracil was used and a mass was found on the hypophysectomized rat when TSH was used. Next, five test tubes were prepared and contained 30 mg/dl, 60 mg/dl, 90 mg/dl, 120 mg/dl, and 150 mg/dl of glucose each. A spectrophotometer was used to determine the optical density of the test tubes differing concentrations. The test tubes were given varying amounts of glucose standard and deionized water. The tubes were then mixed, centrifuged, and the pellet was removed. Five drops of enzyme color reagent were given to each tube and incubated. The results were analyzed, and the findings can be seen in Table 2. As the glucose concentration increased, the optical density increased as well. This experiment was repeated using blood, Barium hydroxide, and heparin. The fasting plasma glucose results (FPG) were measured using a glucose standard curve graph. The recorded optical density and glucose concentrations can be seen in Table 3. The final experiment used a control rat, an estrogen treated rat, and a calcitonin treated rat to determine bone density and the effect hormones can have on it. 1 mL of saline was injected into the control rat, 1 mL of estrogen to the estrogen treated rat, and 1 mL of calcitonin to the calcitonin treated rat. A day was advanced, the rats were anesthetized, and an X-ray screening was performed on each rat. The T score of the bone density of each rat was recorded as can be seen in Table 4. The control rat had a T score of -2.81 which meant it had osteoporosis. The estrogen treated rat had a T score of -1.69 so it had osteopenia. Finally, the calcitonin treated rat had a T score of -2.08 so it had osteopenia. These results concluded that hormones help with bone density in the human body and that in order to prevent bone density thinning and osteoporosis, hormones need to be regulated and used as treatment. The results over these four experiments showed that hormones can have a significant effect on health, whether it is through goiters or bone density. The significance of this experiment was to demonstrate how important hormones are and how essential the endocrine system is at regulating hormones. These tests showed that too much or too little of a hormone can be calamitous for the health of the body.

Table 1: Effects of Hormones on Metabolic Rate

	Normal Rat	Thyroidectomized Rat	Hypophysectomized Rat
Baseline			
Weight (g)	250	244	245
ml O ₂ used in 1 min (ml)	7.3	6.4	6.3
ml O ₂ used per hour (ml)	426	384	378
Metabolic Rate (ml O ₂ /kg/hr)	1704	1574	1543
Palpitation Results	No mass	No mass	No mass
With thyroxine			
Weight (g)	250	244	245
ml O ₂ used in 1 min (ml)	8.4	7.9	7.8
ml O ₂ used per hour (ml)	504	474	468
Metabolic Rate (ml O ₂ /kg/hr)	2016	1943	1910
Palpitation Results	No mass	No mass	No mass
With TSH			
Weight (g)	250	244	245
ml O ₂ used in 1 min (ml)	8.0	6.3	7.7
ml O ₂ used per hour (ml)	480	378	462
Metabolic Rate (ml O ₂ /kg/hr)	1920	1549	1886
Palpitation Results	Mass found	No mass	Mass found
With propylthiouracil			
Weight (g)	250	244	245
ml O ₂ used in 1 min (ml)	6.4	6.3	6.3
ml O ₂ used per hour (ml)	384	378	378
Metabolic Rate (ml O ₂ /kg/hr)	1536	1549	1543
Palpitation Results	Mass Found	No mass	No mass

Table 1: A control rat, a rat without a thyroid (thyroidectomized), and a rat without a pituitary gland (hypophysectomized) were given different hormones to see how their metabolic rate and O₂ consumption rate was affected along with any masses were found. The metabolic rates were highest when thyroxine was injected into the rats and lowest when propylthiouracil was injected into the rats. Masses were only found in the control rate when TSH and propylthiouracil was used and the hypophysectomized rat when TSH was used.

Table 2: Glucose Standard Curve Results

Tube	Optical Density	Glucose (mg/dl)
1	0.30	30
2	0.50	60
3	0.60	90
4	0.80	120
5	1.00	150

Table 2: Five test tubes contained 30 mg/dl, 60 mg/dl, 90 mg/dl, 120 mg/dl, and 150 mg/dl of glucose each. A spectrophotometer was used to determine the optical density of the test tubes differing concentrations. The test tubes were given varying amounts of glucose standard and deionized water. The tubes were then mixed, centrifuged, and the pellet was removed. Five drops of enzyme color reagent were given to each tube and incubated. As the glucose concentration increased, so did the optical density

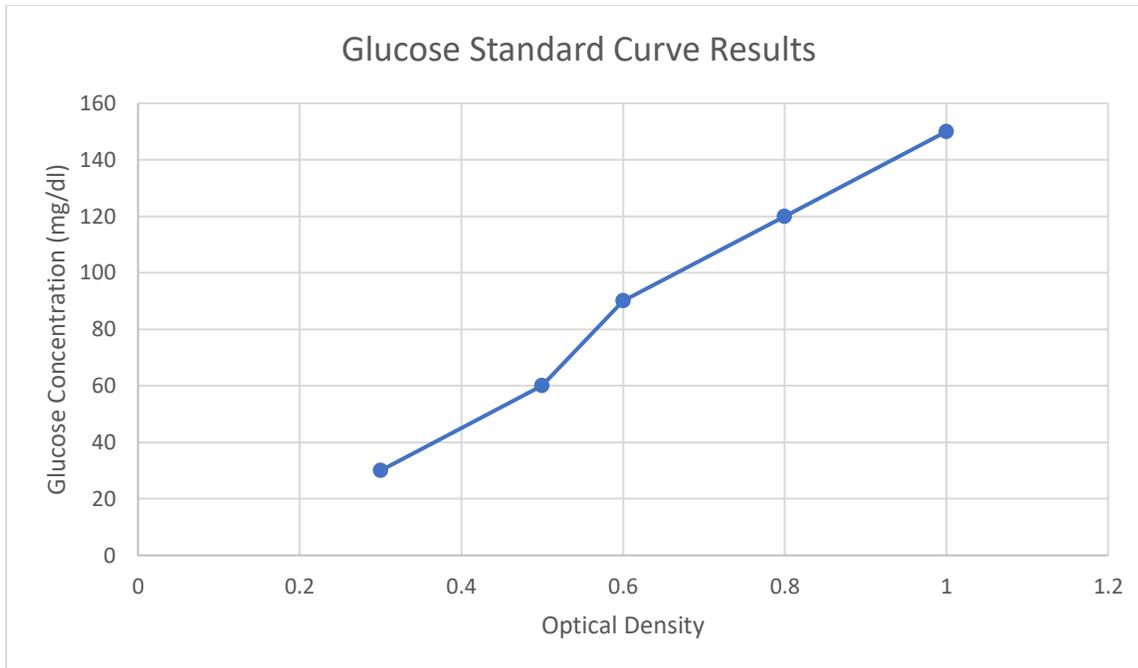


Figure 1: This graph shows the results from Table 1, where the x-axis is optical density and the y-axis is glucose concentration. The trendline shows a positive correlation between optical density and glucose concentration

Table 3: Fasting Plasma Glucose Results

Sample	Optical Density	Glucose (mg/dl)
1	0.73	104
2	0.79	115
3	0.89	131
4	0.83	122
5	0.96	143

Table 3: Three drops of the blood sample were added to each tube along with five drops of deionized water, five drops of barium hydroxide and one drop of heparin into each tube. The tubes were then mixed, centrifuged, pellet removed, enzyme color reagent added, incubated, and analyzed. As glucose concentration increased, the optical density increased as well.

Table 4: Hormone Replacement Therapy Results

Rat	T score
Control	-2.81
Estrogen Treated	-1.69
Calcitonin Treated	-2.08

Table 4: 1 mL of saline was injected into the control rat, 1 mL of estrogen to the estrogen treated rat, and 1 mL of calcitonin to the calcitonin treated rat. A day was advanced, the rats were anesthetized, and an X-ray screening was performed on each rat. The control rate has a T score showing osteoporosis. The estrogen and calcitonin treated rats have a T score showing osteopenia.