DEVELOPMENT OF A LOW RESIDUE DIET FOR SMALL PRIMATES

16061

CONTRACT NASw-517

ANNUAL REPORT

October 4, 1966-October 3, 1967

GPO PRICE $

CFSTI PRICE(S) $

Hard copy (HC) 3.00

Microfiche (MF) .65

ff 653 July 65

Submitted by

SCHWARZ BIORESEARCH
Mountain View Avenue
Orangeburg, New York

N68-16061 (ACCESSION NUMBER)

(THRU)

82 (PAGES)

1 (CODE)

CR# 91904 (NASA CR OR TMX OR AD NUMBER)

04 (CATEGORY)

FACILITY FORM 602

Ralph Shapiro
Ralph Shapiro, Ph.D.
Principal Investigator

SCHWARZ BIORESEARCH

Table of Contents

SCHWARZ BIORESEARCH

Abstract

Preliminary studies were conducted to determine the nutritional efficacy of chemically defined, low residue liquid diets for squirrel monkeys (Saimiri sciureus). Although budgetary limitations restricted the scope and duration of the program, we accomplished the objectives set forth in our contract proposal and were able to demonstrate that squirrel monkeys can be maintained in a healthy condition when a chemically defined liquid diet is their sole source of nutrition.

Twenty male squirrel monkeys participated in a 3 phase transition program in which they were to be switched from a standard stock diet, to several chemically defined powder diets and then to a liquid diet. Eight monkeys successfully passed through each phase. In the course of transition, one monkey died from unknown causes and eleven rejected each of the powdered diets offered. As a result of diet rejection six monkeys died of malnutrition. The other five were returned to the stock diet and eventually recovered.

At present four squirrel monkeys have been maintained on a 50% (w/v) chemically defined liquid diet for 28 weeks and three have been maintained for 16 weeks. The eighth monkey was on liquid diet for 4 weeks when it died from acute heart failure not related to diet. All the animals on liquid diet have either gained or maintained weight and appear active and healthy. There are no signs of hair loss, dermatitis, emaciation or malnutrition. Diet consumption averaged 76 ml/day. On a daily basis this provided 136 calories, 6.9 g protein, 0.15 g fat as ethyl linoleate, 0.19 g calcium and 0.15 g phosphorus. Water consumption averaged 129 ml/day. The monkeys are presently being continued solely on liquid diet and drinking water to

determine whether they can sustain a good state of health for one year.

The success or failure of the liquid regime was found to be dependent upon diet acceptance. This proved to be the chief problem in the present series of experiments. Once diet acceptance was accomplished, nutritional adequacy could be demonstrated. Two dietary manipulations proved useful for expediting the transition to liquid diet and enhancing diet consumption. One entailed diluting the diet to 30% (w/v) with distilled water and providing it as the sole source of water and nutrients. The other was based on the monkeys' preference for apples and involved the addition of apple juice to the diet in place of water. Both procedures helped the monkeys overcome the initial lag in consumption when they were switched to liquid diet.

Metabolism studies with a limited number of animals showed that monkeys' ingesting liquid diet were in positive nitrogen, calcium and phosphorus balance at daily intakes of 1.5, 0.3 and 0.2 g/kg-B.W. respectively. Their retention of nitrogen and calcium was less than when they consumed the stock diet or when compared with control animals maintained on the stock diet throughout the metabolic period. Phosphorus balance was highest for monkeys ingesting the liquid diet.

The metabolism data showed that the calcium content of the liquid diet should be increased to provide around 0.5 g calcium/kg-B.W./day (equivalent to about 0.4 g/day) and that calcium glycerophosphate should be replaced by a different source of dietary calcium to yield a 2:1 Ca:P ratio. The data also showed that the amino acid pattern of the liquid diet requires modification.

Nutrient absorption (nitrogen, calcium and phosphorus) was much greater when the monkeys consumed liquid diet. Total fecal output was reduced by more than 80% and total fecal solids were reduced by more than 90%. The average daily fecal output on the stock diet was 15.3 g wet and 5.7 g dry. On the liquid regime the average daily fecal excretion was 2.6 g wet and 0.4 g dry.

Urine volume was not determined in these studies. The aerosol nature of the urine from male squirrel monkeys resulted in rapid evaporation and prevented quantitative measurements. However, continuous observations indicated that urine output was very small regardless of the diet consumed, and that insensible water loss is probably a major route of water elimination by the squirrel monkey.

During the metabolism studies the intestinal flora were monitored by means of rectal swabs. Definite changes were observed when the monkeys were switched from a stock diet to synthetic diets. The same alterations occurred when diets of the same composition were fed in powder or liquid form. The alterations which occurred when the monkeys were switched to the synthetic diets, were not deleterious and did not appear to influence the monkeys' performance. Individual data from a monkey which remained on stock diet throughout the experiment showed a relatively stable microbial population.

Introduction

The feeding of experimental animals during space travel requires a nutritionally adequate, palatable, low residue diet, which can be readily dispensed in the space vehicle. Experiments at Schwarz BioResearch have shown that these specifications can be satisfied when chemically defined liquid diets are fed to rats(1). In addition, we have shown that a single solution of such a diet can simultaneously satisfy the water and nutritive needs of these animals, thereby offering opportunities for simplifying the feeding system in the space craft(2).

It is well recognized that for medical experimentation, primates are the animals of choice for approximating man. In recent years the squirrel monkey (Saimiri sciureus) has been utilized to an increasing extent in primate studies. Their small size, relative docility and ability to learn rather complex tasks, make them particularly well-suited for space bio-medical research.

Two years ago, investigators at the Naval Aerospace Medical Institute, Pensacola, Florida conducted preliminary tests, in which a chemically defined liquid diet previously used successfully with rodents(1) was modified and fed to squirrel monkeys(3). Although these studies met with only limited success, valuable information was gained concerning the feeding behavior of squirrel monkeys fed such a diet.

The present report represents an extension of this work and describes the results of experiments to determine whether a highly defined low residue, liquid diet can maintain squirrel monkeys in a state of good health and nutrition.

General Procedures

Male squirrel monkeys imported from Columbia, South America were used in all studies. Since this species has not been successfully bred in captivity, their age, decent and early history were unknown. All animals were tuberculin tested and partially dewormed by the supplier prior to delivery. Unless otherwise noted, the monkeys were housed in separate cages in an isolated room. Ambient conditions were kept at: 72-78°F., 56-68% relative humidity and 12 hours of artificial light.

All monkeys were allowed a preliminary environmental adaptation period (1-2 months) followed by a program of dietary transitions designed to culminate in a liquid feeding regime. The monkeys were started on a standard stock biscuit (Rockland Primate Diet), (Table 1), transferred to a casein or hydrolyzate based powder diet (P.D. 2, 3 or 4) (Tables 2, 3 and 4) and finally were switched to a liquid diet, P.D. 5 (Table 5). Fresh food and water were supplied daily and fed *ad libitum*. Because of wide differences in diet acceptance, the feeding program for each monkey differed slightly and in some cases alternate dietary manipulations were instituted to enhance food consumption.

During the course of transition, several monkeys were selected for metabolic balance studies. Each monkey was individually caged in a specially designed metabolic unit to facilitate the quantitative separation and collection of urine and feces (Figure 21). Collections were made for 12 days after a two week dietary adaptation period. Urine specimens were collected under toluene daily at 9:00 AM and 3:30 PM and pooled over a 48 hour collection period. Fecal specimens were collected at 9:00 AM each day and pooled for the entire 12 day period. All fecal samples were immediately frozen. Urine samples were refrigerated immediately after collection. The pooled urine and fecal samples were analyzed for calcium, phosphorus and nitrogen.

During each metabolic period, rectal swabs were taken three times a week from each monkey for bacteriological survey. The bacteria observed were categorized by gram-reaction, morphology and size. The individual types of bacteria were counted in three to five fields on duplicate smears.

Details of the chemical methods, microbiological techniques and individual feeding procedures are described in the Appendix.

Results

Twenty-four monkeys were used in the experimental program. Four died shortly after arrival during the preliminary environmental adaptation period. The etiology of their death is not clear. In three cases, the symptoms were identical: conjunctivitis and blepharitis accompanied by fluid secretions from the eye. This was followed by anorexia and drastically reduced water intake. Death occurred within one week after the initial symptoms became apparent.

Application of bacitracin and polymixin B[1] to the inflamed area was ineffective. Ampicillin oral[2] was also ineffective. Autopsy showed no signs of pneumonia or respiratory infection. Specimens from the lungs, eyes, nose and throat showed the presence of <u>Proteus</u>, <u>Pseudomonas</u> and coagulose positive <u>Staphylococcus aureus</u>. Sensitivity tests showed sensitivity to ampicillin, penicillin, and

---

1 Polysporin, Opthalmic - Burroughs Wellcome Co., Tuckahoe, New York.

2 Omnipen, Oral - Wyeth Laboratories, Philadelphia, Pa.

triacetyloeandomycin (Cyclamycin); resistance to terramycin; and partial resistance to chloramphenical (Chloromycetin), kanamycin (Kantrex), streptomycin and neomycin.

The results obtained from the surviving twenty monkeys are summarized in Tables 8, 9 and 10. During the experiment, five different diets were employed. A comparison of the major nutrients present in each diet is shown in Table 7. Individual feeding schedules and weekly data are presented in Figures 1-20 and in Appendix Table 1-20. The legend for Figures 1-20 is on page 31.

Except for two monkeys (2 and 7) which lost less than 10% of their starting body weights, all monkeys fed the stock diet gained weight. The average daily diet consumption ranged between 30-60 g (111-222 calories) with most monkeys consuming 30-40 g/day (111-148 calories/day). There was no clear correlation between intake and body size although the heavier animals tended to consume more diet. Water consumption did not follow any particular pattern. It ranged between 72-164 ml/day with most of the monkeys consuming between 75 and 115 ml/day.

During the transition period all monkeys, but one, lost weight. The weight losses were most severe for those transferred directly to the hydrolyzate-based powder diets (P.D. 3 and 4) (Monkeys 13 through 20A) and were due to diet rejection. Average daily diet intake decreased to 19 g/day (67 calories/day) and ranged between 10 to 30 g (36-108 calories/day). Water intake also decreased and averaged 79 ml/day (range 48-94 ml/day). Six monkeys fed the hydrolyzate-based powder diets died from malnutrition. Only three (14, 15 and 17B) overcame their weight loss and completed the transition to liquid diet.

Body weight loss was not as great when the monkeys were fed a casein-based powder diet (P.D. 2) during transition. Diet intake averaged 46 g/day (173 cal/day) and the average water intake increased to 99 ml/day. In all cases where the monkeys were transferred directly from P.D. 2 to the liquid diet the transition was successful. Since caloric intake for most of the monkeys was greater than on the stock diet (144 cal/day), poor diet utilization, nutrient deficiency and/or, nutrient imbalance were probably responsible for the observed weight losses. In view of the similarity in composition of P.D. 2 (Table 2) and the nutritionally adequate liquid diet, P.D. 5 (Table 5), it is most likely that nutrient deficiency resulting from poor utilization of the powder diet was primarily responsible.

A total of seven monkeys successfully completed the transition to liquid diet (P.D. 5). Although the data in Table 8 show that they were kept on this regime 12-24 weeks, we have maintained them for an additional 4 weeks (i.e. a total of 16-28 weeks) and plan to continue them on this diet for at least one year. All are maintaining or gaining weight, and all appear active and healthy. Diet intake ranged between 61 and 96 ml/day (111-175 cal/day) and averaged 76 ml/day (equivalent to approximately 38 g/day on a dry matter basis). Water intake ranged between 90 and 171 ml and was higher than when the monkeys were on the powder or stock diets.

Two dietary manipulations were used to enhance liquid diet consumption. One entailed diluting the diet to 30% (w/v) with distilled water and providing it as the sole source of water and nutrients. The other was based on the monkeys preference for apples and involved the addition of apple juice (Table 6) to the diet in place of water. Once the monkeys adapted to the liquid regime the concentration was restored to 50% (w/v) and/or the apple jucie was replaced by an equivalent volume of water. In two cases (Monkeys 4 and 6) apple juice could not be withdrawn from the diet without resulting in reduced intake.

Table 10 shows comparative data obtained from the seven monkeys completing the transition to liquid diet. Diet and caloric intake as well as body weight gain were similar on the stock and liquid diets over almost equivalent time periods. All the monkeys except No. 4 lost weight during the transition period even though caloric intake was greatest. The factors which may have been responsible for this weight loss were described earlier.

Ad libitum water consumption was more than 20% greater when the monkeys consumed liquid diet. Taking into account the water provided by the liquid diet the total fluid intake was more than 60% greater than on the other two dietary regimes. Apparently, this increased fluid intake represents an attempt by the squirrel monkey to compensate for the osmotic load imposed by the rapid absorption of nutrients from the diet.

The results of metabolic studies with monkeys fed the stock diet and the liquid diet are presented in Tables 11, 12 and 13. Phase I was a 12 day collection period in which all the monkeys were on stock diet. Phase III represents a second 12 day collection period comparing monkeys 5, 10 and 16 which were kept on the stock diet and monkeys 14, 15 and 17 which had been successfully adapted to liquid diet.

Total fecal excretion was reduced by more than 80% when the monkeys were switched to liquid diet. The total dry solid material was also significantly reduced (more than 90%). Average nitrogen, calcium and phosphorus excretion decreased by approximately 60%, 70% and 50% respectively.

Urine volume was not determined in the present study. It was found that male squirrel monkeys excrete an aerosol-like urine at irregular intervals and in small quantities. This resulted in rapid evaporative losses from the walls of the metabolism unit and prevented accurate measurement of urine volume. Nevertheless, urine output was observed to be minimal even on the liquid regime, suggesting that squirrel monkeys have a very high insensible water loss.

The analytical data (Tables 11, 12 and 13) show wide variations for each animal and between animals for each of the constituents measured. All of the monkeys were in positive nitrogen, calcium and phosphorus balance regardless of the diet consumed. Of the three monkeys switched to liquid diet (14, 15 and 17), two decreased in nitrogen balance and one remained essentially the same. Calcium balance decreased in all instances where the monkeys were switched to liquid diet whereas phosphorus balance increased. Comparison with the control animals kept on stock diet throughout the experiment also shows that nitrogen and calcium balance were generally higher for the stock-fed animals whereas phosphorus balance was greater for animals fed the liquid diet.

The lower calcium balance observed with the liquid fed monkeys was due to inadequate intake. Calcium utilization was virtually the same when they were fed the stock or liquid diet (89 vs 85% retention respectively). Since the phosphorus concentration (0.5%) was adequate, as evidenced by the greater phosphorus balance of the liquid fed animals, it appears that the ratio of Ca:P (1:1) in calcium glycerophosphate (the primary source of calcium and phosphorus in the liquid diet) is not optimal for the squirrel monkey. The calcium concentration of the stock diet used in this study was 1.1% and the Ca:P ratio was about 2:1 (Table 1). This provided an average daily calcium intake of 0.5 g/kg-B.W./day (equivalent to 0.4 g/day) and promoted strong calcium balance. In order to furnish this level of intake with liquid diet and also achieve a favorable Ca:P ratio (2:1), its calcium concentration must be increased from 0.5% to 1% with a water soluble source of calcium other than calcium glycerophosphate.

Although total nitrogen intake was higher for the stock fed monkeys (1.7-2.0 g/kg-B.W./day vs 1.4 g/kg-B.W./day) it is doubtful that this was the primary factor responsible for greater retention. The lower nitrogen balance of monkeys fed the liquid diet was more likely due to a sub-optimal dietary amino acid pattern than to inadequate nitrogen intake. Had the amino acids in the diet been properly balanced, it may have been possible to reduce the total dietary nitrogen still further. This view is supported by the low percentage retention (60%) and high urinary nitrogen output of monkeys fed liquid diet and undoubtedly reflects the excretion of free amino acids not utilized by the animal.

During the course of the metabolism studies gram-stained smears were prepared from material obtained via rectal swabs of squirrel monkeys to determine any diet induced changes in the intestinal flora. The bacteria were categorized by gram reaction, morphology and size.

Fourteen different bacterial types were observed and counted in the stained smears. Four of these were peculiar to specific individual monkeys, several others appeared sporadically and four types appeared rather consistently in all the smears. One type, a gram-negative coccobacillus occurring singly and in pairs, was not observed until the monkeys were fed synthetic diets. This organism accounted for nearly 40% of the bacteria present in specimens obtained from monkeys consuming synthetic diets (Table 14). It measured 0.5 by 1.0 u and was designated type N.

Two large, thick, gram-negative bacilli were presented in virtually all the animals and, regardless of diet appeared as a relatively consistent but low percentage of the bacterial population. Five types of gram-positive organisms were present in smears during the first four weeks of metabolism study. Their numbers decreased during the fifth and sixth weeks, when synthetic diets were fed, and were observed in only two animals after the sixth week.

A slender, straight, gram-negative bacillius, occurring singly, and measuring 0.5 u wide and 2 u long, represented about 19% of the bacterial population in animals consuming stock diets, and 37% of the population in specimens obtained from animals consuming synthetic diets (liquid or powder). This organims was designated type D.

The organism designated as type A was a slender, long, curved, gram-negative bacillus with pointed ends, measuring approximately 0.2 by 5 u. This organism accounted for an average of 54% of the bacterial population in specimens obtained from monkeys consuming the stock diet (Table 14). Type A was present at levels of 12% and 2% respectively in monkeys consuming powdered synthetic and liquid synthetic diets. One monkey (17) feeding on liquid diet had inadvertantly gained access to a biscuit of stock diet and fed on it for a period of about one hour. Overnight, its level of type A bacteria rose from 2% to 53%.

Fourteen bacterial types were counted individually. For clarity and conciseness of presentation, the bacteria were grouped as: gram-positive; gram-negative other than types A, D or N; and the three individual types A, D and N described previously.

The data presented in Table 14 represents mean values for all animals in the experiment. Monkeys 14, 15 and 17 are presented as individuals in Table 15 because only these three had received all diets during the metabolism studies. Individual data for monkey 16 represents a subject which remained on stock diet throughout the experiment (Table 16). This monkey's flora is shown to be relatively stable, with the exception of the gram-positive bacteria which seem to be transient at the dilution used to prepare the stained smears.

The presence of bacterial types D and N increased greatly upon administration of synthetic diets (Tables 14 and 15), while type A decreased under the same conditions. Decreases in the gram-positive population were not solely related to the type of diet being consumed.

Discussion

In view of the history of past failures to achieve an effective liquid diet for squirrel monkeys, the results of these experiments are very encouraging. To our knowledge, these studies represent the longest period of time a group of squirrel monkeys have been successfully maintained in a good state of health on a low residue, water soluble chemically defined diet.

While only eight out of twenty monkeys successfully completed the transition to liquid diet, we believe greater success would have been achieved had we employed the conditioning techniques learned in the course of this study. Most of the failures in the present experiment were not related to limitations of the liquid diet but were due rather to the monkeys' rejection of the synthetic powder diets. This rejection may have been due to a) unacceptable physical form i.e. pellets or biscuits may have been more acceptable b) excessively high concentration of free amino acids with consequent effect on flavor or other unknown appetite factors c) nutrient deficiency and/or imbalance. Whatever the responsible factor(s), we believe that had the transition diets been modified or eliminated, more monkeys would have been successfully switched to the liquid diet. It may be possible, for example, to transfer squirrel monkeys directly from stock diet to liquid diet by employing the same apple juice dilution, and water dilution techniques used with those animals successfully completing the transition.

The marked decrease in fecal output both on a wet and dry basis was particularly encouraging. The decrease was primarily due to the absence of bulk in the liquid diet as well as increased nutrient absorption. Contrary to common belief, the absence of dietary bulk did not seem to adversely affect the animals and, while alterations in intestinal flora occurred, none were deleterious.

Unfortunately, urine volume could not be accurately determined in this study due to rapid evaporative losses. Our observations indicated that the animals excreted a low volume of urine regardless of the diet being consumed. In view of the high fluid intake on the liquid regime it would appear that squirrel monkeys have a large insensible water loss. Clearly, quantitative data on urine volume and insensible water loss is especially important for the proper design of the space capsule and should be obtained in future experiments.

Although the monkeys have been maintained in good health on the liquid diet for as long as 28 weeks, both the maintenance data and metabolic data indicate that modifications are necessary to improve its utilization. The present study showed the necessity for adjusting the amino acid pattern, as well as calcium source and level. Undoubtedly other alterations will also be necessary as the nutrient requirements of the squirrel monkey become known.

Due to budgetory restrictions it was necessary to conduct these experiments with a limited number of animals over a relatively short period of time. This was especially true in the case of the metabolism and microbiological studies where data were obtained from only 3 monkeys on liquid diet and where classification of the intestinal flora was limited. It should be recognized therefore that the results of these experiments are preliminary and require additional follow up. The following list of recommendations suggests those areas of investigation which we feel will be useful to NASA in the future development of liquid diets for squirrel monkeys and other primates.

1) Adaptation studies determine the most expeditious way to transfer squirrel monkeys to a liquid diet and to establish a routine procedure of implementation.

2) Long term studies to determine whether squirrel monkeys can be maintained in a good state of health for at least one year.

3) Metabolism studies (preferably with female squirrel monkeys) to establish requirement levels for such major nutrients as protein, energy, calcium, and phsophorus and to determine nutrient utilization by monkeys fed liquid diets.

4) Performance studies to determine whether squirrel monkeys which have been maintained on a liquid diet for at least 6 months can perform in-flight tasks with the same dexterity as control animals fed stock diets.

5) Microbiological studies to isolate and biochemically identify the intestinal flora of squirrel monkeys on solid and liquid diets.

TABLE-1

ROCKLAND LABORATORY PRIMATE DIET

Guaranteed Analysis:

Crude Protein ....17.0% Min.
Crude Fat .... 5.0% Min.
Crude Fiber .... 3.0% Max.

Ingredients

Ground Yellow Corn
Dried Skimmed Milk
Dehulled Solvent Extracted Soybean Meal
Animal Fat (preserved with Propylene Glycol, BHT, Citric Acid)
Ground Whole Wheat
Dehydrated Alfalfa Meal
Brewer's Dried Yeast
Cane Sugar
1.5% Calcium Carbonate
0.75% Dicalcium Phosphate
0.5% Salt
Vitamin B-12 Supplement
Riboflavin Supplement
Calcium Pantothenate
Niacin
Folic Acid
Pyridoxine Hydrochloride
Thiamine Hydrochloride
Vitamin A Palmitate
D-Activated Plant Sterol (Source of Vitamin D-2)
Vitamin E Supplement
Choline Chloride
Ascorbic Acid, and traces of Manganese Sulphate
Iron Carbonate
Iron Oxide
Copper Oxide
Cobalt Carbonate
Potassium Iodide
Zinc Sulphate

TABLE-2

COMPOSITION OF PURIFIED-SOLID DIET NO. 2
P.D. 2

Ingredient	Grams/Kilo
Casein	200
Cerelose	596
DL-Methionine	5
B-Vitamin Mix No. 116	75
Mineral Mix No. 15 H	68
Ascorbic Acid	1
Choline·HCl	5
Fat Mix No. 517-1	50

(continued)

SCHWARZ BIO RESEARCH

TABLE-2 (continued)

B-Vitamin Pre-Mixture No. 116

Ingredient	Grams/50 Grams
Ascorbic Acid	0.500
Biotin	0.0003
B_{12} (0.1% trituration)	0.100
Calcium Pantothenate	0.050
Folic Acid	0.0005
Inositol	0.250
Niacin	0.0375
Para-aminobenzoic acid	0.300
Pyridoxine·HCl	0.0063
Riboflavin	0.0075
Thiamine·HCl	0.005
Glucose	48.743

Mineral Mix No. 15H

Ingredient	mg/13.51g mix
Sodium Chloride	916.0
Sodium Bicarbonate	700.0
Potassium Gluconate	5,148.0
Magnesium Gluconate	828.0
Calcium Glycerophosphate	5,572.0
Ferrous Ammonium Sulfate	280.0
Ammonium Molybdate·$4H_2O$	1.2
Cobalt Acetate·$4H_2O$	1.8
Cupric Acetate·$4H_2O$	3.0
Manganese Acetate·$4H_2O$	52.0
Potassium Iodide	6.0
Zinc Benzoate	4.4

Fat Mix No. 517-1

Ingredient	mg/Kilo
Corn Oil	998.421g
Vitamin A Acetate	599
Vitamin D_3	250
α-Tocopherol Acetate	729
Menadione	1

Table 3

COMPOSITION OF PURIFIED SOLID DIET-3
P.D. 3

Ingredient	Grams/Kilo
Cerelose	603.7
Acid hydrolyzed protein	204.6
L-Methionine	6.7
L-Tryptophan	3.0
L-Arginine·HCl	1.8
B-Vitamin Mix No. 116[1]	75.0
Choline·HCl	5.0
Mineral Mix No. 15H[1]	68.0
Fat Mix No. 116 w D_3[2]	10.1

1 For composition see Table 2.

2 Per 10.1 g fat mix 116: Vit. A acetate (3000 IU/mg) 10 mg; Calciferol (40 IU/mg) 7.0 μg; Menadione 4.2 mg; α-tocopherol acetate (1 IU/mg) 50.0 mg; Vitamin D_3 19.8 mg; Ethyl linoleate 4.0 g; Polysorbate 80 6.0 g.

SCHWARZ BIORESEARCH

Table 4

COMPOSITION OF PURIFIED SOLID DIET-4
P.D. 4

Ingredient	grams/kilo
Cerelose[1]	606.8
Acid Hydrolyzed protein	204.6
L-Methionine	6.7
L-Tryptophan	3.0
L-Phenylalanine	7.0
L-Arginine·HCl	1.8
L-Lysine·HCl	8.8
Glycine	3.2
B-Vitamin Mix No. 116[2]	75.0
Choline·HCl	5.0
Mineral Mix No. 15H[2]	68.0
Fat Mix No. 116 w D_3[3]	10.1

1. Glucose hydrate, Technical - Corn Products, New York, New York.
2. For composition see Table 2
3. For composition see Table 3

Table 5

COMPOSITION OF LIQUID DIET-5[1]
P.D.5

Ingredient	grams/liter
Cerelose[2]	303.4
Acid Hydrolyzed protein	102.3
L-Methionine	3.4
L-Tryptophan	1.5
L-Phenylalanine	3.5
L-Arginine·HCl	0.9
L-Lysine·HCl	4.4
Glycine	1.6
B-Vitamin Mix No. 116[3]	37.5
Choline·HCl	2.5
Mineral Mix No. 15H[3]	34.0
Fat Mix No. 116 w D_3[4]	5.1

1. 50% weight:volume solid nutrients.
2. Glucose, Anhydrous - Corn Products, New York, New York.
3. For composition see Table 2.
4. For composition see Table 3.

TABLE 6

APPROXIMATE ANALYSIS OF MOTT'S APPLE JUICE	
Total soluble solids	12.6%
Carbohydrate	12.2%
Protein	0.1%
Fat	0.05%
Ash	0.25%
Calcium mgs/100 grams	6.00
Phosphorus mgs/100 grams	9.00
Iron mgs/100 grams	0.60
Sodium mgs/100 grams	1.00
Thiamin mgs/100 grams	0.01
Riboflavin mgs/100 grams	0.02
Niacin mgs/100 grams	0.10
Ascorbic Acid mgs/100 grams	1.00
Potassium mgs/100 grams	100.00

TABLE 7

COMPARISON OF MAJOR INGREDIENTS PRESENT IN TEST DIETS*

Ingredient		Test Diet			
	Stock**	P.D.2	P.D.3	P.D.4	P.D.5***
Protein Equiv† %	17	17	18	18.1	18.1
Carbohydrate %	65	67	68	68.6	68.6
Fat %	5	5	0.4	0.4	0.4
Fiber %	3	0	0	0.0	0.0
Calcium %	1.1	0.5	0.5	0.5	0.5
Phosphorus %	0.6	0.4	0.4	0.4	0.4
Calories cal/g	3.7	3.8	3.6	3.6	3.6

*Values calculated on a dry matter basis.
**Rockland Laboratory Primate Diet.
***Liquid diet.
†N x 6.25. Provided by: natural proteins in the stock diet; Casein + supplemental amino acids in P.D. 2; and acid hydrolyzed casein + supplemental amino acids in P.D. 3, 4 and 5.

TABLE 8

SUMMARY OF DATA OBTAINED FROM MALE SQUIRREL MONKEYS ON THREE DIFFERENT DIETARY REGIMES*

No.	Stock Diet					Transition Diet				Liquid Diet			
	Dur.	Body Wt.		Consumption		Dur.	Body Wt.	Consumption		Dur.	Body Wt.	Consumption	
		Initial	△	Diet	Water		△	Diet	Water		△	Diet	Water
	wks.		g	g/day	ml/day	wks.	g	g/day	ml/day	wks.	g	ml/day	ml/day
2	8	1,119	(-) 20	60.0	164.0	12	(-)145	54.3	109.1	24	(+)124	97.4	109.6
4	8	782	(+)194	59.7	153.9	12	(+) 13	53.5	84.3	21	(+) 51	61.4	89.9
5	13	620	(+) 94	40.9	105.6	1	(-)175	13.1	49.1	31**	(+)255	103.9g**	52.3
6	8	623	(+)128	38.6	112.9	13	(-) 52	47.2	90.6	24	(+) 10	76.9	105.1
7	8	696	(-) 39	33.9	83.1	13	(-) 61	44.0	85.6	23	(+)135	71.3	114.9
8	8	762	(+) 24	36.9	144.7	13	(-)215	43.7	139.1	0	Died - Malnutrition+		
9	8	597	(+) 39	35.9	108.9	13	(-)145	43.2	86.7	0	Died - Malnutrition+		
10	8	774	(+) 63	39.6	111.4	7	(-)116	33.4	96.1	28	(+)377	60.9g**	133.3
13	20	677	(+)181	43.3	93.9	4	(-)170	29.1	102.3	4**		60.6g**	134.9
14	20	668	(+) 61	33.1	82.3	3	(-) 66	28.6	93.3	12	(+)171	74.7	148.4
15	20	587	(+) 74	31.7	78.6	3	(-) 93	23.6	98.1	12	(+)116	78.7	160.9
16	20	718	(+)124	37.4	96.7	3	(-)334	15.4	65.7	14**	(+)440	53.9g**	124.1
17A	14	522	(+)217	29.9	82.9	Died - Unknown Cause							
17B	20	691	(+)195	45.3	104.9	4	(-)187	30.4	94.1	12	(+) 10	69.3	171.4
18A	20	654	(+) 22	32.6	76.4	2	-	12.9	84.6	5**	-	39.9g**	107.9
18B	22	797	(+) 91	39.7	76.6	2	(-)324	18.1	78.3	6**	(+)302	46.9g**	154.4
19A	21	637	(+)112	33.4	78.1	2	(-)227	16.9	89.9	0	Died - Malnutrition+		
19B	22	737	(+) 45	33.1	79.7	3	(-)291	11.3	69.4	0	Died - Malnutrition+		
20A	21	667	(+) 81	34.7	71.9	2	(-)146	9.9	47.9	0	Died - Malnutrition+		
20B	22	610	(+)148	36.1	76.3	2	(-)306	14.6	77.9	0	Died - Malnutrition+		

*For detailed data see Figures 1-20 and Appendix Tables 1-20. Composition of diets shown in Tables 1-5.
**Returned to stock diet.
+Died during the transition phase.

TABLE 9

DAILY NUTRIENT CONSUMPTION OF MALE SQUIRREL MONKEYS ON THREE DIFFERENT DIETARY REGIMES

Regime		Control Diet		Transition Diets				Liquid Diet	
Nutrient		Stock Diet		P.D.2		P.D. 3 & 4		P.D.5	
		Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.
Protein	g	5.1- 10.2	6.6	5.7 - 9.2	7.8	1.8 - 5.5	3.4	5.6 - 8.8	6.9
Carbohydrate	g	19.4- 39.0	25.2	22.4 - 36.4	30.6	6.8 - 20.9	12.8	21.1 - 33.4	25.9
Fat	g	1.5- 3.0	1.9	1.7 - 2.7	2.3	0.04- 0.12	0.07	0.12- 0.19	0.15
Calcium	g	0.3- 4.7	0.43	0.17- 0.27	0.22	0.05- 0.15	0.09	0.15- 0.24	0.19
Phosphorus	g	0.2- 0.5	0.23	0.13- 0.22	0.18	0.04- 0.12	0.07	0.12- 0.19	0.15
Calories		110.6-222.0	143.6	126.9 -206.3	173.3	35.6 -109.4	67.3	110.5 -175.3	136.3
Water	ml	71.9-164.0	99.1	84.3 -139.1	98.8	47.9 - 94.1	79.2	89.9 -171.4	128.6

TABLE 10

AVERAGE BODY WEIGHT, DIET CONSUMPTION AND WATER CONSUMPTION OF MALE SQUIRREL MONKEYS ON THREE DIFFERENT DIETARY REGIMES*

Dietary Regime	Av. Dur.	Av. Body Weight			Av. Daily Consumption		
		Initial	Final	△	Diet	Energy	Water
	wks.		g		g	cal.	ml
Stock Diet	13	738	823	(+)85	40.7	150.6	102.5
Transition Diet	9	820	741	(-)79	49.9	199.6	92.7
Liquid Diet	14	718	783	(+)65	38.8**	143.6	121.7

*Composition of diets shown in table 1-5. Averages obtained from seven monkeys (2, 4, 6, 7, 14, 15, 17B) during each regime.
**Based on a 50% (w/v) diet.

TABLE 11

URINALYSIS OF SQUIRREL MONKEYS FED
A STOCK DIET AND A LIQUID DIET*

	Body Wt.		Nitrogen**		Phosphorus**		Calcium**	
Phase***	I	III	I	III	I	III	I	III
Monkey	g		mg/kg-B.W./day					
5	722	779	212	285	2.9	2.6	0.99	1.32
10	949	1,016	114	226	2.3	3.9	0.99	2.31
16	842	846	153	409	2.0	6.2	0.99	2.97
14	729	753	239	182	4.2	17.9	1.32	6.27
15	661	647	120	621	1.6	18.9	.66	7.26
17	886	731	251	711	2.9	18.6	1.32	6.6

*Rockland Primate Diet, Teklad Co., Monmouth, Illinois. Liquid Diet: P.D.5.

**Analytical procedures described in the Appendix.

***Monkeys 5, 10 and 16 were fed the stock diet during both phases. Monkeys 14, 15 and 17 were fed the stock diet during phase I and liquid diet during phase III. The results represent mean values for a 12 day collection period.

SCHWARZ BIORESEARCH

TABLE 12

FECAL EXCRETION OF SQUIRREL MONKEYS
FED A STOCK DIET AND A LIQUID DIET*

	Total Fecal Ex.				Nitrogen**		Phosphorus**		Calcium**	
	Wet		Dry							
Phase***	I	III	I	III	I	III	I	III	I	III
Monkey	g/kg-B.W./day				mg/kg-B.W./day					
5	21	27	8	10	540	780	42.4	48.9	56.1	75.9
10	28	48	9	16	740	1,300	78.2	71.7	99.0	102.3
16	10	39	3	13	110	113	16.3	65.2	19.8	102.3
14	21	4	7	0.4	230	60	52.2	13.0	59.4	16.5
15	14	3	5	0.5	170	90	26.1	13.0	49.5	23.1
17B	24	3	10	0.8	220	100	42.4	35.9	59.4	36.3

*Rockland Primate Diet, Teklad Co., Monmouth, Illinois. Liquid Diet: P.D.5.

**Analytical procedures described in the Appendix.

***Monkeys 5, 10 and 16 were fed the stock diet during both phases. Monkeys 14, 15 and 17 were fed the stock diet during phase I and liquid diet during phase III. The results represent mean values for a 12 day collection period.

TABLE 13

AVERAGE DAILY NITROGEN, PHOSPHORUS AND CALCIUM BALANCE OF SQUIRREL MONKEYS CONSUMING STOCK AND LIQUID DIETS*

Monkey	Phase***	Body Wt.	Nitrogen** Intake	Nitrogen** Ex.	Nitrogen** Bal.	Phosphorus** Intake	Phosphorus** Ex.	Phosphorus** Bal.	Calcium** Intake	Calcium** Ex.	Calcium** Bal.
		g	mg/kg-B.W./day			mg/kg-B.W./day			mg/kg-B.W./day		
5	I	722	2.60	0.75	1.85	185	45	140	557	57	500
	III	779	2.92	1.07	1.85	212	52	160	627	77	550
10	I	949	2.06	0.85	1.21	147	81	66	439	100	339
	III	1,016	2.60	1.53	1.07	186	76	110	558	105	453
16	I	842	1.67	0.26	1.41	121	18	103	356	21	335
	III	846	2.42	1.54	0.88	173	71	102	518	105	413
14	I	729	1.73	0.47	1.26	124	56	68	370	61	309
	III	753	1.42	0.24	1.18	212	31	181	297	23	274
15	I	661	1.95	0.29	1.66	140	28	112	416	50	366
	III	647	1.44	0.71	0.73	215	32	183	300	30	270
17	I	886	1.97	0.47	1.50	140	45	95	422	61	361
	III	731	1.52	0.81	0.71	225	55	170	317	43	274

*Rockland Primate Diet, Teklad Co., Monmouth, Illinois (table 1). Liquid Diet: P.D.5 (table 5).

**For analytical procedures see Appendix Table.

***Monkeys 5, 10 and 16 were fed the stock diet during both phases. Monkeys 14, 15 and 17 were fed the stock diet during phase I and liquid diet during phase III. The results represent mean values for a 12 day collection period.

TABLE 14

BACTERIAL TYPES PRESENT IN RECTAL SPECIMENS,
MEAN VALUES FOR ALL EXPERIMENTAL MONKEYS

Diet	Percent of Bacterial Population, Mean Value				
	Type A*	Type D*	Type N*	Gram Negative Group**	Gram Positive Group
Stock (biscuit)	54.3	18.7	0	14.4	12.9
P.D. 4 (powder, synthetic)	11.8	37.8	35.0	10.5	7.3
P.D. 5 (liquid, synthetic)	2.3	37.3	42.0	18.0	0.0

*Described in text.
**Gram negative organisms other than types A, D or N.

SCHWARZ BIO RESEARCH

TABLE 15

BACTERIAL TYPES PRESENT IN RECTAL SPECIMENS, MEAN VALUES FOR THREE MONKEYS WHICH HAVE RECEIVED ALL DIETS

Diet	Percent of Bacterial Population, Mean Value				
	Type A*	Type D*	Type N*	Gram Negative Group**	Gram Positive Group
2A. Monkey No. 14					
Stock (biscuit)	65	5	0	27	3
P.D. 4 (powder, synthetic)	16	38	24	15	7
P.D. 5 (liquid, synthetic)	3	31	40	8	0
2B. Monkey No. 15					
Stock (biscuit)	65	14	0	16	5
P.D. 4 (powder, synthetic)	2	32	45	12	12
P.D. 5 (liquid, synthetic)	2	43	43	12	0
2C. Monkey No. 17					
Stock (biscuit)	49	14	0	10	26
P.D. 4 (powder, synthetic)	5	52	32	10	1
P.D. 5 (liquid, synthetic)	2	38	43	16	0

*Described in text.
**Gram negative organisms other than types A, D or N.

TABLE 16

BACTERIAL TYPES PRESENT IN RECTAL SPECIMENS, MEAN VALUES FOR MONKEY NO. 16 CONSUMING STOCK DIET THROUGHOUT EXPERIMENT

	Percent of Bacterial Population, Mean Value				
Diet Metabolism Phase	Type A*	Type D*	Type N*	Gram Negative Group**	Gram Positive Group
Phase I	68	9	0	13	11
Phase II	56	9	2	19	14
Phase III	64	18	3	15	0

*Described in text.
**Gram negative organisms other than types A, D or N.

LEGEND FOR FIGURES 1-20

Trans.:	Transition phase	
Stock Diet:	Teklad, Rockland Primate Diet	(Table 1)
P.D. 2:	Casein based powder diet	(Table 2)
P.D. 3:	Hydrolyzate based powder diet	(Table 3)
P.D. 4:	Hydrolyzate based powder diet	(Table 4)
P.D. 5:	Liquid Diet	(Table 5)
	Another diet fed simultaneously with liquid diet. The broken line represents volume of liquid diet consumed. The solid line represents weight of solid diet consumed.	

Figure No. 1
Monkey No. 2

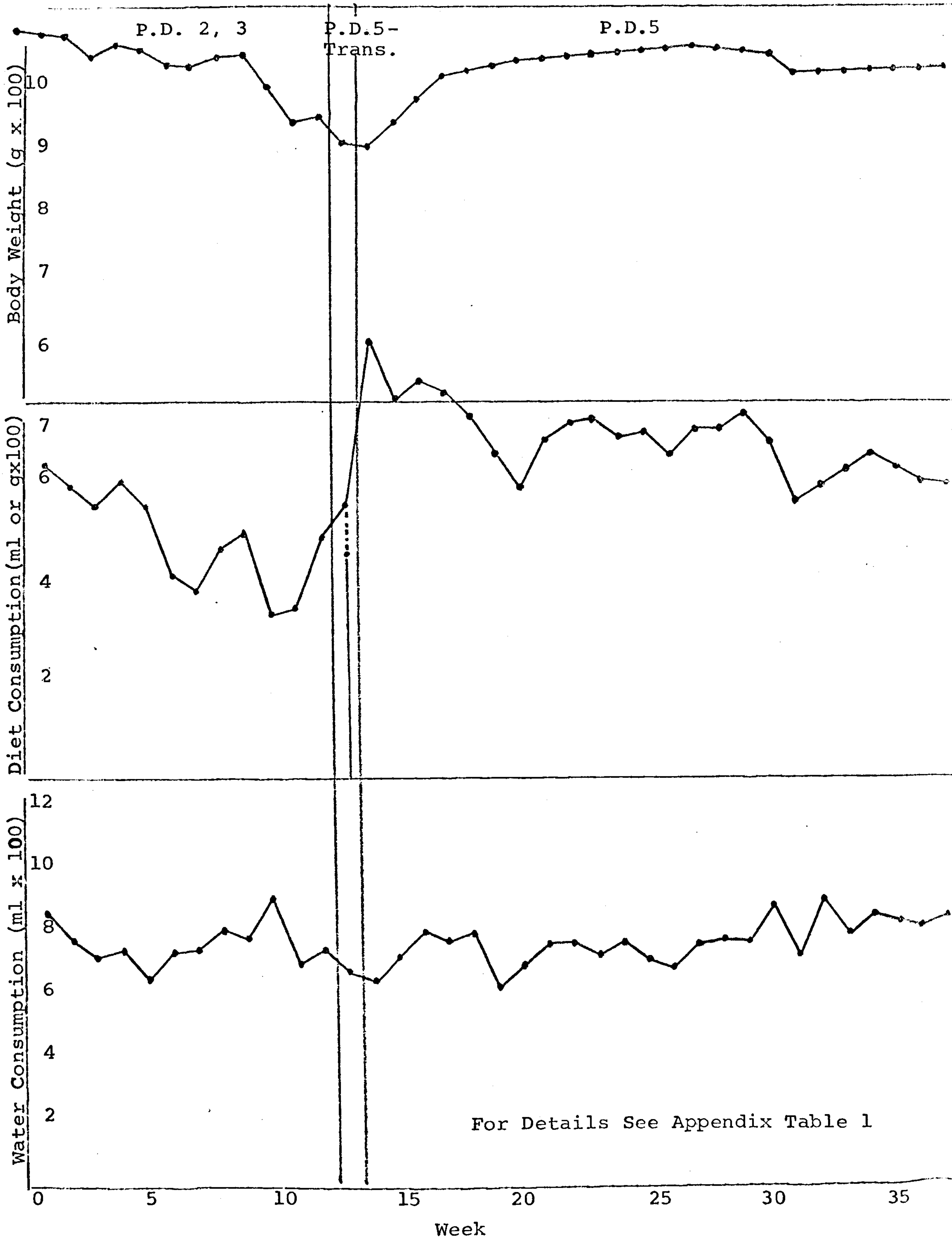


Figure No. 2
Monkey No. 4

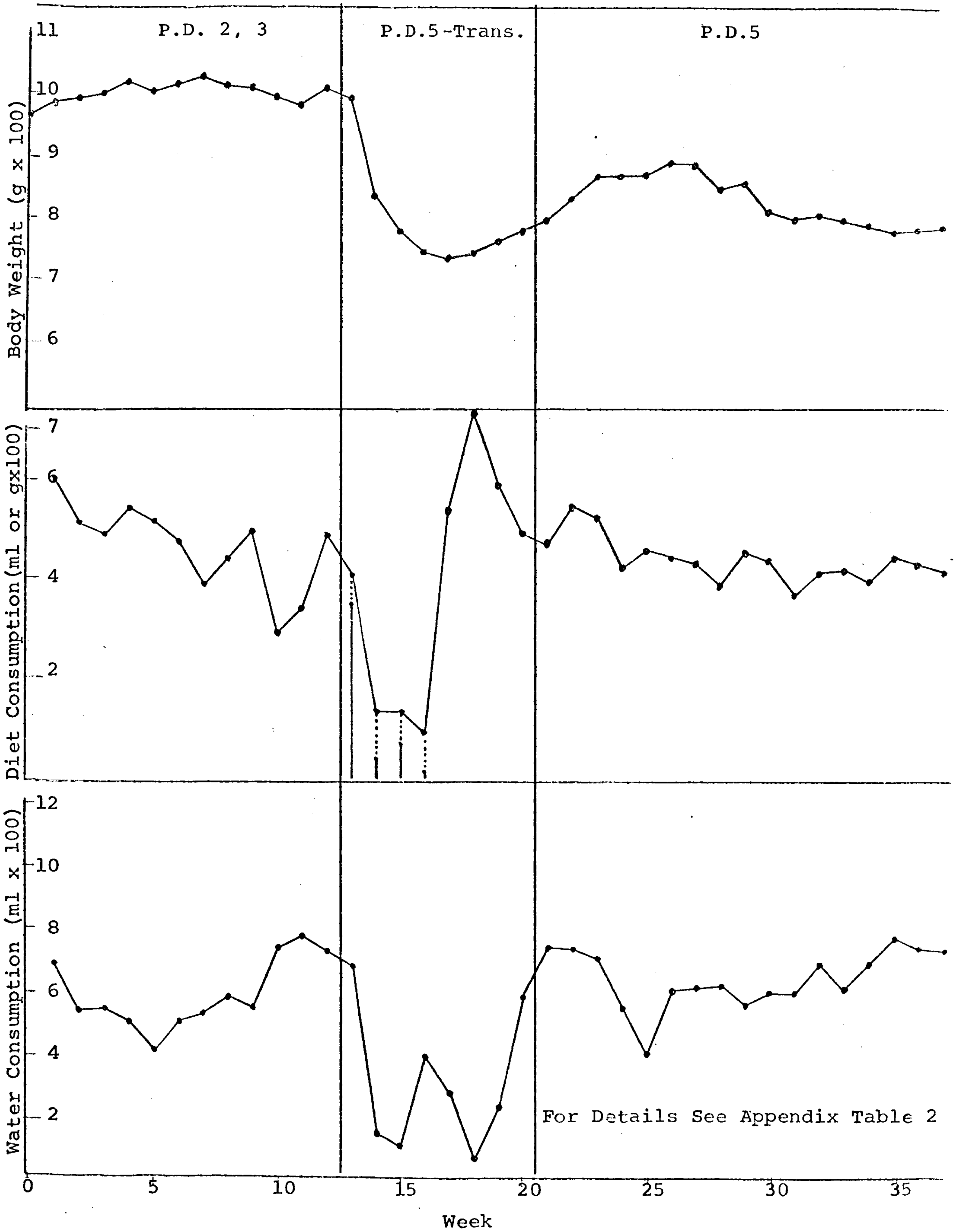


Figure No. 3
Monkey No. 5

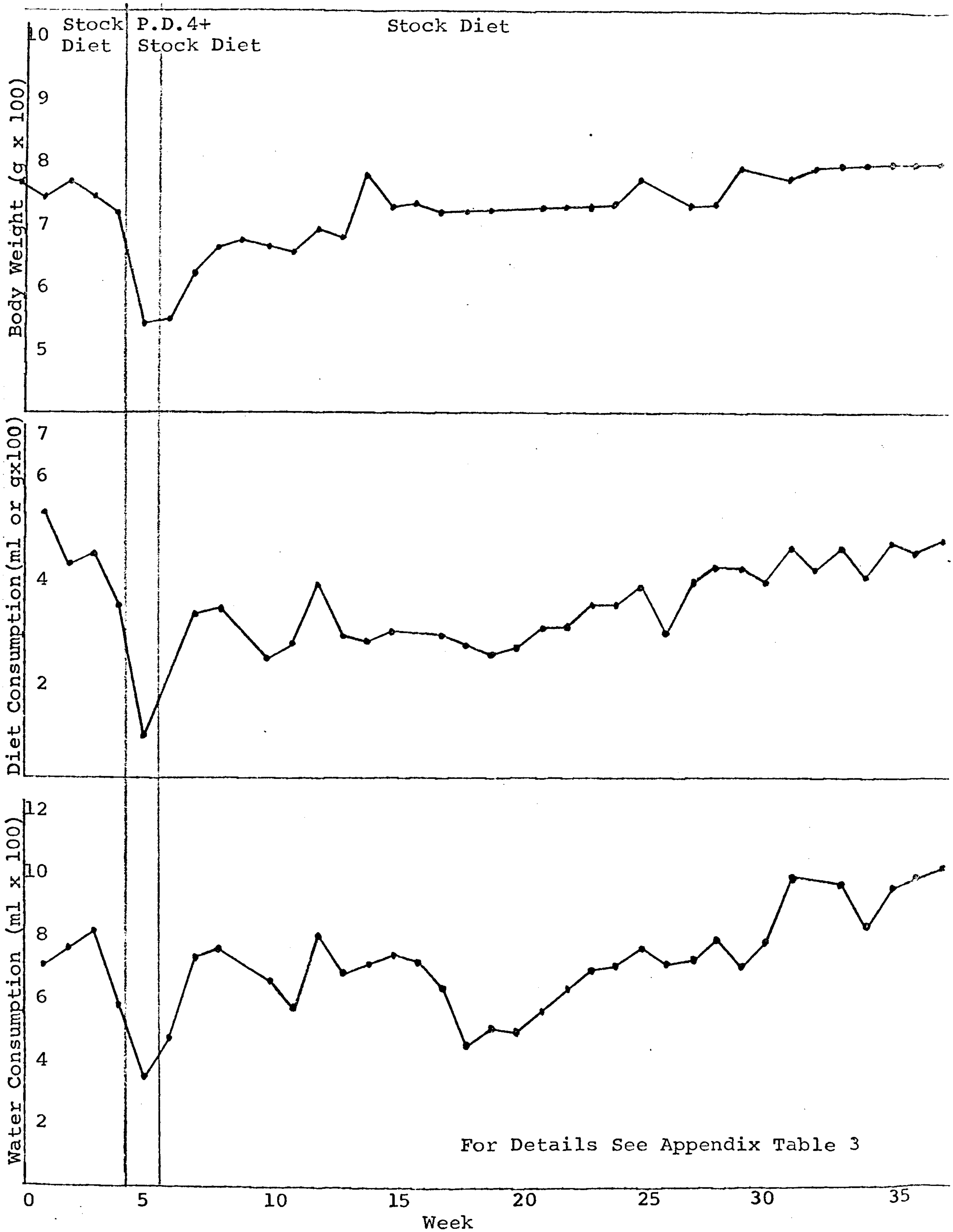


Figure No. 4
Monkey No. 6

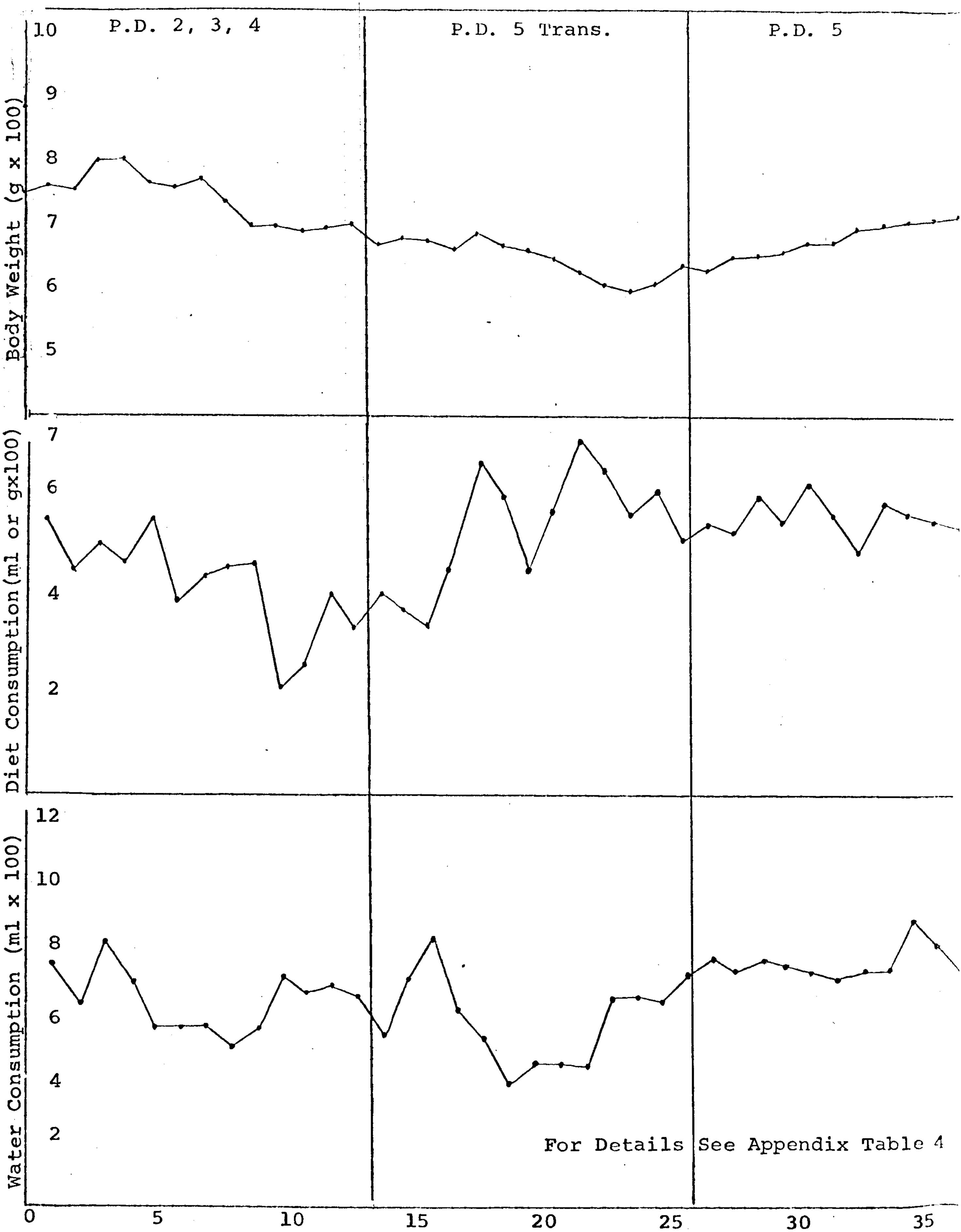


Figure No. 5
Monkey No. 7

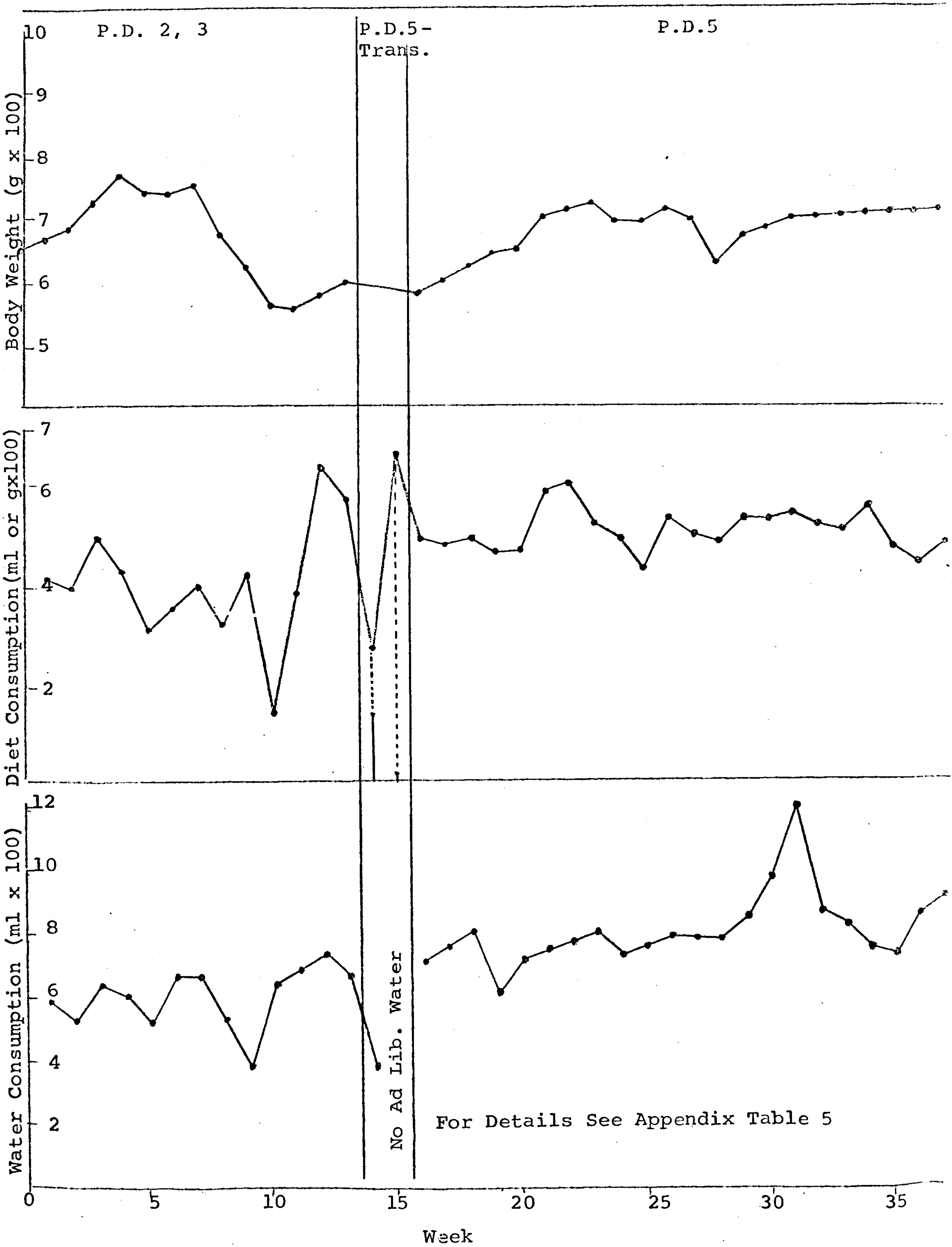


Figure No. 6
Monkey No. 8

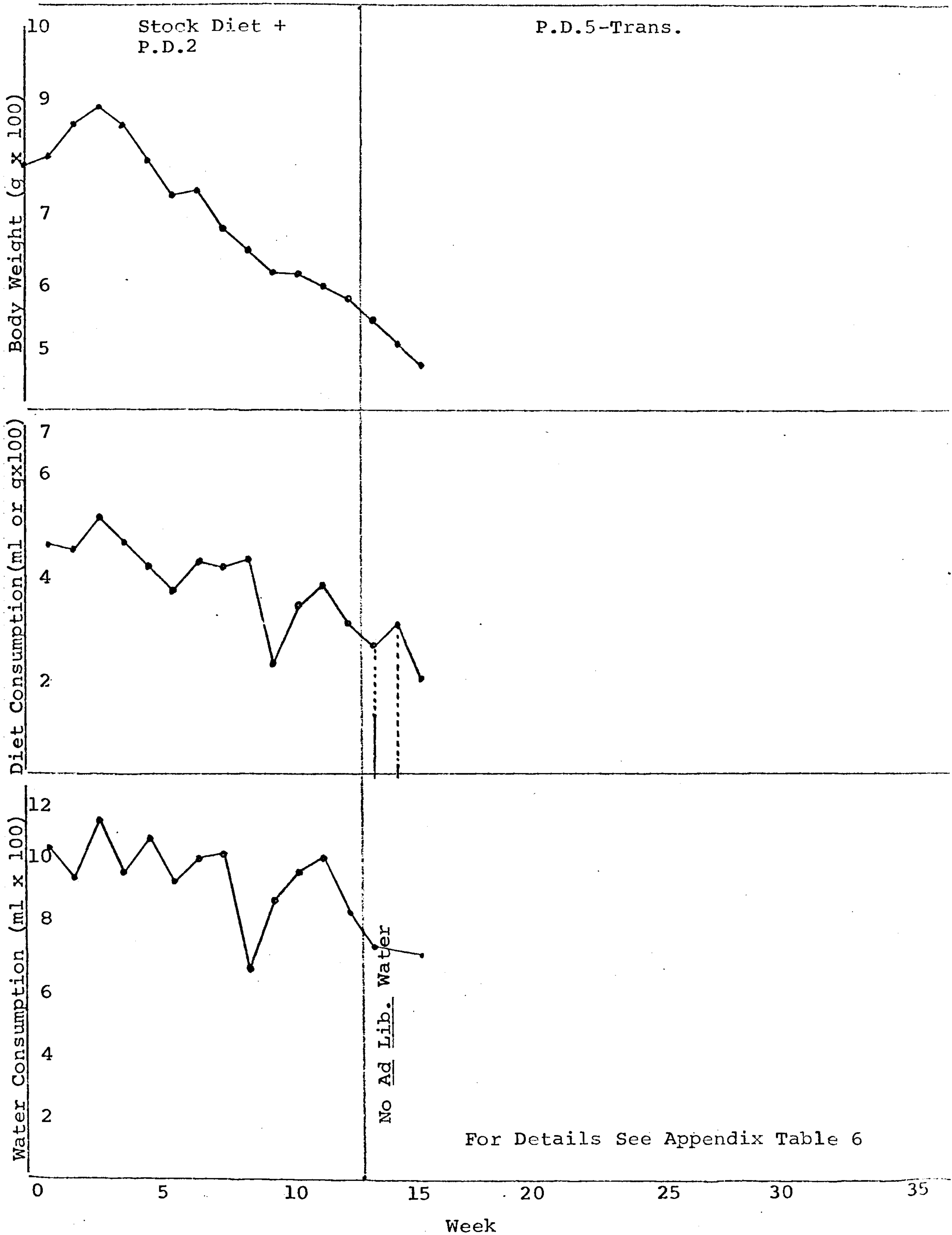


Figure No. 7
Monkey No. 9

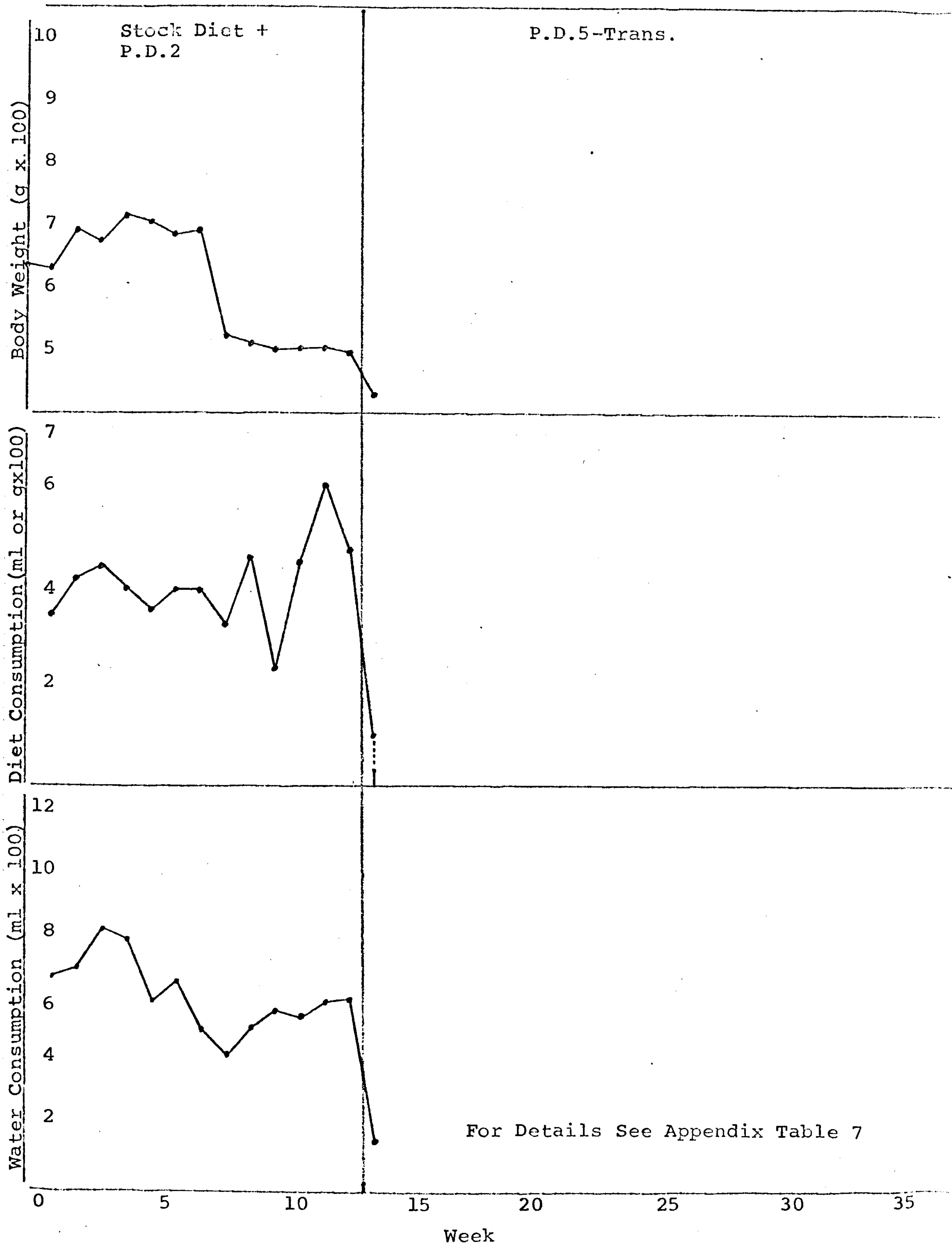


Figure No. 8
Monkey No. 10

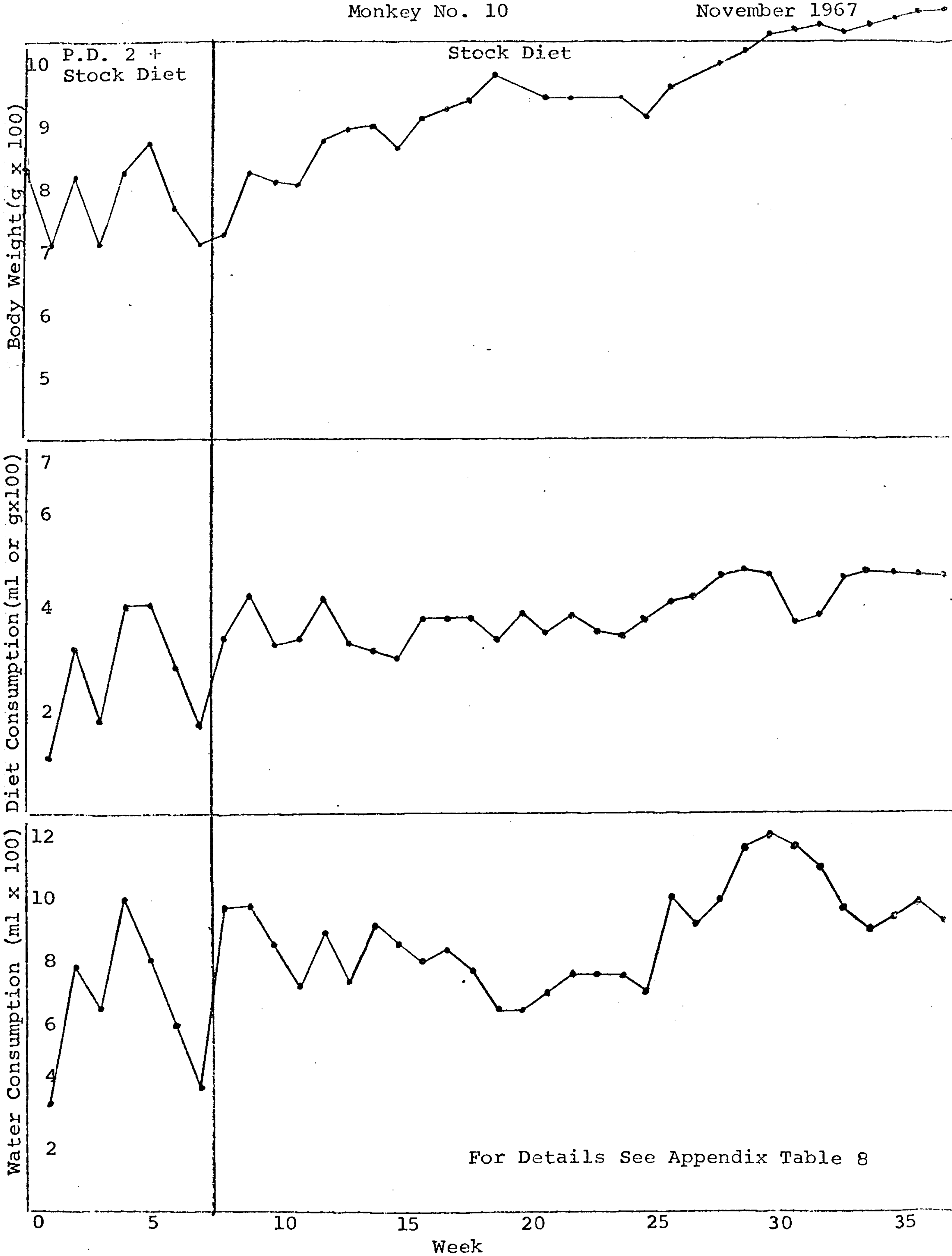


Figure No. 9
Monkey No. 13

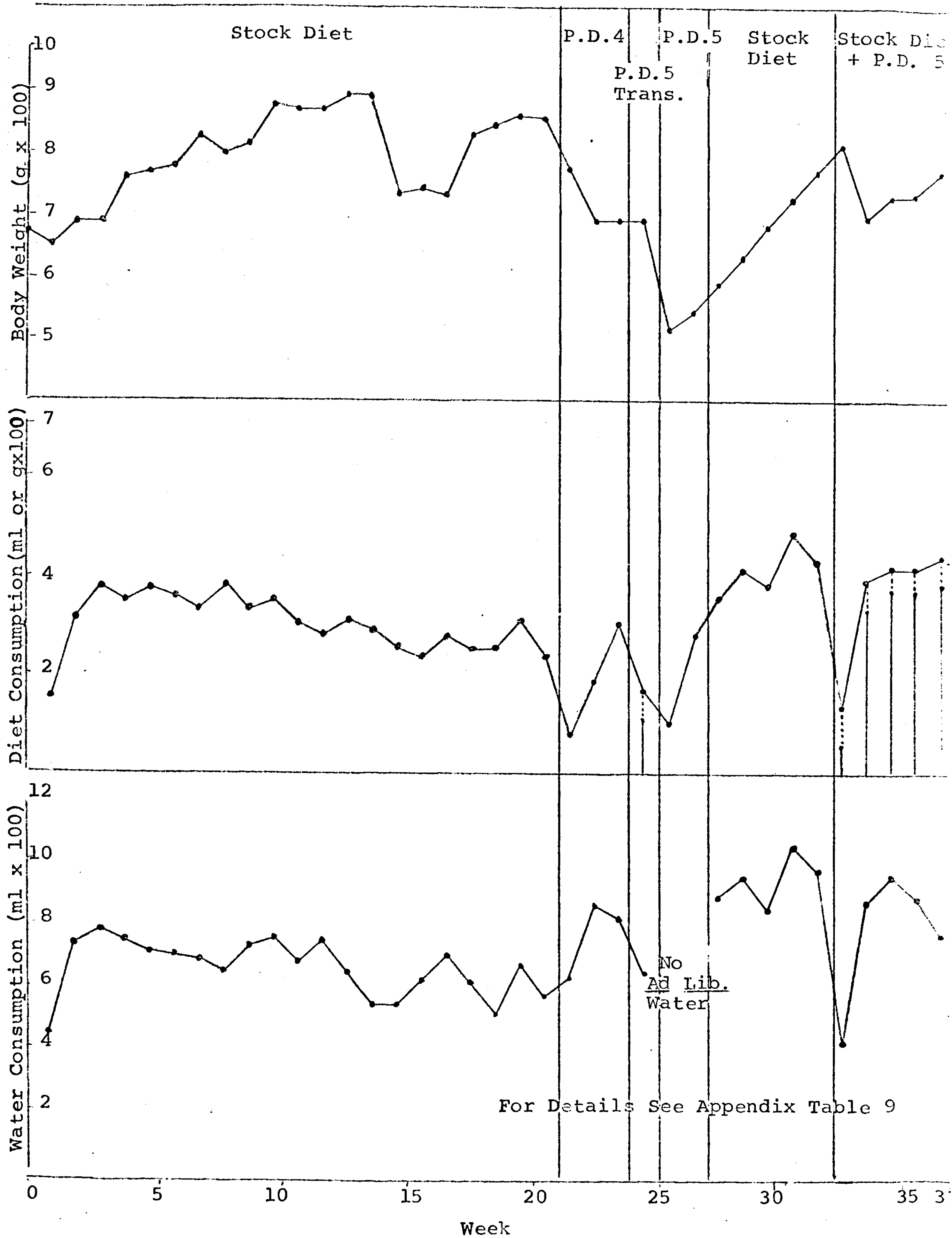


Figure No. 10
Monkey No. 14

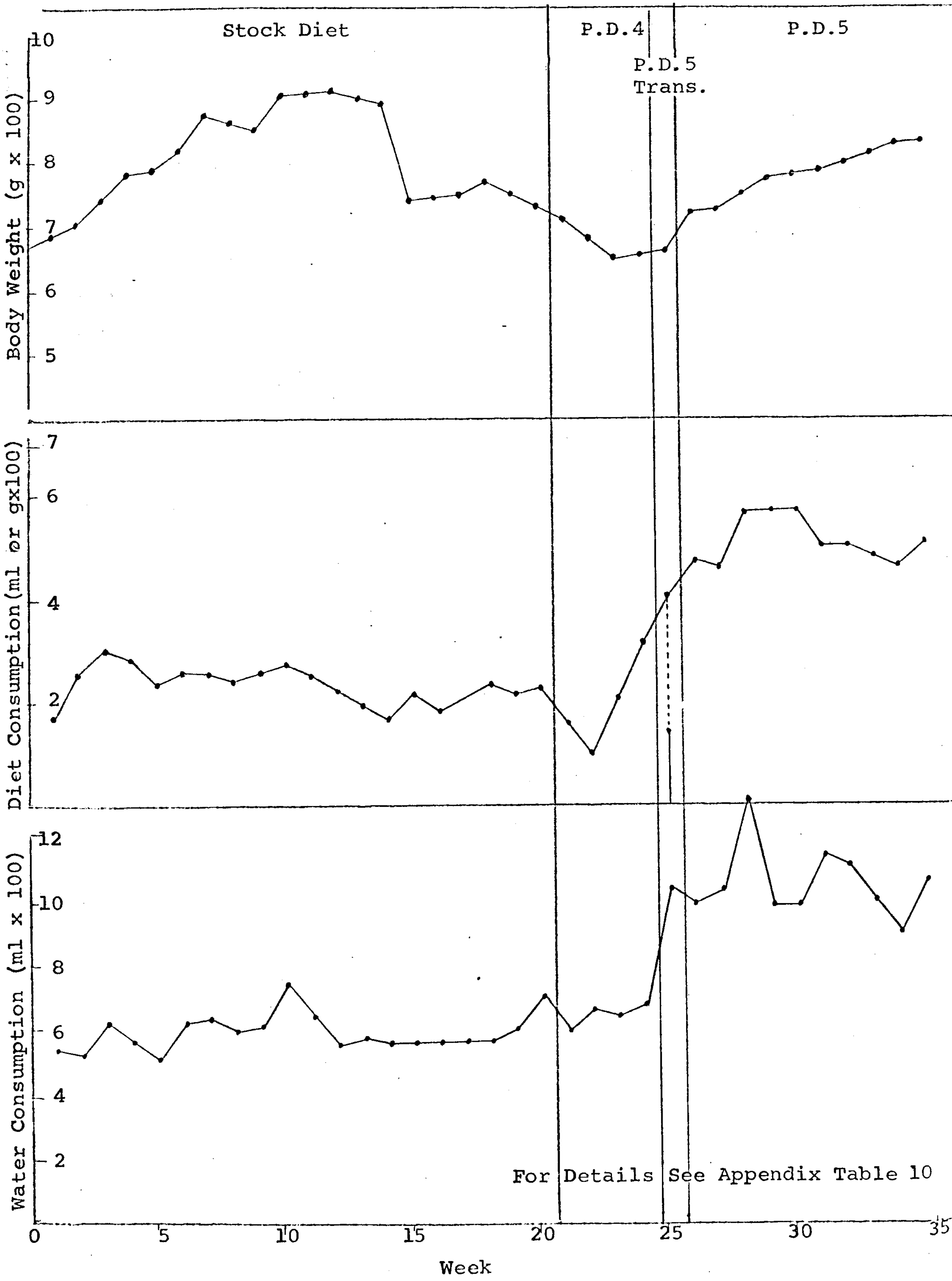


Figure No. 11
Monkey No. 15

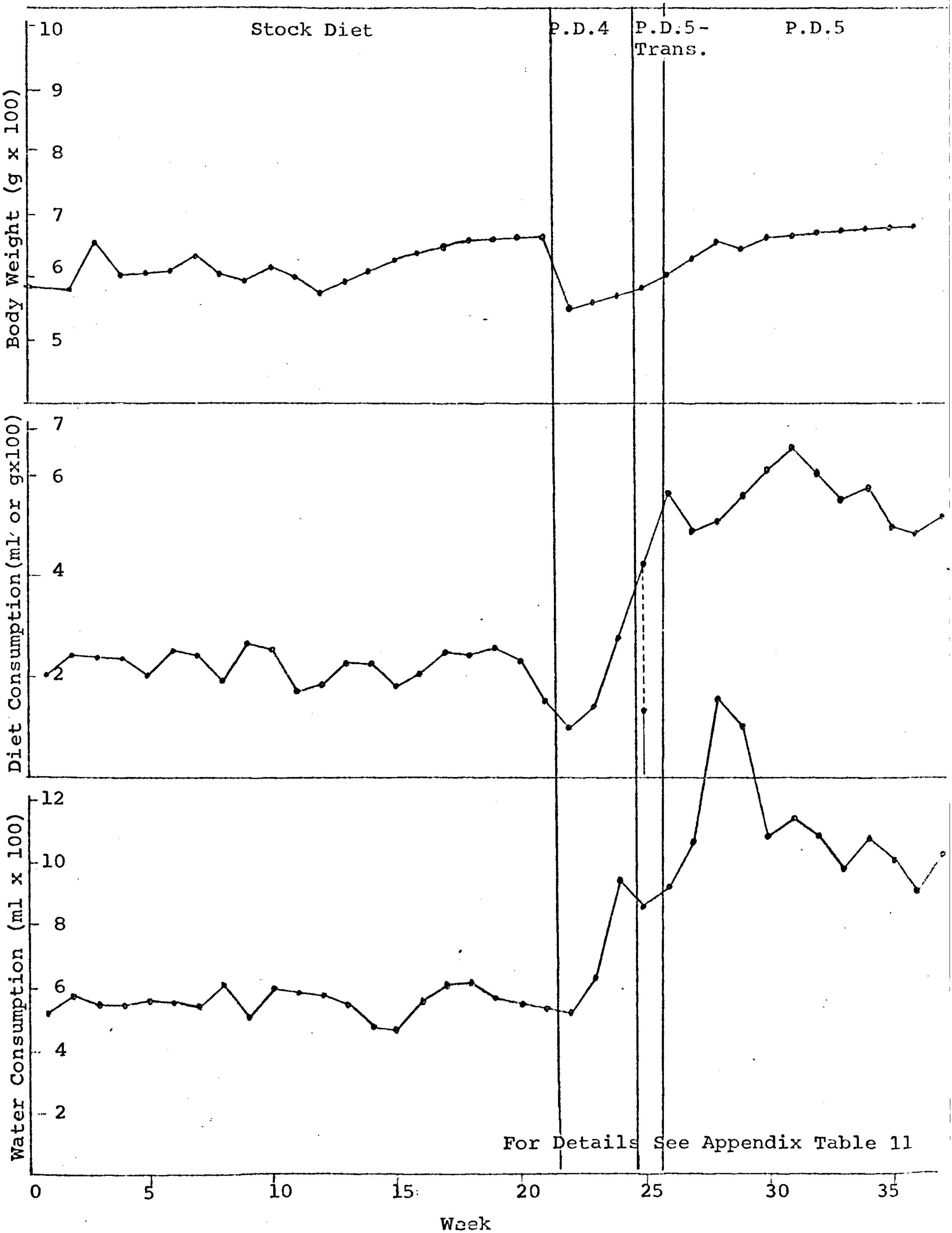


Figure No. 12
Monkey No. 16

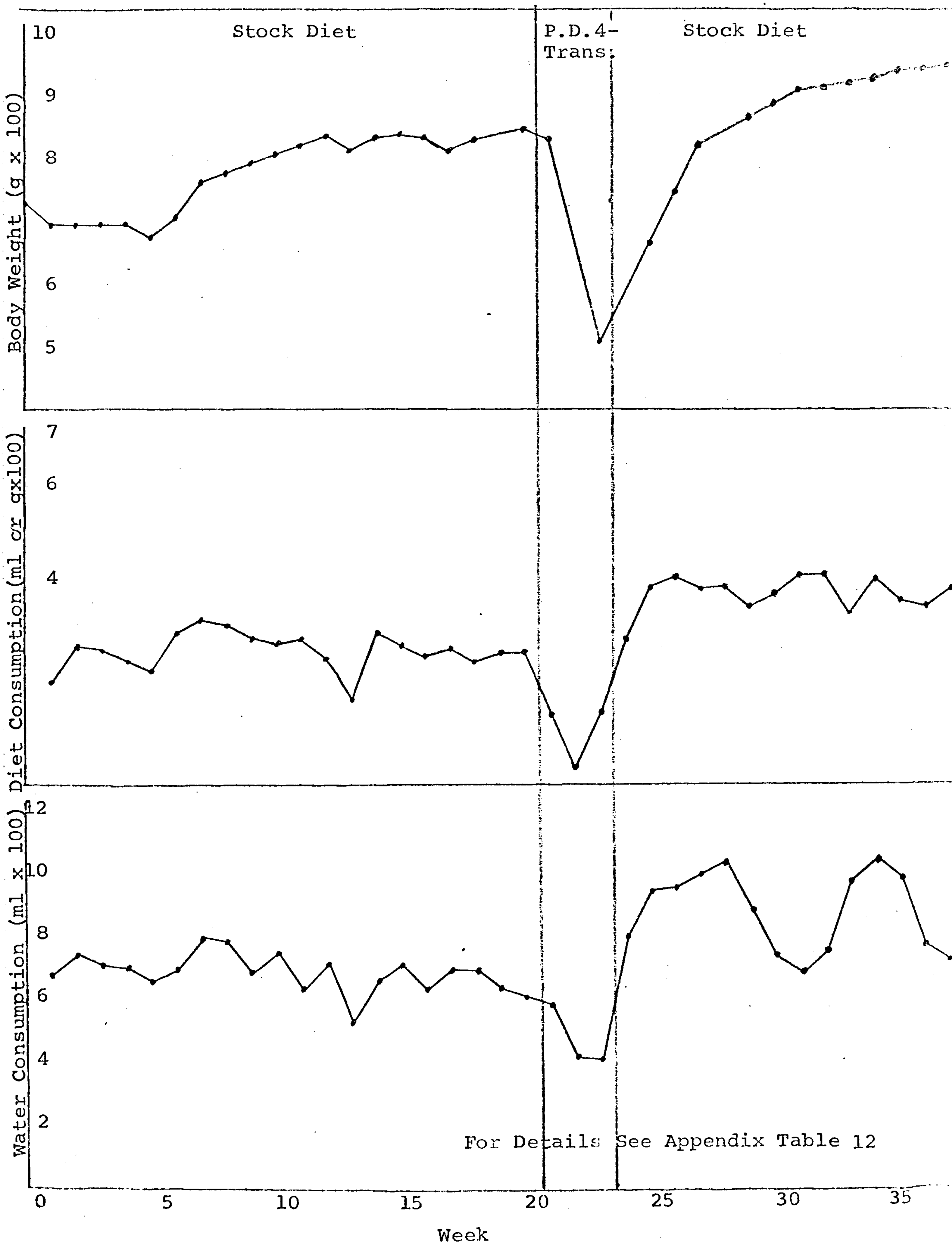
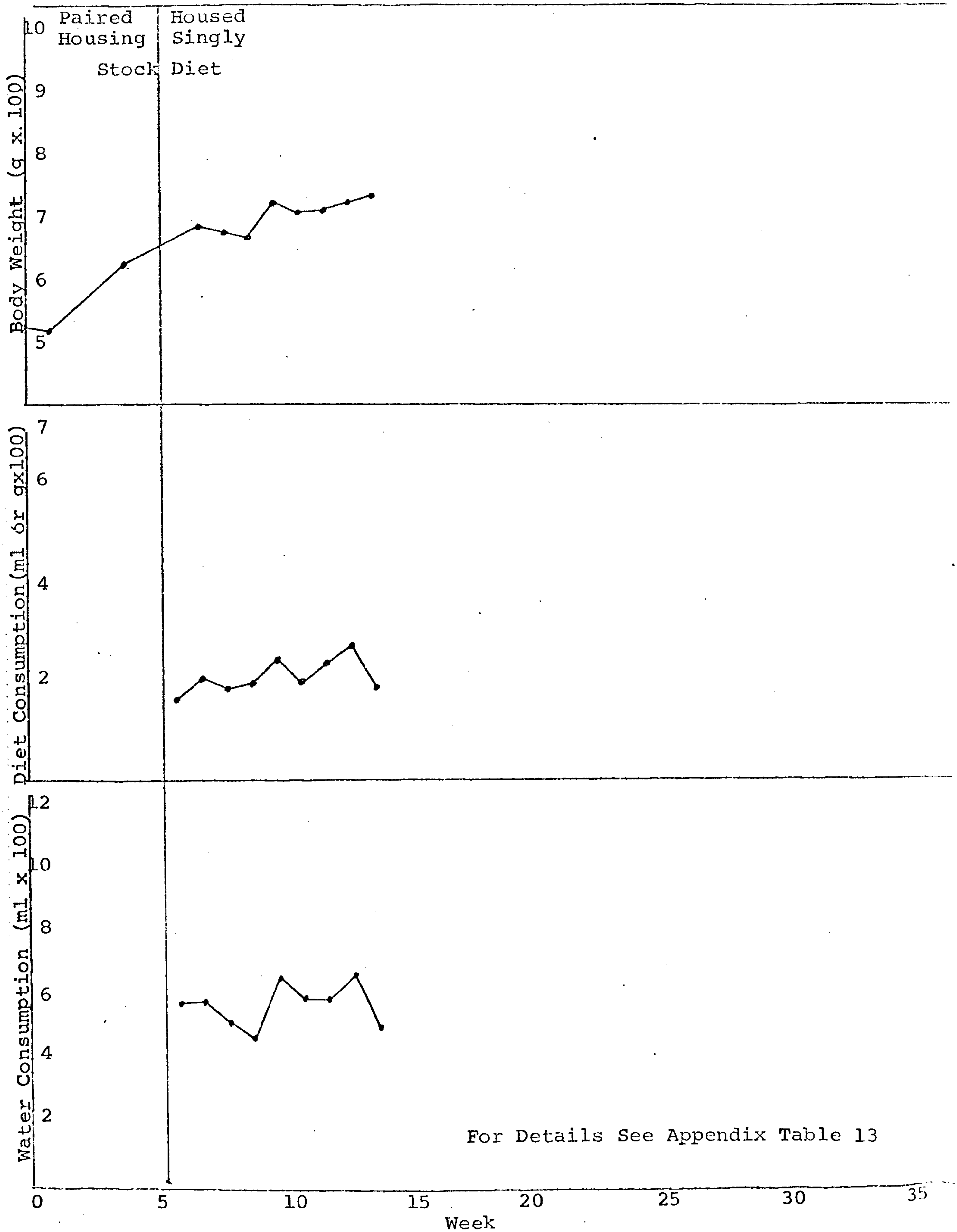


Figure No. 13
Monkey No. 17A



For Details See Appendix Table 13

Figure No. 14
Monkey No. 17B

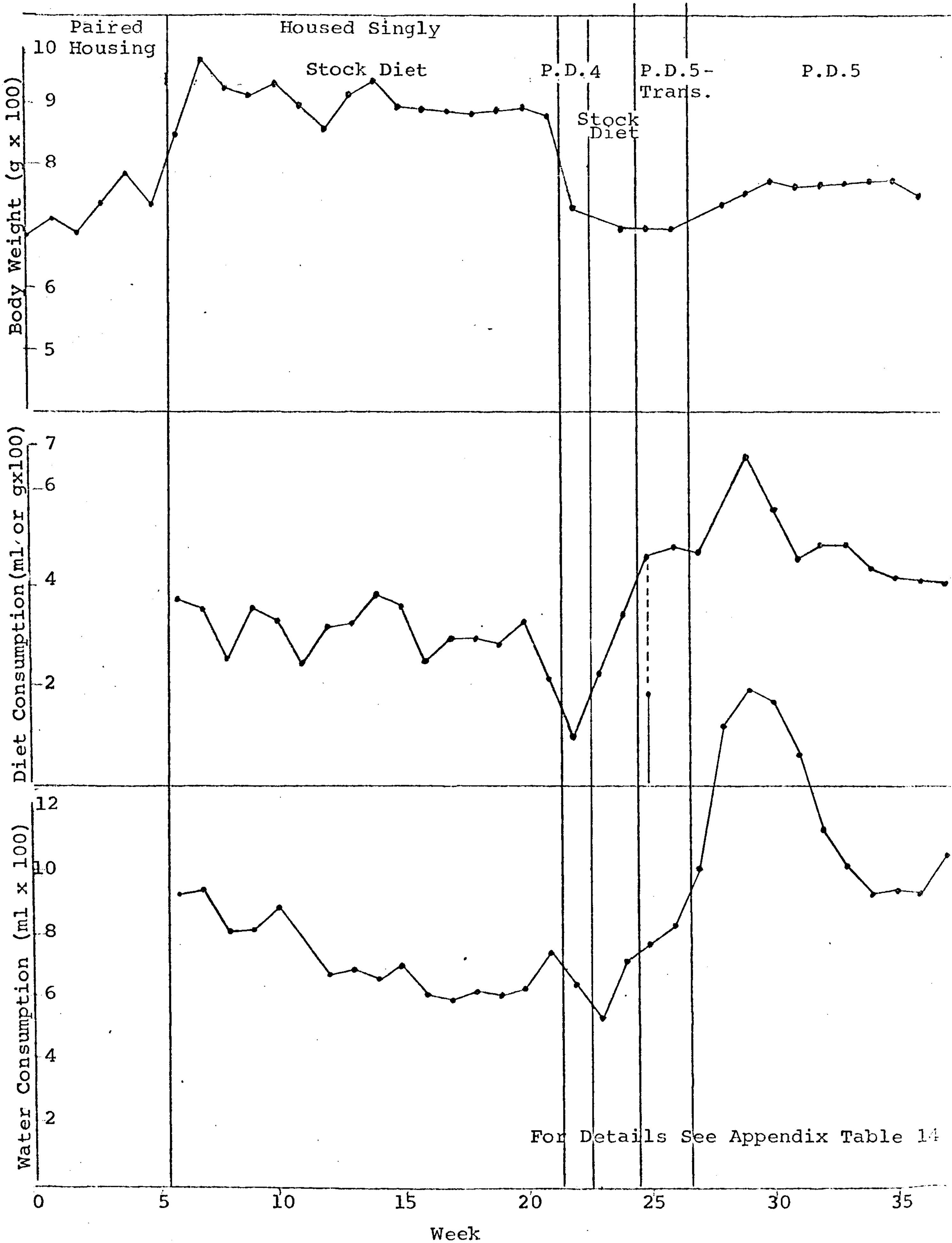


Figure No. 15
Monkey No. 18A

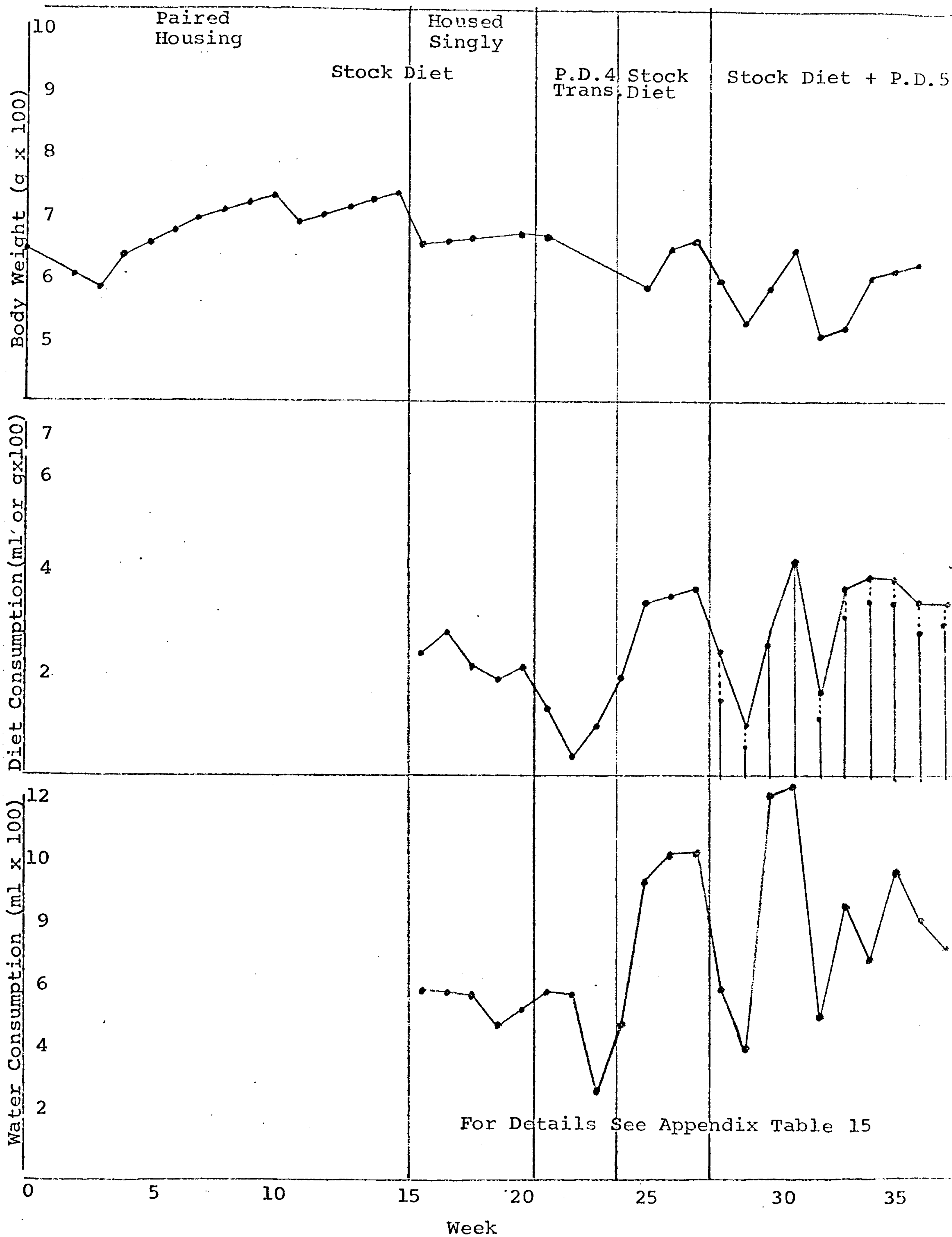


Figure No. 16
Monkey No. 18B

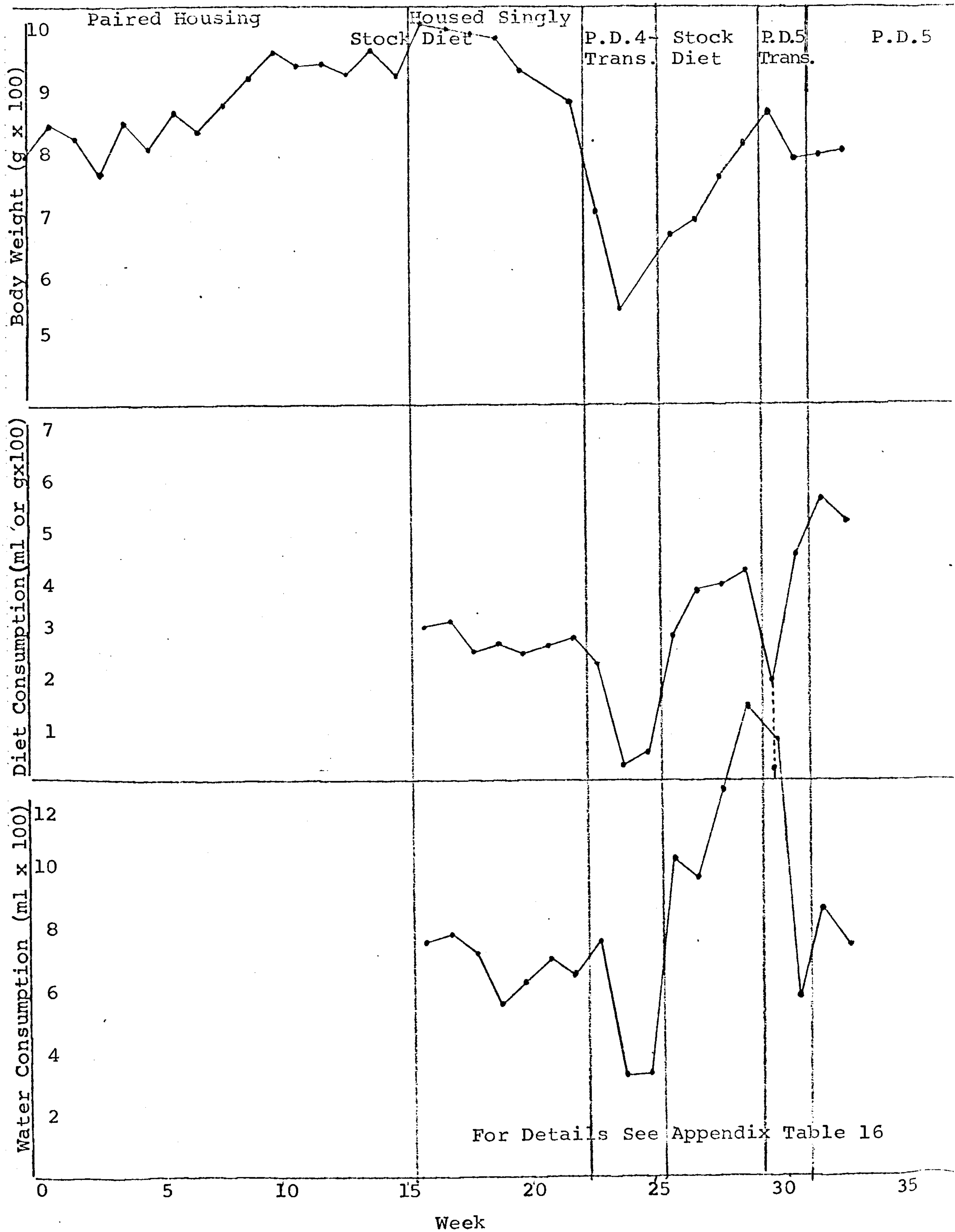


Figure No. 17
Monkey No. 19A

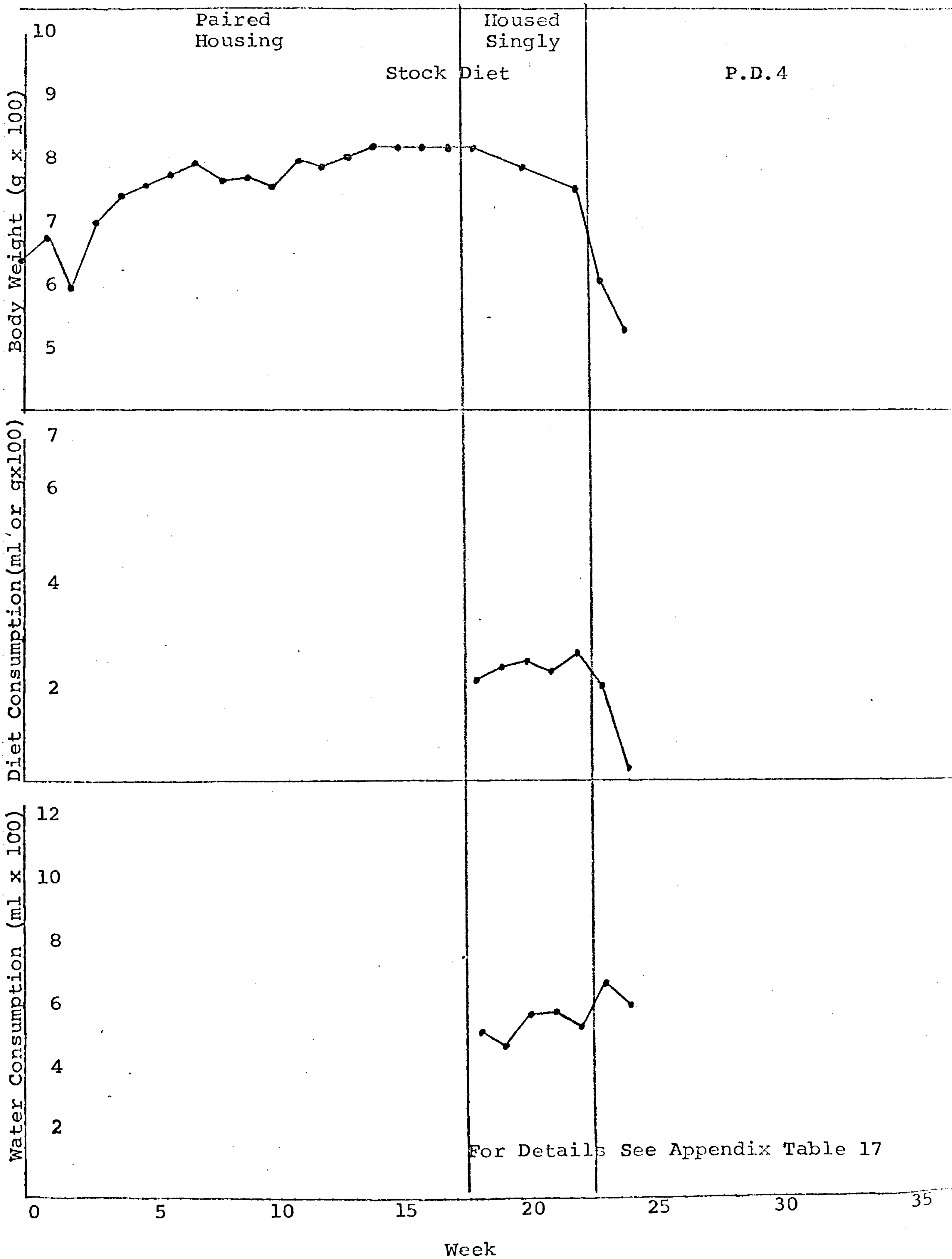


Figure No. 18
Monkey No. 19B

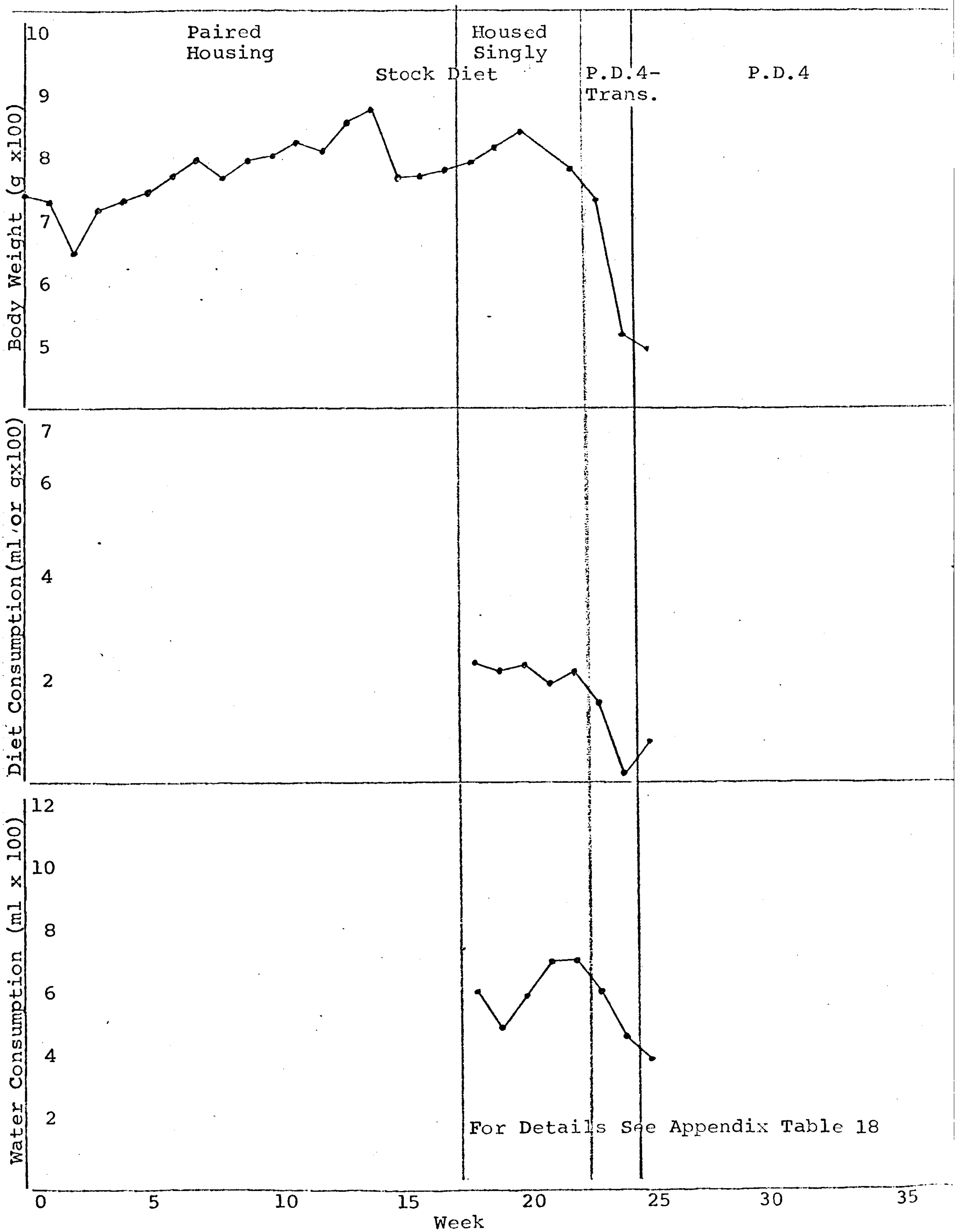


Figure No. 19
Monkey No. 20A

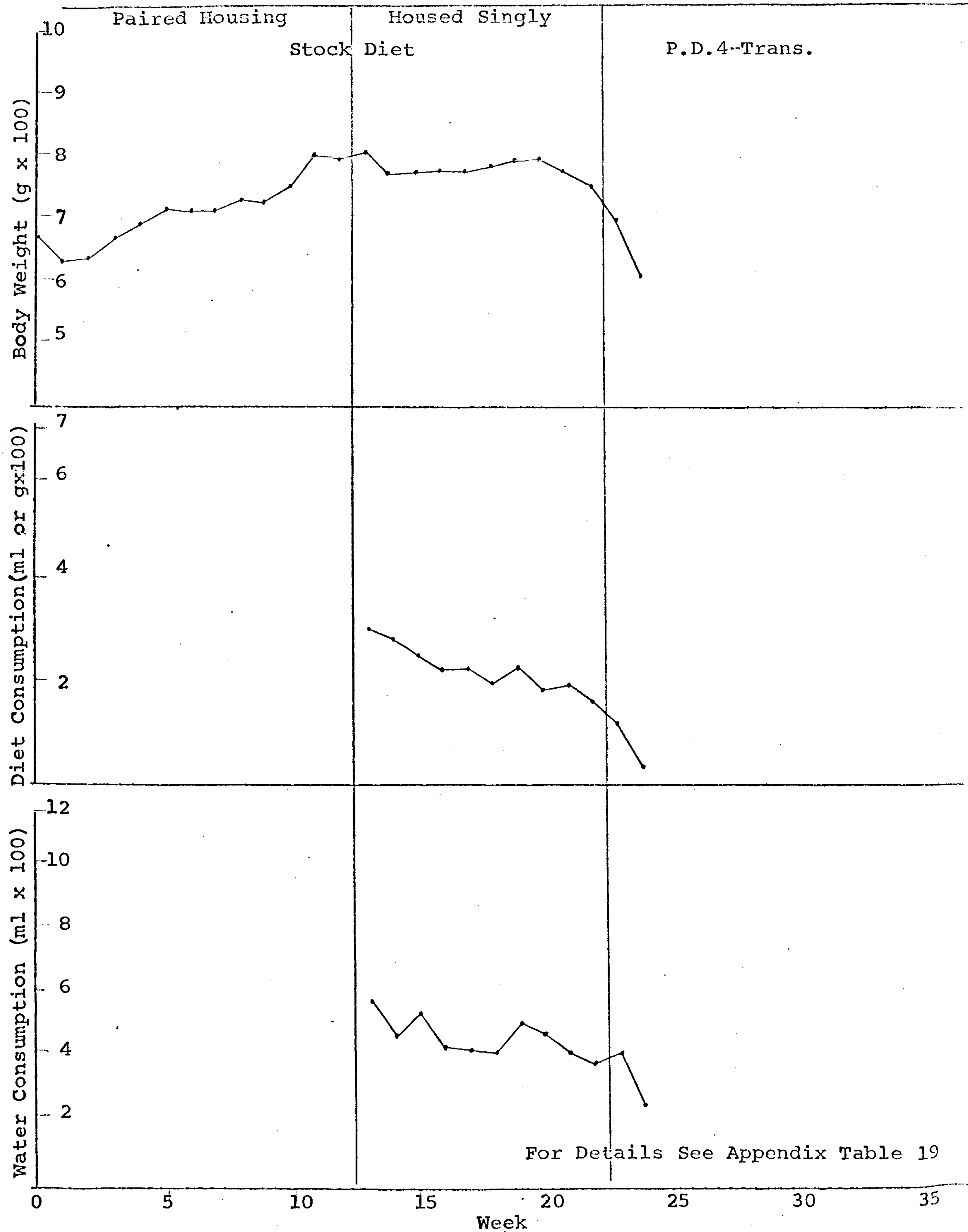


Figure No. 20
Monkey No. 20B

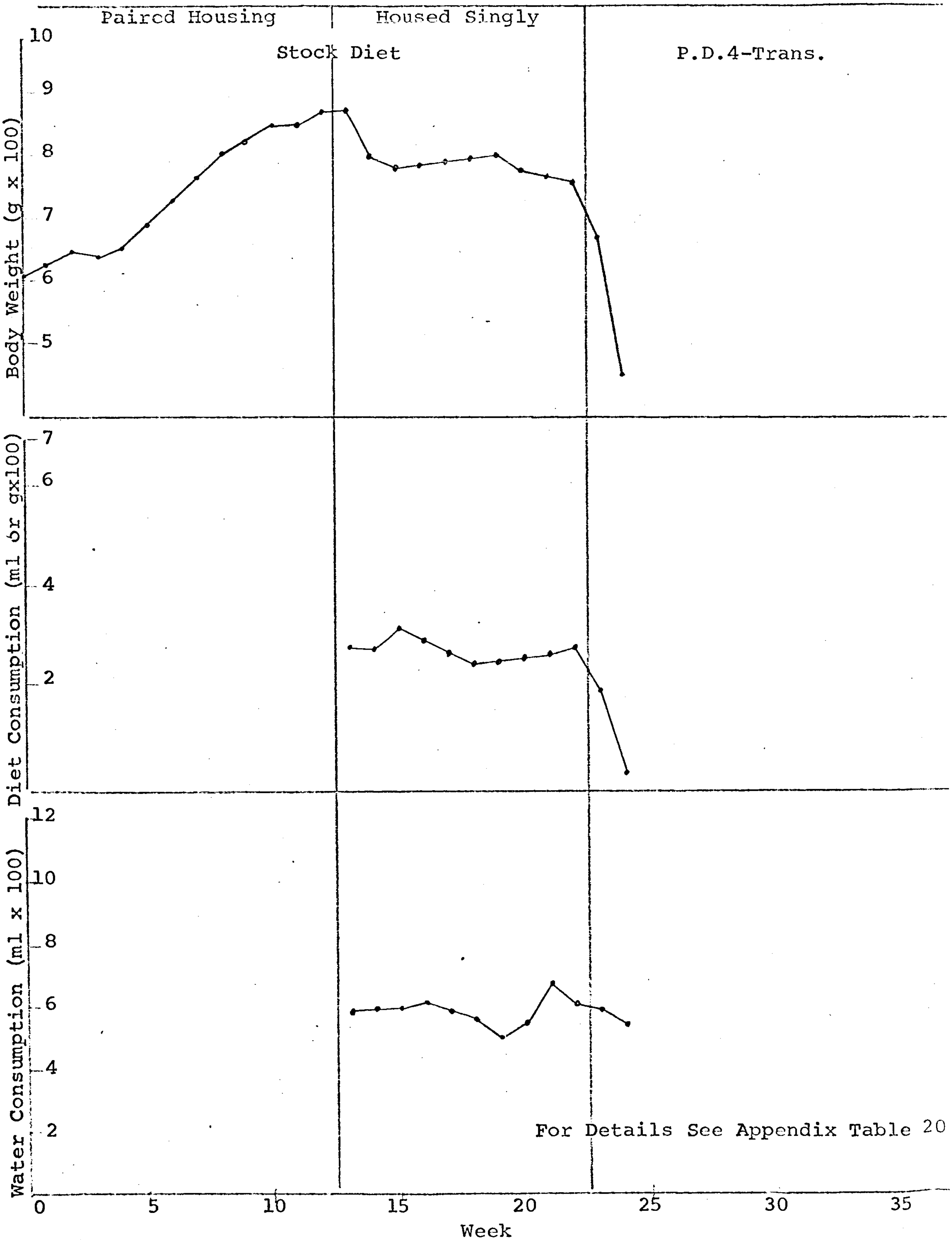
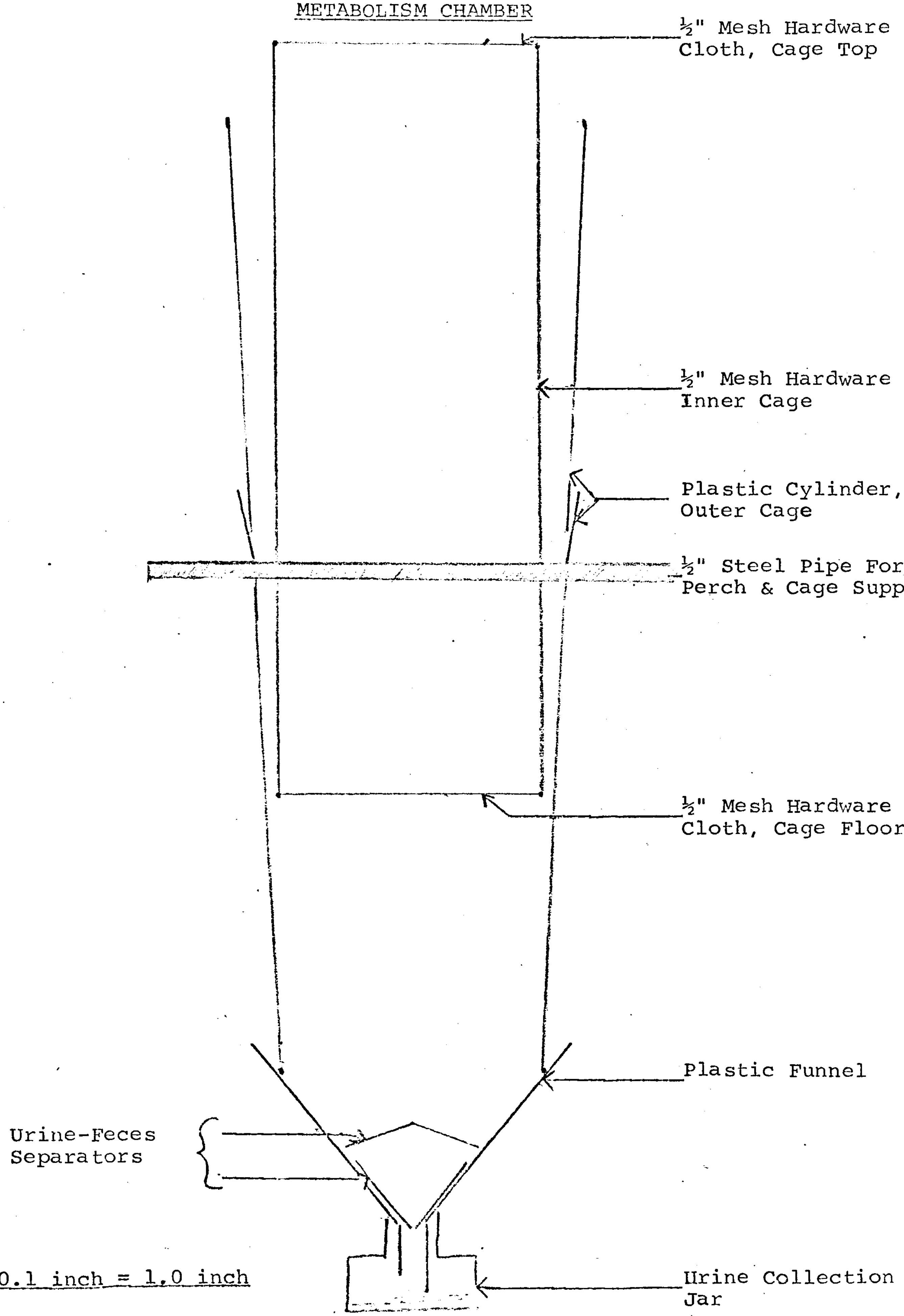


Figure No. 21

METABOLISM CHAMBER



SCALE 0.1 inch = 1.0 inch

References

1. Annual Reports submitted under Contract NASw-517 by Schwarz BioResearch, Inc. for periods 1961-1962, 1962-1963, 1964-1965 and 1965-1966.

2. Water-Food Interrelationships in Rats Fed Chemically Defined Liquid Diets, Proc. Soc. Expt. Biol. Med. 124:195 (1967), R. Shapiro, B. K. Gold and N. A. Rosenthal.

3. Personal communications with D. E. Beischer, Ph.D., A. E. New, D.V.M., and J. Thatch, Ph.D., Naval Aerospace Medical Institute, Pensacola, Florida.

Appendix

Collection of Excreta

Individual metabolism cages of the type shown in Figure 21 of the text were used in all metabolic studies. Urine was collected under toluene at 9:00 AM and 3:30 PM each day and immediately refrigerated. Specimens collected over a 48 hour period were pooled, filtered and brought to a specified volume prior to analyses. Fecal specimens were collected at 9:00 AM each day and immediately frozen. The specimens were pooled over a 12 day period and homogenized with a known volume of water prior to analyses. Appropriate aliquots of urine and feces were taken in duplicate for each chemical analysis. In cases where duplicate analyses did not agree, the analysis was repeated.

Inorganic Phosphate

The Fiske and Subbarow procedure[1] was modified for use with the Technicon Auto Analyzer. This method is based upon the formation of phospho-molybdic acid which is then reduced by 1-amino-2-naphthol-4-sulfonic acid. In this procedure the reductant (1-amino-2-naphthol-4-sulfonic acid) is the recipient stream for the dialyzable phosphate. After dialysis, an acidic solution of ammonium molybdate is added, with the formation of phospho-molybdic acid, immediately followed by reduction. The reaction yields a blue color which is read at 660 mu. Details of the procedure are described in Technicon Method File N-4V.

All fecal and diet samples were wet-ashed prior to automated colorimetric analyses for phosphorus and calcium. The following wet-ashing procedure was employed:

1 J. Biol. Chem. 66, 375 (1925).

1) Weigh 2-3 grams wet feces (diet) into a 250 ml Ehrlenmeyer Flask.

2) Add 10 ml concentrated nitric acid, then 3 ml concentrated sulfuric acid.

3) Cover with an air-condenser and heat over a small gas flame until second white fumes appear (10-15 min.). Cool for 5 minutes.

4) Add 2 ml (70-72%) perchloric acid and digest again until yellowish straw color appears. Cool.

5) Wash the sides of the flask and condenser with distilled water.

6) Heat to boiling again. Cool.

7) Neutralize with concentrated ammonium hydroxide (8-10 ml) using two drops of phenol-phthalein as the indicator.

8) Acidify slightly with nitric acid to the disappearance of phenol-phthalein color. Then add 1 ml excess. Cool.

9) Dilute to the appropriate volume and put on the Auto Analyzer for either calcium or phorphorus determination.

Calcium

Calcium was analyzed on the Auto Analyzer by a modification for the procedure of Kessler and Wolfman[1]. In this procedure calcium is dialyzed under acidic conditions into a recipient stream of Cresolphthaline Complexone solution. A colored complex between calcium and the dye is formed upon the addition of diethylamine, which alkalinizes the reaction mixture. The developed color (violet) is

1 Clin. Chem. 10, 686 (1964).

measured at 580 mu. Details of the automated procedure described in Technicon Method File 11-3A.

Nitrogen Analysis

An appropriate aliquot of excreta (urine or feces) was added to a 30 ml Kjeldahl flask. A digestion mixture containing 2% perchloric (70-72%), 0.3g selenium dioxide in 90% sulfuric acid was added to the flask. Usually 2 ml of digestion mixture was sufficient for a 1 ml urine sample or a 100-500 mg wet fecal sample. The digestion flasks were placed on burners and allowed to digest for at least 1 hour after clearing. After cooling distilled water was added (5-10 ml) and the solution was again allowed to cool. The solution was then brought to an appropriate volume and introduced into the Auto Analyzer for colorimetric analysis. The diluted digest was neutralized with sodium hydroxide cooled and then successively mixed with alkaline phenol and sodium hypochlorite reagents. A blue color developed which was measured at 630 mu. Details of colorimetric phase of this procedure are described in Technicon Method File 662.

Microbiological Methods

All monkeys went through a period of adaptation to each diet before being placed in metabolism cages for 2 weeks.

The two week metabolism period was selected as the best time for obtaining specimens for bacteriological survey. Rectal swabs were taken three times a week from each animal during the times they were being removed to clean cages. The specimens were collected in "Swubes"[1] (a pre-sterilized plastic test tube and swab), to which had been added 1.0 ml sterile distilled water. The swab contents were suspended in

---

1 Falcon Plastics, Los Angeles, California.

1.0 ml sterile distilled water immediately before the suspension was used to prepare replicate smears. The time elapsed between obtaining rectal swabs and preparing the smears was never more than 15 minutes.

Heat-fixed smears were gram-stained using the Hucker Modification[1]. The stained smears were examined under a microscope equipped with a calibrated ocular micrometer. The bacteria observed were categorized by gram-reaction, morphology and size. The individual types of bacteria were counted in three to five fields on duplicate smears, the number of fields counted depending upon concentration and uniformity of distribution of the bacteria.

1 Conn, J.J., et al, "Staining Procedures Used by the Biological Stain Commission", The Williams and Wilkins Co., Baltimore, Maryland, 1960.

APPENDIX TABLE 1

Animal No. 2

Week	Diet TEK	Diet P.D.2 %	Diet H_2O*	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0				1,099			
1	21	57	22	1,096	630		871
2	3	78	19	1,091	582		780
3	0	77	23	1,056	548		721
4	0	76	24	1,075	590		735
5	0	75	25	1,067	545		663
6	0	75	25	1,041	411		725
7	0	75	25	1,041	384		744
8	0	75**	25	1,057	458**		804
9	0	76	24	1,056	496		782
10	0	89	11	1,008	332		890
11	0	96	4	947	345		707
12	0	97	3	959	483		737
13		97***	3	917	454***	100***	676
14	P.D. 5			914		877+	643
15				951		763	725
16				985		796	795
17				1,026		774	772
18				1,038		729	793
19				1,046		648	617
20				1,051		588	693
21				1,056		681	759
22				1,059		716	763
23				1,060		724	724
24				1,064		690	764
25				1,073		697	713
26				1,069		651	682
27				1,074		701	759
28				1,069		706	777
29				1,069		729	770
30				1,063		678	881
31				1,031		562	728
32				1,036		586	894
33				1,031		617	797
34				-		651	857
35				1,038		625	834
36				1,035		600	816
37				1,041		590	842

Abbreviations: See Appendix Table 6

*Powdered transition mixtures of P.D. #2 + TEK +H_2O.
**Started on P.D. #3 first day of wk 8 and continued through wk 12.
***Fed. P. D. #4 first six days of wk 13. Started on P.D. #5 30% (w/v) last day of wk 13.
+Started on P.D. #5 50% (w/v) third day of wk 14.

APPENDIX TABLE 2

Animal No. 4

Week	Diet TEK	Diet P.D.2 %	Diet H_2O*	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0				976			
1	21	57	22	994	603		687
2	11	71	18	994	517		542
3	5	70	25	1,002	495		543
4	0	76	24	1,021	541		512
5	0	75	25	1,004	523		409
6	0	75	25	1,018	475	508	508
77	0	75	25	1,023	393		526
8	0	75**	25	1,017	446		575
9	0	76	24	1,014	496		548
10	0	89	11	997	294		736
11	0	96	4	986	343		770
12	0	97	3	1,009	487		722
13		97***	3	989	356	19	675
14	P.D.5-30%(w/v) + TEK			833	37	91	142+
15				781	67	63	100+
16				747	11	80	381
17	P.D.5 + A.J.-16%(w/v)‡			740		535	269
18	P.D.5 + A.J.-20%(w/v)			746		742	62
19	P.D.5 + A.J.-38%(w/v)			769		589	222
20	P.D.5 + A.J.-45%(w/v)			782		496	584
21	P.D.5 in A.J.-50%(w/v)‡‡			801		474	738
22						540	733
23				871		525	707
24				879		424	534
25				875		459	395
26				891		441	592
27				891		433	617
28				856		388	609
29				860		451	557
30				814		439	587
31				807		370	596
32				809		411	686
33				799		418	599
34				-		401	700
35				782		443	771
36				788		429	744
37				791		423	736

Abbreviations: See Appendix Table 6

*Powdered transition mixtures of P.D. #2 + TEK + H_2O.

**Started on P.D. #3 first day of wk 8 and con't. through wk 12.

***Fed P.D. #4 first six days of wk 13. Started on P.D. #5 - 30% (w/v) last day of wk 13.

+*Ad libitum* water withdrawn from last day of wk 14 through fourth day of wk 15. Water intake restricted last 3 days of wk 15. Restored to normal thereafter.

‡Between wks 17-20 P.D. #5 - 50% (w/v) was diluted to the designated concentrations w A.J.

‡‡Beginning wk 21 P.D. #5 - 50% (w/v) made in A.J.

SCHWARZ BIORESEARCH

APPENDIX TABLE 3

Animal No. 5

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		759			
1	TEK	739	544		707
2		761	436		758
3		743	461		802
4		714	363		561
5	TEK + P.D. 4	539	92*		344
6	TEK	546	197		474
7		617	333		718
8		659	354		751
9		668	298		700
10		662	247		651
11		654	282		566
12		691	398		828
13		676	294		677
14		778	284		694
15		722	300		731
16		731	298		717
17		718	296		629
18		721	283		447
19		722	259		506
20		-	277		492
21		722	313		550
22		722	315		635
23		721	359		683
24		731	359		703
25		776	391		756
26		-	301		715
27		727	400		722
28		731	434		785
29		784	433		702
30		-	411		786
31		773	470		984
32		786	454		971
33		794	469		960
34		801	418		835
35		791	479		949
36		797	467		975
37		801	484		1,011

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4

*Started on TEK + P.D. #4 (1.5:1) on fourth day of wk 5.
Switched to TEK + P.D. #4 (2.3:1) on fifth day of wk 5.

APPENDIX TABLE 4

Animal No. 6

Week	Diet			Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
	TEK	P.D.2 %	H_2O*				
0				751			
1	51	7	42	762	541		747
2	32	42	26	753	447		623
3	35	39	26	799	492		828
4	0	77	23	802	460		693
5	0	75	25	764	539		536
6	0	75	25	757	377		553
7	0	74	26	768	430		553
8	0	75	25	737	450		491
9	0	76**	24	691	453		548
10	0	89	11	697	207		708
11	0	95	5	686	255		650
12	0	96	4	691	391		672
13	0	96***	4	699	327		638
14	P.D. 5+			668		395	516
15				678		358	700
16				671		326	823
17	P.D.5 + A.J.-36%(w/v)‡			657		489	588
18	P.D.5 + A.J.-25%(w/v)			684		656	507
19	P.D.5 + A.J.-30%(w/v)			666		585	359
20	P.D.5 + A.J.-36%(w/v)			656		433	427
21	P.D.5 + A.J.-30%(w/v)			642		552	434
22	P.D.5 + A.J.-33%(w/v)			621		692	414
23	P.D.5 + A.J.-35%(w/v)			598		634	625
24				592		547	637
25				603		587	613
26	P.D.5 + A.J.-50%(w/v)ǂ			629		496	695
27				622		529	750
28				642		510	715
29				644		577	734
30				648		525	726
31				664		607	705
32				664		541	688
33				692		472	710
34				694		562	715
35				698		542	870
36				703		530	789
37				709		522	696

Abbreviations: See Appendix Table 6

*Powdered transition mixtures of P.D. #2 + TEK +H_2O.
**Started on P.D. #3 third day of wk 9. Continued through wk 13.
***Started on P.D. #4 third day of wk 13.
+P.D. #5 - 50% (w/v).
‡Between wks 17-25 P.D. #5 - 50%(w/v) was diluted to the designated concentrations $\bar{w}$ A.J.
ǂBeginning wk 26 P.D. #5 - 50%(w/v) made in A.J.

APPENDIX TABLE 5

Animal No. 7

Week	Diet TEK	Diet P.D.2 %	Diet H_2O*	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0				657			
1	20	58	22	675	413		580
2	8	69	23	686	399		524
3	29	43	28	733	488		641
4	0	75	25	748	425		599
5	0	75	25	721	308		520
6	0	75	25	719	345		669
7	0	74	26	734	393		659
8	60	15**	25	671	314		534
9	0	76	24	622	418		374
10	61	26***	13	562	134		635
11	0	76	24	557	380		682
12	0	76	24	579	619		723
13	0	82	18	596	568		652
14	(P.D.4 + TEK) + P.D.5			-	134	130+	366
15	P.D.5 + TEK			-	9	647	0‡
16				581		496ǂ	709ǂ
17				597		476	766
18				622		486	805
19				641		458	606
20				651		464	708
21				702		579	744
22				718		599	778
23				724		520	800
24				694		490	723
25				692		425	750
26				712		524	785
27				701		490	777
28				626		477	781
29				664		524	846
30				681		522	983
31				696		532	1,192
32				701		508	865
33				707		500	825
34				711		539	750
35				713		462	731
36				715		432	850
37				716		475	903

Abbreviations: See Appendix Table 6

*Powdered transition mixtures of P.D. #2 + TEK + H_2O.

**Fed P.D. #3 + TEK first six days of wk 8. Switched back to P.D. #2 through wk 9.

***Returned to P.D. #3 + TEK first six days of wk 10. Switched back to P.D. #2 through wk 13.

+Fed P.D. #4 (80%) + TEK (20%) first four days of wk 14; then switched to P.D. #5 - 30% (w/v).

‡*Ad libitum* water removed wk 15. Fed P.D. #5 - 30% (w/v) + TEK.

ǂReturned to *ad libitum* water and started P.D. #5 - 50% (w/v) beginning wk 16.

SCHWARZ BIORESEARCH

APPENDIX TABLE 6

Animal No. 8

Week	Diet TEK	Diet P.D.2 %	Diet H_2O*	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0				786			
1	50	7	43	801	472		1,057
2	38	37	25	846	465		957
3	35	38	27	876	523		1,153
4	22	53	25	849	475		986
5	35	38	27	794	433		1,090
6	23	54	23	741	376		957
7	0	75	25	744	432		1,012
8	0	75	25	682	425		1,038
9	0	76	24	652	439		664
10	0	85	15	617	226		889
11	0	80	20	609	340		980
12	0	76	24	586	387		1,025
13	0	78	22	571	308		848
14	P.D. 4 + P.D. 5			537	127**	139	735
15	P.D. 5***			499	20	286	100+
16				466		200	706
17					Deceased‡		

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 2 - Primate Diet No. 2
P.D. 4 - Primate Diet No. 4
P.D. 5 - Primate Diet No. 5

*Powdered transition mixtures of P.D. #2 + TEK + H_2O.
**P.D. #4 (90%) + TEK (10%) started on first day of wk 14.
P.D. #5 30% (w/v) started on fourth day of wk 14.
***P.D. #5 - 50% (w/v).
+*Ad libitum* water removed first 6 days of wk 15.
‡Died second day of wk 17. Death attributed to malnutrition.

APPENDIX TABLE 7

Animal No. 9

Week	Diet			Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
	TEK	P.D.2 %	H_2O*				
0				636			
1	53	23	44	632	341		676
2	39	35	26	691	412		693
3	35	39	26	676	439		821
4	0	77	23	718	390		791
5	0	75	25	705	351		589
6	0	75	25	682	389		647
7	0	74	26	687	395		501
8	0	75	25	521	325		411
9	0	76	24	509	458		500
10	0	85	15	498	232		549
11	0	76	24	501	445		534
12	0	75	25	502	600		584
13	0	79	21	491	465		599
14	(P.D.4 + TEK) + P.D.5			423	33**	64	142
15					Deceased***		

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 2 - Primate Diet No. 2
P.D. 4 - Primate Diet No. 4
P.D. 5 - Primate Diet No. 5

*Powdered transition mixtures of P.D. #2 + TEK + H_2O.
**P.D. #4 (90%) + TEK 10% fed first day of wk 14. P.D. #5 - 30% (w/v) started on second day of wk 14.
***Died on sixth day of wk 14. Death attributed to malnutrition.

SCHWARZ BIORESEARCH

APPENDIX TABLE 8

Animal No. 10

Week	Diet TEK	Diet P.D.2 %	Diet H_2O*	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0				837			
1	57	2	41	720	113		365
2	100	0	0	823	331		794
3	69	0	31	716	190		656
4	100	0	0	828	421		1,013
5	100	0	0	877	424		819
6	56	20	24	776	290		649
7	70	0	30	721	175		413
8	100	0	0**	735	344		975
9				827	437		984
10				816	342		851
11				808	350		737
12				878	434		905
13				899	339		755
14				905	335		934
15				864	317		866
16				914	381		816
17				928	380		852
18				947	397		786
19				987	353		650
20				-	406		667
21				947	369		716
22				951	404		770
23				0	370		771
24				949	358		772
25				919	396		724
26				974	430		1,018
27				-	446		945
28				1,016	485		1,020
29				1,032	497		1,188
30				1,056	485		1,225
31				1,067	391		1,189
32				1,079	404		1,117
33				1,061	480		998
34				1,079	492		921
35				1,082	486		971
36				1,097	487		1,027
37				1,098	480		950

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 2 - Primate Diet No. 2

*Powdered transition mixtures of P.D. #2 + TEK + H_2O.
**Returned to dry Teklad biscuit beginning wk 8.

SCHWARZ BIORESEARCH

APPENDIX TABLE 8

Animal No. 10

Week	Diet			Body Weight g	Diet Consumption g/wk ml/wk	Water Consumption ml/wk
	TEK	P.D.2 %	H_2O*			
0				837		
1	57	2	41	720	113	365
2	100	0	0	823	331	794
3	69	0	31	716	190	656
4	100	0	0	828	421	1,013
5	100	0	0	877	424	819
6	56	20	24	776	290	649
7	70	0	30	721	175	413
8	100	0	0**	735	344	975
9				827	437	984
10				816	342	851
11				808	350	737
12				878	434	905
13				899	339	755
14				905	335	934
15				864	317	866
16				914	381	816
17				928	380	852
18				947	397	786
19				987	353	650
20				-	406	667
21				947	369	716
22				951	404	770
23				0	370	771
24				949	358	772
25				919	396	724
26				974	430	1,018
27				-	446	945
28				1,016	485	1,020
29				1,032	497	1,188
30				1,056	485	1,225
31				1,067	391	1,189
32				1,079	404	1,117
33				1,061	480	998
34				1,079	492	921
35				1,082	486	971
36				1,097	487	1,027
37				1,098	480	950

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 2 - Primate Diet No. 2

*Powdered transition mixtures of P.D. #2 + TEK + H_2O.
**Returned to dry Teklad biscuit beginning wk 8.

APPENDIX TABLE 9

Animal No. 13

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		677	-	-	
1	TEK	656	160		463
2		692	312		736
3		693	375		774
4		762	353		753
5		768	371		717
6		781	356		710
7		826	329		680
8		799	380		642
9		813	330		721
10		876	350		749
11		686	301		670
12		871	285		743
13		893	304		623
14		891	286		543
15		736	258		544
16		741	235		612
17		736	275		689
18		824	248		606
19		-	253		490
20		858	302		667
21		851	238*		569
22	P.D.4 + A.J.	-	81		628
23		694	191		856
24		-	304		812
25	P.D. 5	688	111	54**	638
26		516		100***	-
27		546		274	-
28	TEK		350+	4	884
29		631	405		934
30		683	384		843
31		721	479		1,030
32		767	426		968
33	P.D.5 + TEK	814	58	70‡	408
34		697	324	52	822
35		729	367	52	933

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4
P.D. 5 - Primate Diet No. 5
A.J. - Apple Juice

*Started on P.D. #4+A.J. (15:1) last day of wk 21.
**Started on P.D. #5 - 50% (w/v) in A.J. fourth day of wk 25.
***Started on P.D. #5+H_2O (2:1) no _ad-lib._ H_2O.
+Returned to TEK + _ad-lib._ water on fourth day of wk 28.
‡P.D. #5 - 50% w/v in A.J.

APPENDIX TABLE 10

Animal No. 14

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		668			
1	TEK	683	165		524
2		701	256		516
3		741	297		596
4		777	283		537
5		783	249		492
6		813	257		589
7		869	253		606
8		861	249		575
9		853	255		597
10		901	274		734
11		911	254		619
12		909	223		552
13		907	188		558
14		889	167		535
15		743	217		545
16		746	186		554
17		753	202		556
18		769	228		559
19		-	215		587
20		729	225		685
21		711	165*		597
22	P.D.4 + A.J.	-	97		643
23		648	194		625
24		-	310		690
25	P.D. 5	663	130	271**	1,026
26		724		474	982
27		729		465***	1,014
28	P.D. 5	-		567	1,285
29		776		569	959
30		779		572	960
31		786		503	1,111
32		802		503	1,089
33		814		487	992
34		827		472	891
35		831		510	1,022

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4
P.D. 5 - Primate Diet No. 5
A.J. - Apple Juice

*Started on P.D. #4 + A.J. (15:1) on last day of wk 21.
**Started on P.D. #5 -(50% w/v) in A.J. fourth day of wk 25.
***Started on P.D. #5 - 50% (w/v) w 25% v/v A.J. fourth day of wk 27.

SCHWARZ BIORESEARCH

APPENDIX TABLE 11

Animal No. 15

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		587			
1	TEK	581	201		524
2		580	244		573
3		658	238		548
4		602	235		552
5		601	202		565
6		608	246		559
7		631	237		549
8		601	193		648
9		592	262		517
10		611	250		589
11		597	168		570
12		573	176		569
13		591	221		548
14		606	219		474
15		623	175		460
16		631	201		552
17		642	241		603
18		657	242		606
19		-	251		560
20		661	231		542
21		660	144		524
22	P.D. 4	546	86		515
23		-	133		613
24		567	275		934
25	P.D.4 + P.D.5 in A.J.	576	130	297*	870
26	P.D. 5 in A.J.	598		554	915
27		-		489**	1,060
28	P.D. 5	647		507	1,527
29		641		558	1,446
30		658		609	1,087
31		661		648	1,130
32		664		601	1,090
33		667		544	990
34		669		567	1,057
35		674		492	1,019
36		679		477	904
37				509	1,024

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4
P.D. 5 - Primate Diet No. 5
A.J. - Apple Juice

*Started on P.D. #5 - 50% (w/v) in A.J. on fourth day of wk 25.
**P.D. #5 - 50% (w/v) in 25% v/v A.J.

SCHWARZ BIORESEARCH

APPENDIX TABLE 12

Animal No. 16

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		718			
1	TEK	691	196		671
2		694	260		727
3		689	264		704
4		691	239		696
5		670	224		646
6		697	294		691
7		756	325		793
8		767	311		771
9		779	283		677
10		797	277		743
11		819	286		619
12		831	250		708
13		812	171		521
14		829	298		644
15		836	279		706
16		829	255		634
17		811	267		686
18		826	248		684
19		-	258		620
20		842	257		606
21	TEK+ (P.D.4 + A.J.)	833	147*		575
22	P.D.4 + A.J.	-	36		405
23	(P.D.4 + A.J.) + TEK	508	141**		401
24	TEK	-	284		794
25		674	385		934
26		754	412		948
27		827	390		977
28		-	390		1,033
29		865	359		874
30		884	369		724
31		914	410		679
32		921	419		746
33		926	339		965
34		931	405		1,041
35		947	372		970
36		951	355		764
37		948	387		719

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4
A.J. - Apple Juice

*Started on P.D.#4 + A.J. (15:1) on last day of wk 21.
**Returned to TEK on fourth day of wk 23.

SCHWARZ BIO RESEARCH

APPENDIX TABLE 13

Animal No. 17A

Week	Diet	Body Weight g	Diet Consumption g/wk ml/wk	Water Consumption ml/wk
0		522		
1	TEK	520	(368)*	(1,114)*
2		-	(383)	(1,042)
3		-	(449)	(1,106)
4		622	(522)	(1,471)
5		-	(382)	(1,241)
6		-	(164)	565
7		681	201	575
8		677	184	513
9		667	199	462
10		721	246	642
11		711	199	578
12		714	237	574
13		721	271	652
14		739	190	481
15			Died of Unknown Cause**	
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				

Abbreviations: TEK - Teklad, Rockland Primate Diet

*Values in brackets represent the total consumption for two monkeys (17A&B) housed in a single cage.

**Previous history of recurring swelling and apparent infection of left eye beginning wk 6. Treatment with Omnipen (oral) resulted in temporary regression.

SCHWARZ BIORESEARCH

APPENDIX TABLE 14

Animal No. 17B

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		691			
1	TEK	713	(368)*		(1,114)*
2		690	(383)		(1,042)
3		739	(449)		(1,106)
4		784	(522)		(1,471)
5		736	(382)		(1,241)
6		846	377		938
7		963	355		971
8		922	255		813
9		912	352		828
10		926	327		891
11		879	248		778
12		852	314		681
13		908	325		684
14		933	387		668
15		891	364		706
16		887	251		603
17		883	295		595
18		879	298		619
19		-	282		609
20		886	327		634
21		879	218		747
22	P.D.4	723	95		639
23	TEK	-	210		531
24		699	328		718
25	TEK + P.D.5 w A.J.	699	179	281**	768
26	P.D.5 in A.J.	696		475	827
27		-		469***	1,006
28	P.D.5	731		567	1,467
29		754		654	1,583
30		769		549	1,553
31		761		452	1,376
32		767		477	1,137
33		771		485	1,025
34		773		436	928
35		776		413	948
36		751		416	929
37				404	1,055

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 5 - Primate Diet No. 5
A.J. - Apple Juice

*Values in brackets represent the total consumption for two monkeys (17A&B) housed in a single cage.
**Started on P.D. #5 - 50% (w/v) in A.J. on fourth day of wk 25.
***Started on P.D. #5 - 50% (w/v) w 25% v/v A.J. on second day of wk 27.

SCHWARZ BIORESEARCH

APPENDIX TABLE 15

Animal No. 18A

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		654			
1	TEK	-	(375)*		(1,142)*
2		611	(382)		(1,046)
3		593	(366)		(927)
4		641	(436)		(1,106)
5		660	(453)		(1,119)
6		681	(513)		(1,075)
7		701	(420)		(934)
8		714	(493)		(1,163)
9		721	(502)		(1,197)
10		739	(514)		(1,080)
11		691	(447)		(976)
12		703	(478)		(985)
13		716	(473)		(907)
14		729	(454)		(904)
15		741	(482)		(1,328)
16		661	251		603
17		666	295		595
18		669	225		581
19		-	201		489
20		676	226		557
21	TEK + (P.D.4 + A.J.)	671	136**		595
22	P.D. 4 + A.J.	-	44		588
23	TEK	-	103		268
24		-	205		493
25		588	352		944
26		647	364		1,030
27		662	376		1,040
28	TEK + P.D. 5 in A.J.	602	158	76***	602
29		534	64	31+	403
30	TEK	584	299		1,220
31		643	442		1,251
32	TEK + P.D. 5 in A.J.	513	122	43‡	513
33		521	325	51	873
34		601	357	42	699
35		611	360	39	982
36		624	293	50	808
37			310	39	734

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4
P.D. 5 - Primate Diet No. 5
A.J. - Apple Juice

*Values in brackets represent the total consumption for two monkeys (18A&B) housed in a single cage.

**Started on P.D. 4 + A.J. last day of wk 21.

***Started on P.D. 5 - 50% (w/v) in A.J. on second day of wk 28.

+*Ad libitum* water withdrawn and P.D. 5 - 30% (w/v) in A.J. + H_2O (2:1) started on second day of wk 29. Returned to TEK + *ad lib.* H_2O on 6th day.

‡Started on P.D. 5 - 35% (w/v) in A.J.

SCHWARZ BIORESEARCH

APPENDIX TABLE 16

Animal No. 18B

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		797			
1	TEK	842	(375)*		(1,142)*
2		821	(382)		(1,046)
3		775	(352)		(927)
4		842	(428)		(1,106)
5		809	(431)		(1,119)
6		861	(499)		(1,075)
7		838	(415)		(934)
8		884	(484)		(1,163)
9		927	(490)		(1,197)
10		964	(505)		(1,080)
11		942	(447)		(976)
12		946	(478)		(985)
13		931	(473)		(907)
14		962	(454)		(904)
15		933	(482)		(1,328)
16		989	305		760
17		982	320		791
18		979	252		724
19		966	271		560
20		919	255		641
21		-	264		699
22		888	280		649
23	TEK + (P.D.4 + A.J.)	721	227**		761
24	P.D. 4 + A.J.	564	26		334
25		-	52		340
26	TEK	672	285		1,030
27		696	383		959
28		764	392		1,246
29		811	417		1,502
30		866	446		1,406
31	TEK + P.D.5 in A.J.	796	23	168***	579
32	P.D. 5 in A.J.	803		554+	874
33		807		523‡	750
34			Deceased‡		

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4
P.D. 5 - Primate Diet No. 5
A.J. - Apple Juice

*Values in brackets represent the total consumption for two monkeys (18A&B) housed in a single cage.

**Started on (P.D. 4 + A.J.) on fifth day of wk 23.

***Started on P.D.5 - 50% (w/v) in A.J. first 3 days of wk 31. Switched to 30% (w/v) in A.J. days 4,5,6 and to 35% (w/v) in A.J. day 7.

+P.D. 5 - 40% (w/v) in A.J.

‡Started on P.D. 5 - 50% (w/v) in A.J. on day 3 of wk 33.

‡Acute death on last day of wk 33 immediately after weighing. No previous pathogenic history. Death attributed to hypertension and heart failure.

SCHWARZ BIORESEARCH

APPENDIX TABLE 17

Animal No. 19A

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		637			
1	TEK	668	(398)*		(1,282)*
2		594	(358)		(858)
3		691	(453)		(1,161)
4		738	(457)		(1,107)
5		749	(453)		(1,194)
6		766	(508)		(1,052)
7		785	(493)		(1,156)
8		761	(481)		(1,079)
9		763	(503)		(1,186)
10		750	(491)		(1,156)
11		791	(508)		(1,116)
12		783	(455)		(1,003)
13		797	(491)		(1,082)
14		812	(469)		(990)
15		814	(470)		(1,058)
16		817	(477)		(1,081)
17		814	(480)		(1,153)
18		816	217		505
19		-	234		465
20		784	245		556
21		-	228		564
22		749	266		520
23	P.D. 4	601	198		669
24		522	39		592
25				Dead**	
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4

*Values in brackets represent the total consumption for two monkeys (19A&B) housed in a single cage.
**Died on second day of wk 25. Death attributed to malnutrition.

SCHWARZ BIORESEARCH

APPENDIX TABLE 18

Animal No. 19B

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		737			
1	TEK	731	(398)*		(1,282)*
2		643	(358) -		(858)
3		714	(453)		(1,161)
4		726	(457)		(1,107)
5		741	(453)		(1,194)
6		762	(508)		(1,052)
7		794	(493)		(1,156)
8		772	(481)		(1,079)
9		789	(503)		(1,186)
10		799	(491)		(1,156)
11		821	(508)		(1,116)
12		812	(455)		(1,003)
13		851	(491)		(1,082)
14		873	(469)		(990)
15		769	(470)		(1,058)
16		771	(477)		(1,081)
17		779	(480)		(1,153)
18		788	232		601
19		816	223		484
20		839	227		-
21		-	194		698
22		782	221		710
23	TEK + (P.D.4 + A.J.)	732	148**		603
24	P.D. 4 + A.J.	509	16		460
25		491	73		395
26			Dead***		
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4
P.D. 5 - Primate Diet No. 5
A.J. - Apple Juice

*Values in brackets represent the total consumption for two monkeys (19A&B) housed in a single cage.
**Started on P.D. #4 on fifth day of wk 23.
***Died on fourth day of wk 26. Death attributed to malnutrition.

SCHWARZ BIORESEARCH

APPENDIX TABLE 19

Animal No. 20A

Week	Diet	Body Weight g	Diet Consumption g/wk ml/wk	Water Consumption ml/wk
0		667		
1	TEK	632	(425)*	(1,107)*
2		639	(383)	(893)
3		673	(439)	(1,105)
4		688	(498)	(1,027)
5		719	(485)	(1,117)
6		709	(498)	(997)
7		712	(516)	(954)
8		727	(579)	(1,123)
9		724	(539)	(1,091)
10		753	(536)	(997)
11		801	(548)	(983)
12		794	(492)	(1,012)
13		801	305	582
14		766	287	478
15		773	258	545
16		778	225	440
17		774	229	430
18		781	200	424
19		792	234	519
20		791	186	480
21		-	194	422
22		748	159	384
23	TEK + (P.D.4 + A.J.)	693	111**	421
24	(P.D. 4 + A.J.)	602	27	251
25			Deceased***	
26				
27				
28				
29				
30				
31				
32				
33				
34				
35				
36				
37				

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4
A.J. - Apple Juice

*Values in brackets represent the total consumption for two monkeys (20A&B) housed in a single cage.
**Started on (P.D. 4 + A.J.) fifth day of wk 23.
***Died on third day of wk 25. Death attributed to malnutrition.

SCHWARZ BIORESEARCH

APPENDIX TABLE 20

Animal No. 20B

Week	Diet	Body Weight g	Diet Consumption g/wk	Diet Consumption ml/wk	Water Consumption ml/wk
0		610			
1	TEK	632	(425)*		(1,107)*
2		654	(383)		(893)
3		641	(439)		(1,105)
4		656	(498)		(1,027)
5		688	(485)		(1,117)
6		729	(498)		(997)
7		766	(516)		(954)
8		806	(579)		(1,123)
9		822	(539)		(1,091)
10		853	(536)		(997)
11		847	(548)		(983)
12		869	(492)		(1,012)
13		873	274		560
14		792	274		576
15		781	311		574
16		781	288		596
17		789	262		575
18		796	244		535
19		801	244		522
20		776	252		567
21		-	257		648
22		758	270		584
23	TEK + (P.D.4 + A.J.)	669	185**		567
24	(P.D. 4 + A.J.)	452	20		520
25				Deceased***	
26					
27					
28					
29					
30					
31					
32					
33					
34					
35					
36					
37					

Abbreviations: TEK - Teklad, Rockland Primate Diet
P.D. 4 - Primate Diet No. 4
A.J. - Apple Juice

*Values in brackets represent the total consumption for two monkeys (20A&B) housed in a single cage.
**Started on (P.D. 4 + A.J.) fifth day of wk 23.
***Died on fifth day of wk 25. Death attributed to malnutrition.