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ABSTRACT

Three purposes guided compilation of this final report on the nutritional status of New Orleans, Mississippi, and Alabama Head Start children: (1) to evaluate the causes of anemia through detailed studies of urban New Orleans preschool children and their mothers, (2) to study the effect of dietary supplementation of school feeding programs upon the nutritional status of groups of anemic and non-anemic children in preschool and kindergarten programs, (3) to use nationally standardized procedures to collect and integrate New Orleans data with data obtained from Mississippi and Alabama studies on rural and semi-urban children. The New Orleans study was conducted in three phases and utilized control and nutritionally supplemented groups when they were available. Comparison procedures were used, based on thirteen analyses of blood and urine data. The report's general conclusion was that it is not possible to ascertain or to influence the hematological status of the populations investigated. One third of this document is made up of tables which permit an examination of the number of individuals tested for each parameter, for each school, and for variation between schools. (WY)

NUTRITIONAL STATUS OF NEW ORLEANS, MISSISSIPPI AND ALABAMA HEAD START CHILDREN

Final Report

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NUTRITIONAL STATUS OF NEW ORLEANS, MISSISSIPPI AND ALABAMA

HEAD START CHILDREN

I. INTRODUCTION

In the summer of 1966, Operation Head Start conducted a study of New Orleans children who were enrolled in the summer Head Start Program. Medical personnel revealed that 178 of 2448 children enrolled in the program had hematocrits of less than 33%, levels classified by the Expert Committee on Iron Deficiency Anemia of the World Health Organization as indicating the presence of anemia. No other hematological procedures were carried out at that time. This finding was a concern to the local Head Start medical personnel. It led to our proposal to engage upon a study of anemia in pre-school children. An attempt was made to evaluate the causes of anemia through detailed studies of these children and their mothers. We also wanted to study the effect of dietary supplementation of school feeding programs upon the anemia problems and general nutritional status of groups of anemic and non-anemic children enrolled in this program.

This application was not approved in time to enable the study to be initiated in the summer of 1967, but was finally approved and funded to begin July 1, 1968.

This study was coordinated with the National Nutrition Survey in the state of Louisiana, which was directed by Dr. Arnold E. Schaefer, Director of the National Nutrition Program of the Department of Health, Education, and Welfare. This survey covered far more detailed clinical, biochemical, and dietary observations than had been envisioned in our original program. With Dr. Schaefer's support and after discussions with Dr. A. Frederick North, Jr., then Chief Pediatrician for Operation Head Start, it was decided to apply these more comprehensive study methods, using nationally standardized procedures, to our New Orleans Head Start studies. Additional information to be gained included more detailed clinical and

anthropometric, biochemical and dietary data than originally planned, X-ray studies of the hand and wrist, in order to compare bone development age with chronological age; a procedure widely employed for the study of retardation of physical growth. It was learned through another contract with the Office of Economic Opportunity that the Center for Research and Evaluation of Tulane University under the direction of Dr. Shuell H. Jones was planning psychological studies on the same group of children. These studies were to be carried out under the direction of Dr. Jefferson L. Sulzer, Associate Professor of Psychology of the A. Sophie Newcomb College of Tulane University. Accordingly, study plans were coordinated and the results of our study were made available to Dr. Sulzer for use in analysis of his data.

This report will include data obtained from the New Orleans study under contract number B89-4660 and the Mississippi-Alabama study under contract number 4123. Since the experimental methods in both studies are quite similar, the ease of reporting and the comparison of data between the urban area of New Orleans and the rural or semi-urban areas of Mississippi and Alabama make this plan desirable.

II. NEW ORLEANS PRE-KINDERGARTEN AND HEAD START STUDY

The first phase was carried out during the period July 12 through July 29, 1968, coordinated as indicated above with the studies of Dr. Sulzer and his group. During this period, 512 children from five schools and 67 of their mothers were examined.

Project Pre-Kindergarten in New Orleans, from which initial samples from the first phase of our study were drawn, was in effect from June 17, 1968 to August 2, 1968. A sufficiently high percentage of anemia was found in four of the five initial study schools. In the second phase of the study; one school,

Henderson, was dropped from the study because of the relatively small number of Operation Pre-Kindergarten children available there. First priority was given to the hematological studies. Five hundred blood and 478 urine samples were collected for the study, plus blood and urine samples from their mothers.

During the summer program, the total number of children participating in Orleans Parish was 2268, of which 1817 were Negroes and 446 were white. Our first phase sample included 512 children, all Negroes, or 35.4% of all Negro children in Head Start. During the summer program, all children enrolled received, upon arrival at their school, a snack consisting of cheese, cookies or fruit, and a fruit juice. A hot school lunch was provided.

In early September, the children were enrolled in their regular kindergarten classes of the New Orleans Public School System. These classes are half day, either morning or afternoon and no hot school lunch is provided. Each child receives a mid-class snack, consisting of one half pint of milk and two cookies. Of the original 512 children who were studied, in the first phase, 332 were enrolled in the regular kindergarten program of the four schools studies in the second phase. Between October 3 and October 30, 1968, an additional 187 children (who did not participate in the pre-kindergarten program) were added to the study and were subjected to the same examination procedures as the July group. The sex and age characteristics of these children are given in Table 1.

Immediately upon completion of the second examination, supplementation was started. Classes were selected in such a way that approximately half of the children of the studies population received in addition to the usual mid-morning snack of cookies and milk, a one ounce serving of fortified cereal (Kellogg's Product 19) and a packet of granulated sugar (5 grams). The nutrient content of Product 19 is given in Table 2. Milk was provided for a total of 664 children,

TABLE 1

AGE AND SEX CHARACTERISTICS OF SAMPLE FOR OCTOBER 1968

	Control Group	Supplemented Group
N =	223	287
Average age (mos.)	64.6	61.7
Range (mos.)	58 - 69	57 - 69
% Males	54.7	52.6
% Females	45.3	47.4

333 of these children received fortified cereal and sugar. Children not involved in the supplemental feeding program, due to the lack of parental permission, were given milk for the sake of administrative expediency.

The supplementation program was continued for approximately six months. At which time the children were completely re-evaluated with respect to their nutritional status. Careful supervision assured us that the supplement was enthusiastically and regularly consumed.

III. MISSISSIPPI AND ALABAMA

At the request of Dr. Shueil H. Jones and Dr. Jefferson L. Sulzer and with the permission of Dr. A. Frederick North, Jr., we conducted an identical evaluation of nutritional status in groups of children which Dr. Jones and Dr. Sulzer had selected for their study in southern Mississippi and Alabama. This study was supported by the Office of Economic Opportunity Contract No. 4123. A final report is herewith included.

Operation Head Start in these two states was a full day, year round program which provided a Class A school lunch and, in many instances, breakfast. Another difference from the New Orleans study was the number of white children included in these groups. Another variable to be considered was that Mississippi-Alabama groups consist largely of small town or rural children. These children were also re-evaluated with respect to nutritional and performance status after a six month period.

IV. RESULTS

A. Nutritional Health Status

The results reported here have been grouped according to the hematological findings, serum vitamin data, serum protein data, and

TABLE 2

NUTRIENT CONTENT FOR KELLOGG'S PRODUCT 19

Nutrient	Amount per Ounce Serving	
Calcium	75.0	mg.
Phosphorus	60.0	mg.
Iron	10.0	mg.
Thiamine	1.0	mg.
Riboflavin	1.2	mg.
Niacin	10.0	mg.
Vitamin A	4000	USP units
Vitamin D	400	USP units
Vitamin C	30.0	mg.
Vitamin B_6	1.2	mg.
Vitamin B_{12}	2.2	mg.
Sodium	290.0	mg.
Potassium	40.0	mg.
Calories	106	
Protein	2.9	gms.
Fat	0.3	gms.
Total Carbohydrates	23.0	gms.
Fiber	0.1	gm.

urinary vitamin findings. The body of the report will include only data of the combined groups for comparison between the supplemented and control groups in the New Orleans study for each of the three time periods and in the Mississippi-Alabama groups for each time period. Because the actual date of examination of the children is different for each school, the dates will be listed as indicated in Table 3. Each of the New Orleans schools have been divided into control groups and supplemented groups. The data obtained in each individual school for each determination has been included in the Appendix. Also, added to the Appendix is a report from the Center for Human Growth and Development, the University of Michigan, Ann Arbor, Michigan, which was prepared by A. Roberto Frisancho for the examination of the bone growth data which was performed with the cooperation of Dr. Arnold E. Schaefer in the Nutrition Programs, Department of Health, Education, and Welfare. Even though this represents a "Final Report", the data will be used in our continuing studies in this field and therefore, supplements from time to time will be added.

B. Guidelines for Interpretation of Nutritional Data

There are several different sets of guidelines which can be used to interpret these data, including those used by World Health Organization (W H O), Children's Bureau and the Interdepartmental Committee on Nutrition for National Defense (ICNND). The guidelines which have been used are those provided by the ICNND as shown in Table 4. Since we are trying to indicate a generalized status of population, the data are reported not only as the group means but also percent distribution of each group based upon these guidelines.

TABLE 3

DATES FOR EXAMINATION OF SCHOOL CHILDREN

Date as Used in Tables	Actual Date	School
Summer '68	July 12	Henderson
	14	Craig
	18	Lawless
	19	Craig
	22 + 26	Jones
	29	Hardin
Fall '68	October 2 - 4	Craig
	14 - 17	Lawless
	21 - 25	Jones
	28 - 30	Hardin
	November	Mississippi
	December	Alabama
Spring '69	April 8-10, 25	Craig
	15-16, 28	Lawless
	22 - 25	Jones
	29 - 30	Hardin
	May	Mississippi
	August	Alabama

In this way it is possible to evaluate the adequacy or inadequacy of each biochemical determination.

C. Hematological Data

1. Hemoglobin. In Table 5, the mean hemoglobin concentration for New Orleans control and supplemented groups at each collection period are compared, using a T-test to judge statistical significance. The probability (P) of the differences observed being due to chance are also indicated. It should be pointed out that a mathematically significant difference of means may be of little or no biological importance. As seen in Table 5 for New Orleans, the mean hemoglobin concentration increase from 10.95 $\pm$ 1.05 gm% in summer 1968 to 11.64 $\pm$ 0.88 gm% in spring 1969 in the supplemented groups. The values for the control group were very similar, in that, the summer mean hemoglobin concentration was 11.8 $\pm$ 0.98 gm%; fall 11.52 $\pm$ 1.12 gm% and spring 11.59 $\pm$ 0.90 gm%. In comparing the data, the difference between the supplemented and control groups in summer was at the 5% probability level. However, there was no statistical difference between the supplemented and control groups in either fall or spring. It is interesting that in comparing the mean hemoglobin concentrations of the control groups between spring and summer, there was significant change (probability at the 1% level). These data would suggest that if variation in hemoglobin levels from summer 1968 to fall 1968 is due to external supplementation, it must be due to the lunch and breakfast programs of Operation Head Start.

The comparison of the hemoglobin concentration between the supplemented and control groups in fall shows a supplemented group

TABLE 4

GUIDELINES FOR INTERPRETATION OF BLOOD AND URINE DATA FOR FIVE YEAR OLDS

	Acceptable	Low	Deficient
Hemoglobin (gms/100 ml)	≥ 11.0	10.0 - 10.9	< 10
Hematocrit (%)	≥ 34	30 - 33	< 30
MCHC (gms/100 ml RBC)	≥ 30	< 30	
Serum Iron (µg/100 ml)	≥ 40	< 40	
Transferrin Saturation (%)	≥ 20	< 20	
Folic Acid (mµg/ml)	≥ 6.0	3.0 - 5.9	< 3.0
Serum Protein (gms/100 ml)	≥ 5.5	< 5.5	
Serum Albumin (gms/100 ml)	≥ 3.0	< 3.0	
Vitamin C (mg/100 ml)	≥ 0.3	0.2 - 0.29	< 2.0
Carotene (µg/100 ml)	≥ 40	40	
Vitamin A (µg/100 ml)	≥ 30	20 - 29	< 20
Urinary Thiamine (µg/gm creatinine)	≥ 121	85 - 120	< 85
Urinary Riboflavin (µg/gm creatinine)	≥ 300	100 - 299	< 100

TABLE 5

COMPARISON OF GROUP MEANS FOR HEMOGLOBIN DATA FOR NEW ORLEANS SCHOOL CHILDREN

	MEAN (gms)	STAND DEV	T-TEST
Supplemented summer-68 vs.	10.95	1.05	5.49[b]
Supplemented fall-68	11.51	1.17	
Supplemented summer-68 vs.	10.95	1.05	7.51[b]
Supplemented spring-69	11.64	0.88	
Supplemented summer-68 vs.	10.95	1.05	2.44[a]
Control summer-68	11.18	0.98	
Supplemented fall-68 vs.	11.51	1.17	1.38
Supplemented spring-69	11.64	0.88	
Supplemented fall-68 vs.	11.51	1.17	0.03
Control fall-68	11.52	1.12	
Supplemented spring-69 vs.	11.64	0.88	0.52
Control spring-69	11.59	0.90	
Control summer-68 vs.	11.59	0.90	4.68[b]
Control spring-69	11.18	0.98	
Control fall-68 vs.	11.59	0.90	0.73
Control spring-69	11.51	1.12	
Control summer-68 vs.	11.18	0.98	3.25[b]
Control fall-68	11.51	1.12	

a) $P < .05$
b) $P < .01$

mean of 11.51 gm% and control group of 11.52 gm% and indicates no difference between these groups. A similar comparison between the supplemented and control groups in spring, also indicates that there is no significant difference in the mean hemoglobin concentrations of each (11.64 gm% supplemented group; 11.59 gm% control group). These data would indicate that the increased supplementation of Product 19 which contains 10 milligrams of reduced iron per serving (a Recommended Daily Allowance for iron for this age) did not sufficiently affect the hemoglobin status in these children.

Table 6 persents the percent distribution of the hemoglobin data based upon ICNND Standards. If comparison of the hemoglobin data for the New Orleans groups is examined, it will be seen that of those children ultimately in the supplemented group in summer 1968, 54% had acceptable hemoglobin values; while 61% of the children which were ultimately in the control group had acceptable values. By the fall of 1968, these values had increased to approximately 70-and 75% respectively, with approximately 10% of the children in each group having hemoglobin values less than 10 grams per 100 ml. By the spring of 1969, after supplementation, the children whose hemoglobin concentration was acceptable had increased to 84% in the supplemented group and to 78% in the non-supplemented groups, with approximately the same percentage in the deficient categories for each group. Based on these data, a very small effect on the hemoglobin status of the children in the supplemented group was observed. However, this was below expectations if 10 mg. of available iron was provided through this period of time.

TABLE 6

PERCENT DISTRIBUTION OF HEMOGLOBIN DATA

		Acceptable ≥ 11	Low 10.0 - 10.9	Deficient < 10
Orleans summer-68	Supplemented	54.2	32.1	13.6
	Control	60.8	28.7	10.4
Orleans fall-68	Supplemented	75.1	14.5	10.4
	Control	71.4	18.0	10.7
Alabama fall-68		81.5	16.4	2.0
Mississippi fall-68		83.7	13.2	3.1
Orleans spring-69	Supplemented	84.0	12.2	3.8
	Control	78.4	17.4	4.1
Alabama spring-69		68.7	28.6	2.7
Mississippi spring-69		80.3	19.7	0

In Table 7, the mean hemoglobin concentration for the children of Alabama and Mississippi Head Start programs were compared for both time periods, the summer of 1968 and the spring of 1969. This table also includes a comparison of the means of the hemoglobin concentrations from the Alabama children with those from the New Orleans control group, a comparison of the data obtained from the Mississippi children with those from the New Orleans control group, and the Alabama and the Mississippi groups combined and compared with the New Orleans control group. In Alabama in the summer of 1968 the mean hemoglobin concentration was 11.7gm.% which decreased to a mean of 11.4 gm.% by the spring of 1969. This change is significant with a probability of less than 1%. Its biological significance can be seen from Table 6. In the fall of 1968, 81.5% children in the Alabama Head Start programs had acceptable hemoglobin concentrations of greater than 11 gm.% However, during the course of the winter this had decreased to 68.7%. This decrease is due to an increase in the values which are below acceptable standards by a large percentage.

Similar comparisons for Mississippi Head Start can be made. In the summer of 1968 the mean hemoglobin concentrations was 11.78 $\pm$ 0.87gm.%. In the spring of 1969 the mean hemoglobin concentration had decreased to 11.54 gm. $\pm$ 0.77 gm.%. The difference between these means is not significant at the 5% level. The distribution of the data presented in Table 6 show that in the fall of 1968, 83.7% of the children had acceptable hemoglobin values. This number stayed essentially constant in the spring as 83.3% of the children had acceptable hemoglobin values.

TABLE 7

COMPARISON OF GROUP MEANS FOR HEMOGLORIN FOR NEW ORLEANS CONTROL, MISSISSIPPI AND ALABAMA

	MEAN (gms/100 ml)	STAND DEV	T-TEST
Alabama fall-68 vs.	11.70	0.83	3.57[b]
Alabama spring-69	11.40	0.84	
Alabama fall-68 vs.	11.70	0.83	0.51
Mississippi fall-68	11.78	1.87	
Alabama spring-69 vs.	11.40	0.84	1.52
Mississippi spring-69	11.54	0.77	
Mississippi fall-68 vs.	11.78	1.87	1.48
Mississippi spring-69	11.54	0.77	
Alabama spring-69 vs.	11.40	0.84	2.11[a]
New Orleans spring-69	11.59	0.90	
Alabama fall-68 vs.	11.70	0.83	1.81
New Orleans fall-68	11.52	1.12	
Alabama spring-69 vs.	11.40	0.84	1.08
New Orleans fall-68	11.52	1.12	
Alabama fall-68 vs.	11.70	0.83	1.23
New Orleans spring-69	11.59	0.90	
Mississippi fall-68 vs.	11.78	1.87	1.52
New Orleans fall-68	11.52	1.12	
Mississippi spring-69 vs.	11.54	0.77	0.20
New Orleans fall-68	11.52	1.12	
Mississippi fall-68 vs.	11.78	1.87	1.13
New Orleans spring-69	11.59	0.90	
Mississippi spring-69 vs.	11.54	0.77	0.62
New Orleans spring-69	11.59	0.90	
Alabama + Mississippi fall-68 vs.	11.72	1.34	1.97[a]
New Orleans fall-68	11.52	1.12	
Alabama + Mississippi spring-69 vs.	11.47	0.81	0.55
New Orleans fall-68	11.52	1.12	

a) $P < .05$
b) $P < .01$

It is also interesting to note that data collected in the fall of 1968 in both Alabama and Mississippi, do not show significant difference between the mean of Alabama-Mississippi groups from the spring of 1969. However, if data obtained in either of these states are compared with the New Orleans control groups, larger differences are found. For example, if the hemoglobin levels for Alabama-Mississippi are combined and compared with the hemoglobin levels of the New Orleans control group, there is a significant difference at the 5% level for October. From examining these data it can be said that the rural or semi-rural children encountered in Mississippi and Alabama, have significantly higher mean hemoglobin concentrations with a smaller percentage of these children in unacceptable ranges as compared to the New Orleans group which reside in large urban areas.

2. Hematocrit. The hematocrit values for the three examination periods for New Orleans are listed in Table 8 and for Mississippi-Alabama, in Table 9. The mean hematocrits are well within the normal range even though there are some in the New Orleans groups which would indicate mathematical significant differences between means. It is doubtful that these differences are of practical importance. In Table 10, the percent distribution of the data for hematocrit is presented as acceptable $\geq$ 34% and unacceptable $<$ 34% ranges. For New Orleans, there appears to be relatively little difference between the two groups. In the summer of 1968, New Orleans shows that 88.4% and 91.8% of the children in the supplemented and

control groups respectively, have hematocrit values greater than 34% which is considered acceptable at this age. These values do not appreciably change over the course of the study nor do they appear to be an effect due to Product 19.

In comparing the means for the Mississippi-Alabama groups (Table 9) greater differences are observed. The hematocrit decreased in Alabama for 36.4 $\pm$ 2.37 % in summer of 1968, to 35.7 $\pm$ 2.73% in the spring of 1969. The differences of these means are significant at the 1% level. Likewise, a significant drop is observed in the hematocrit of the Alabama children during the same period from 91.4% of the children in an acceptable range greater than 34% to 82.4%. This drop was due to a two-fold increase in the values less than 30%. These data combined with the hemoglobin values for the same period would suggest an increase in the anemia observed in this population of that time period.

In Mississippi there is no significant change between the fall and spring collection periods as observed in hemoglobin values. Neither was there an appreciable change in the distribution of the hematocrits. There appears to be no change in the status of the children during this period as far as anemia is concerned.

It can be seen in Table 9 that if Mississippi children and Alabama children are compared with the New Orleans control groups there are significant differences. However, unlike the hemoglobin values the hematocrit values for the New Orleans groups appear to be higher. There is no significant difference between the

TABLE 8

COMPARISON OF GROUP MEANS FOR HEMATOCRIT DATA FOR NEW ORLEANS SCHOOL CHILDREN

	MEAN (%)	STAND DEV	T-TEST
Supplemented summer-68 vs. Supplemented fall-68	37.16 36.64	2.81 2.80	1.98[a]
Supplemented summer-68 vs. Supplemented spring-69	37.16 36.59	2.81 2.35	2.28[a]
Supplemented summer-68 vs. Control summer-68	37.16 37.26	2.81 2.68	0.41
Supplemented fall-68 vs. Supplemented spring-69	36.64 36.59	2.80 2.35	0.19
Supplemented fall-68 vs. Control fall-68	36.64 37.02	2.80 2.53	1.51
Supplemented spring-69 vs. Control spring-69	36.59 36.76	2.35 2.51	0.71
Control summer-68 vs. Control spring-69	36.76 37.26	2.51 2.68	2.07[a]
Control fall-68 vs. Control spring-69	36.76 37.02	2.51 2.53	1.01
Control summer-68 vs. Control fall-68	37.26 37.02	2.68 2.53	0.95

a) $P > .01$

TABLE 9

COMPARISON OF GROUP MEANS FOR HEMATOCRIT FOR NEW ORLEANS CONTROL, MISSISSIPPI AND ALABAMA

	MEAN (%)	STAND DEV	T-TEST
Alabama fall-68 vs.	36.4	2.37	
Alabama spring-69	35.7	2.73	2.93[b]
Alabama fall-68 vs.	36.4	2.37	
Mississippi fall-68	35.9	2.12	2.11[a]
Alabama spring-69 vs.	35.7	2.73	
Mississippi spring-69	36.3	1.96	2.49[a]
Mississippi fall-68 vs.	35.9	2.12	
Mississippi spring-69	36.3	1.96	1.64
Alabama spring-69 vs.	35.7	2.73	
New Orleans spring-69	36.8	2.51	3.98[b]
Alabama fall-68 vs.	36.4	2.37	
New Orleans fall-68	37.0	2.53	2.47[a]
Alabama spring-69 vs.	35.7	2.73	
New Orleans fall-68	37.0	2.53	4.83[b]
Alabama fall-68 vs.	36.4	2.37	
New Orleans spring-69	36.8	2.51	1.44
Mississippi fall-68 vs.	35.9	2.12	
New Orleans fall-68	37.0	2.53	4.25[b]
Mississippi spring-69 vs.	36.3	1.96	
New Orleans fall-68	37.0	2.53	2.83[b]
Mississippi fall-68 vs.	35.9	2.12	
New Orleans spring-69	36.8	2.51	3.31[b]
Mississippi spring-69 vs.	36.3	1.96	
New Orleans spring-69	36.8	2.51	1.82
Alabama + Mississippi fall-68 vs.	36.2	2.28	
New Orleans fall-68	37.0	2.53	3.56[b]
Alabama + Mississippi spring-69 vs.	36.0	2.43	
New Orleans fall-68	37.0	2.51	4.53[b]

a) $P < .05$
b) $P < .01$

TABLE 10

PERCENT DISTRIBUTION OF HEMATOCRIT DATA

		Acceptable > 34	Low 30 - 34	Deficient < 30
Orleans summer-68	Supplemented	88.4	10.5	1.0
	Control	91.8	7.8	0.4
Orleans fall-68	Supplemented	87.8	11.1	1.1
	Control	91.6	7.8	0.6
Alabama fall-68		91.4	7.8	0.8
Mississippi fall-68		89.2	10.2	0.6
Orleans spring-69	Supplemented	92.1	6.9	1.1
	Control	89.3	10.2	0.5
Alabama spring-69		2.4	14.9	2.8
Mississippi spring-69		92.8	7.2	0

distribution of those values in the unacceptable range when New Orleans control group is compared with Mississippi-Alabama.

3. Mean Corpuscular Hemoglobin Concentration. The mean corpuscular hemoglobin concentration (MCHC) is the mean concentration of hemoglobin per 100 ml. of red cells and is calculatable from the hematocrit and hemoglobin. As would be expected in this determination, if either the hemoglobin or the hematocrit are altered, the changes will be reflected in the MCHC. In New Orleans, very large differences are observed in the mean values for MCHC (Table 11). The summer mean for the MCHC was 29.4 $\pm$ 2.12%and 31.39 $\pm$ 2.33% for the supplemented and control groups respectively. This difference was significant at the 1% level. There was no significant difference in the supplemented or control groups in fall or spring. Because of the low values obtained in summer, all comparison mean values made with the summer data show significance.

The percent distribution of the MCHC as shown in Table 12 indicates in summer 32.2% had values which were greater than 30%. In the control group 49.3% of the children had acceptable values. These values took a sharp increase in the fall of 1968 to 80.3% for the supplemented and to 73.6% for the control group. These values further increased for both the supplemented and control groups to 85.9 and 80.5%, respectively, in spring. From these data, it would be difficult to ascertain if these changes were spontaneous or due to intervention. However, because of the continued rise in both control and supplemented groups, it is our feeling that these changes are spontaneous.

TABLE 11

COMPARISON OF GROUP MEANS FOR MCHC DATA FOR NEW ORLEANS SCHOOL CHILDREN

	MEAN (g/100 RBC)	STAND DEV	T-TEST
Supplemented summer-68 vs. Supplemented fall-68	29.44 31.39	2.12 2.33	9.44[a]
Supplemented summer-68 vs. Supplemented spring-69	29.44 31.75	2.12 1.42	13.31[b]
Supplemented summer-68 vs. Control summer-68	29.44 29.98	2.12 1.85	2.87[b]
Supplemented fall-68 vs. Supplemented spring-69	31.39 31.75	2.33 1.42	2.19[a]
Supplemented fall-68 vs. Control fall-68	31.39 31.05	2.33 2.19	1.56
Supplemented spring-69 vs. Control spring-69	31.75 31.51	1.42 1.57	1.71
Control summer-68 vs. Control spring-69	31.51 29.98	1.57 1.85	9.60[b]
Control fall-68 vs. Control spring-69	31.51 31.05	1.57 2.19	2.31[b]
Control summer-68 vs. Control fall-68	29.98 31.05	1.85 2.19	5.40[a]

a) $P < .05$
b) $P < .01$

TABLE 12

PERCENT DISTRIBUTION OF MEAN CORPUSCULAR HEMOGLOBIN CONCENTRATION DATA

		Acceptable ≥ 30	Low < 30
Orleans summer-68	Supplemented	32.2	67.8
	Control	49.3	50.7
Orleans fall-68	Supplemented	80.3	19.7
	Control	73.6	26.4
Alabama fall-68		91.0	9.0
Mississippi fall-68		91.8	8.2
Orleans spring-69	Supplemented	85.9	14.1
	Control	80.5	19.5
Alabama spring-69		87.9	12.1
Mississippi spring-69		88.2	11.8

Table 13 compares the means for the Head Start children in Mississippi-Alabama. The only significant difference observed is in the comparison of Mississippi in the fall of 1968 with the spring of 1969 where the mean MCHC decreased from 32.3 $\pm$ 1.80% to 31.7 $\pm$ 1.24%. The difference of these means is significant at the 1% level. It should be pointed out that the significance is similar to that observed in comparing the Mississippi and Alabama data with that obtained in the New Orleans control groups. In each case the mean values for Mississippi and Alabama combined are higher than that found in New Orleans control children. Similar data are presented in Table 12 which show that in the fall of 1968, Alabama and Mississippi have 91.0 and 91.8%, respectively, of the children in the acceptable range of greater than 30. This percent decreases slightly in the spring of 1969 but does not decrease to the point of the highest level obtained by the New Orleans group.

4. Summary Hematological Data. A significant increase in the hemoglobin concentration was observed from the summer of 1968 at the beginning of the Head Start Program to the beginning of kindergarten. The data would suggest that the change had occurred from the breakfast and lunch program of Operation Head Start, but there are no control data available to confirm this (children which did not receive the food supplementation). The intervention with Kellogg's Product 19 did not have an effect on the hemoglobin status even though it contains 10 mg. of iron per serving. It must be concluded that either this quantity of iron is insufficient or it was unavailable for absorption for some reason.

TABLE 13

COMPARISON OF GROUP MEANS FOR MCHC FOR NEW ORLEANS CONTROL, MISSISSIPPI AND ALABAMA

	MEAN (gms/100 ml)	STAND DEV	T-TEST
Alabama fall-68 vs. Alabama spring-69	32.1 31.9	1.47 2.28	1.21
Alabama fall-68 vs. Mississippi fall-68	32.1 32.3	1.47 1.80	1.54
Alabama spring-69 vs. Mississippi spring-69	31.9 31.7	2.28 1.24	0.64
Mississippi fall-68 vs. Mississippi spring-69	32.3 31.7	1.80 1.24	3.56[b]
Alabama spring-69 vs. New Orleans spring-69	31.9 31.5	2.28 1.57	1.67
Alabama fall-68 vs. New Orleans fall-68	32.1 31.1	1.47 2.19	5.46[b]
Alabama spring-69 New Orleans fall-68	31.9 31.1	2.28 2.19	3.39[b]
Alabama fall-68 vs. New Orleans spring-69	32.1 31.5	1.47 1.57	3.90[b]
Mississippi fall-68 vs. New Orleans fall-68	32.3 31.1	1.80 2.19	5.95[b]
Mississippi spring-69 vs. New Orleans fall-68	31.7 31.1	1.24 2.19	3.49[b]
Mississippi fall-68 vs. New Orleans spring-69	32.3 31.5	1.80 1.57	4.59[b]
Mississippi spring-69 vs. New Orleans spring-69	31.7 31.5	1.24 1.57	1.41
Alabama + Mississippi fall-68 vs. New Orleans fall-68	32.2 31.1	1.61 2.19	6.22[b]
Alabama + Mississippi spring-69 vs. New Orleans fall-68	31.8 31.1	1.88 2.19	3.83[b]

a) $P < .05$
b) $P < .01$

Very little change was observed in Mississippi or Alabama in the distribution of the hemoglobin levels or in the mean values.

Hematocrits for the children of New Orleans, Mississippi, and Alabama are within the normal range,

D. Serum Protein Data

1. Total Serum Protein. The means of the total serum protein for the New Orleans supplemented and control groups are compared in Table 14. In summer, the mean serum protein level was 7.57 $\pm$ 1.04 gm% and 7.66 $\pm$ 0.97 gm% for the supplemented and control groups, respectively. A decrease was observed in the fall, however, to 7.19 gm% and 7.10 gm% for the supplemented and control groups. It is interesting to note that from fall to spring the supplemented group changed very little, from 7.19 $\pm$ 0.60 gm% to 7.07 $\pm$ 0.48 gm%. This difference is significant at the 5% level. However, the control group decreased by 0.5 gm% from 7.10 $\pm$ 0.56 gm% in fall, to 6.60 $\pm$ 0.93 gm% in spring. This might indicate that the Product 19 did have an effect in preventing the decrease in the serum protein. The distribution of the data (Table 15) tends to support this statement since in both the supplemented and control groups 95.3 and 100% of the serum protein levels were above 5.6 gm%, which is considered the acceptable standard for the summer. These values increased slightly in the fall of 1968 (even though the mean for the groups decreased) in the supplemented group. In the spring of 1969, the group supplemented with Product 19, plus milk had a further increase so that 99.6% of all children had acceptable total serum protein levels of greater

TABLE 14

COMPARISON OF GROUP MEANS FOR SERUM PROTEIN FOR NEW ORLEANS SCHOOL CHILDREN

	MEAN (gms/100)	STAND DEV	T-TEST
Supplemented summer-68 vs. Supplemented fall-68	7.57 7.19	1.04 0.60	2.32[a]
Supplemented summer-68 vs. Supplemented spring-69	7.57 7.07	1.04 0.48	3.11[b]
Supplemented summer-68 vs. Control summer-68	7.57 7.66	1.04 0.97	0.34
Supplemented fall-68 vs. Supplemented spring-69	7.19 7.07	0.60 0.48	2.44[a]
Supplemented fall-68 vs. Control fall-68	7.19 7.10	0.60 0.56	1.52
Supplemented spring-69 vs. Control spring-69	7.07 6.60	0.48 0.93	5.93[b]
Control summer-68 vs. Control spring-69	6.60 7.66	0.93 0.97	5.12[b]
Control fall-68 vs. Control spring-69	6.60 7.10	0.93 0.56	5.79[b]
Control summer-68 vs. Control fall-68	7.66 7.10	0.97 0.56	2.82[b]

a) $P < .05$
b) $P < .01$

TABLE 15

PERCENT DISTRIBUTION OF SERUM PROTEIN DATA

		Acceptable		Deficient
		>6.0	5.6 - 5.9	<5.5
Orleans summer-68	Supplemented	92.9	2.4	4.8
	Control	96.0	4.0	0
Orleans fall-68	Supplemented	97.8	0.9	1.3
	Control	98.7	0.7	0.7
Alabama fall-68		100	0	0
Mississippi fall-68		95.8	4.2	0
Orleans spring-69	Supplemented	99.6	0	0.4
	Control	76.8	4.9	18.3
Alabama spring-69		100	0	0
Mississippi spring-69		99.3	0.7	0

than 5.6 gm.%. However, in the groups supplemented with only milk there was a sharp decrease in the level of total serum protein so that 8.3% of the children had unacceptable values which is a remarkable increase in the values below 5.5 gm.%.

The group means for Mississippi and Alabama are compared in Table 16, where it can be seen that there was no change observed in Alabama between the serum protein levels in the fall of 1968, to the spring of 1969. In Mississippi there was an increase from the fall of 1968 of 6.84 $\pm$ 0.52 gm. per 100 ml. serum, to 6.97 $\pm$ 0.42 gm. per 100 ml. in the spring. These differences are significant at the 5% level. Significant differences are also observed if comparisons are made between the Mississippi and Alabama total serum proteins at any of the time periods with Alabama beginning nearly 0.5% higher than Mississippi. However, it should be pointed out that both these means are well above normal and therefore, have relatively little biological significance. The lack of this biological significance can be emphasized in Table 15, where the distribution of serum proteins are compared. In both the fall of 1968 and Spring 1969, all of the Alabama and Mississippi children had total serum protein levels of greater than 5.6 gm. per 100 ml.

The extremely large differences observed in the distribution in Mississippi and Alabama and those of New Orleans control groups should be noted.

There is no significant difference in the distribution of total serum protein levels for the fall of 1968. However, in the spring of

TABLE 16

COMPARISON OF GROUP MEANS FOR SERUM PROTEIN FOR NEW ORLEANS CONTROL, MISSISSIPPI AND ALABAMA

	MEAN (g/100)	STAND DEV	T-TEST
Alabama fall-68 vs. Alabama spring-69	7.35 7.31	0.45 0.51	0.80
Alabama fall-68 vs. Mississippi fall-68	7.35 6.84	0.45 0.52	8.66[b]
Alabama spring-69 vs. Mississippi spring-69	7.31 6.84	0.51 0.52	6.19[b]
Mississippi fall-68 vs. Mississippi spring-69	6.84 6.97	0.52 0.42	2.22[a]
Alabama spring-69 vs. New Orleans spring-69	7.31 6.60	0.51 0.93	8.40[b]
Alabama fall-68 vs. New Orleans fall-68	7.35 7.10	0.45 0.56	4.16[b]
Alabama spring-69 New Orleans fall-68	7.31 7.10	0.51 0.56	3.33[b]
Alabama fall-68 vs. New Orleans spring-69	7.35 6.60	0.45 0.93	9.05[b]
Mississippi fall-68 vs. New Orleans fall-68	6.84 7.10	0.52 0.56	4.06[b]
Mississippi spring-69 vs. New Orleans fall-68	6.97 7.10	0.42 0.56	2.28[a]
Mississippi fall-68 vs. New Orleans spring-69	6.84 6.60	0.52 0.93	2.85[b]
Mississippi spring-69 vs. New Orleans spring-69	6.97 6.60	0.42 0.93	4.52[b]
Alabama + Mississippi fall-68 vs. New Orleans fall-68	7.08 7.10	0.55 0.56	0.26
Alabama + Mississippi spring-69 New Orleans fall-68	7.14 7.10	0.49 0.56	0.83

a) $P < .05$
b) $P < .01$

of 1969 the New Orleans control groups were significantly lower than those of Mississippi and Alabama.

2. Serum Albumin. The mean values for serum albumin in New Orleans children are seen in Table 17. This mean is well within what is considered to be the normal range of greater than 3.5 gm. per 100 ml. In summer of 1968, there was no difference observed between the albumin concentration in either the supplemented or the control groups. However, in fall, when both groups had been treated alike to this point the supplemented groups had an albumin concentration of 4.2 $\pm$ 0.44 gm% and the control had a value of 4.0 $\pm$ 0.45 gm%. The difference between these means is significant at the 1% level. A further change was observed after the supplementation period in that the supplemented group increased by 0.26 gm. to 4.46 $\pm$ 0.35 gm%, while the control group increased only 0.1 gm. to 4.14 $\pm$ 0.59 gm%. This difference is also significant at the 1% level. It is impossible to state categorically that the difference in albumin concentration in these groups is due to the Product 19 supplementation since a difference was observed in the groups at the beginning of the experiment. However, the trend would lead one to believe that Product 19 did have some effect in this way. The data for serum albumin for Alabama and Mississippi are listed in Table 18 and even though significant differences are observed between groups, relatively little can be said concerning these differences, except to point out that in all cases Alabama values are higher than Mississippi values and both Alabama and Mississippi values are significantly higher than those found in New Orleans. As can be seen from the percent distribution in Table 19, all serum albumin levels are

TABLE 17

COMPARISON OF GROUP MEANS FOR ALBUMIN FOR NEW ORLEANS SCHOOL CHILDREN

	MEAN (g/100)	STAND DEV	T-TEST
Supplemented summer-68 vs.	4.39	0.66	1.75
Supplemented fall-68	4.20	0.44	
Supplemented summer-68 vs.	4.39	0.67	0.60
Supplemented spring-69	4.46	0.35	
Supplemented summer-68 vs.	4.39	0.67	0.17
Control summer-68	4.42	0.50	
Supplemented fall-68 vs.	4.20	0.44	6.41[b]
Supplemented spring-69	4.46	0.35	
Supplemented fall-68 vs.	4.20	0.44	3.11[b]
Control fall-68	4.04	0.45	
Supplemented spring-69 vs.	4.46	0.35	5.94[b]
Control spring-69	4.14	0.59	
Control summer-68 vs.	4.14	0.59	2.50[a]
Control spring-69	4.42	0.50	
Control fall-68 vs.	4.14	0.59	1.60
Control spring-69	4.04	0.45	
Control summer-68 vs.	4.42	0.50	3.50[b]
Control fall-68	4.04	0.45	

a) $P < .05$
b) $P < .01$

TABLE 18

COMPARISON OF GROUP MEANS FOR ALBUMIN FOR NEW ORLEANS CONTROL, MISSISSIPPI AND ALABAMA

	MEAN (g/100)	STAND DEV	T-TEST
Alabama fall-68 vs. Alabama spring-69	4.52 4.40	0.35 0.32	2.66[a]
Alabama fall-68 vs. Mississippi fall-68	4.52 4.23	0.35 0.46	5.47[b]
Alabama spring-69 vs. Mississippi spring-69	4.40 4.36	0.32 0.32	1.22
Mississippi fall-68 vs. Mississippi spring-69	4.23 4.40	0.46 0.32	2.52[a]
Alabama spring-69 vs. New Orleans spring-69	4.40 4.14	0.32 0.59	4.73[b]
Alabama fall-68 vs. New Orleans fall-68	4.52 4.04	0.35 0.45	9.43[b]
Alabama spring-69 vs. New Orleans fall-68	4.40 4.04	0.32 0.45	7.74[b]
Alabama fall-68 vs. New Orleans spring-69	4.52 4.14	0.35 0.59	6.41[b]
Mississippi fall-68 vs. New Orleans fall-68	4.23 4.04	0.46 0.45	3.50[b]
Mississippi spring-69 vs. New Orleans fall-68	4.36 4.04	0.32 0.45	6.68[b]
Mississippi fall-68 vs. New Orleans spring-69	4.23 4.14	0.46 0.59	1.50
Mississippi spring-69 vs. New Orleans spring-69	4.36 4.14	0.32 0.59	3.86[b]
Alabama + Mississippi fall-68 vs. New Orleans fall-68	4.36 4.04	0.43 0.45	6.79[b]
Alabama + Mississippi spring-69 vs. New Orleans fall-68	4.37 4.04	0.32 0.45	7.92[b]

a) $P < .05$
b) $P < .01$

TABLE 19

PERCENT DISTRIBUTION OF ALBUMIN DATA

		Acceptable ≥ 3.5	Low 3.0 - 3.4	Deficient < 3.0
Orleans summer-68	Supplemented	100	0	0
	Control	100	0	0
Orleans fall-68	Supplemented	100	0	0
	Control	100	0	0
Alabama fall-68		100	0	0
Mississippi fall-68		100	0	0
Orleans spring-69	Supplemented	100	0	0
	Control	100	0	0
Alabama spring-69		100	0	0
Mississippi spring-69		100	0	0

in the acceptable range, greater than 3.5 gm. per 100 ml., the true meaning of these differences observed in the mean values is difficult to interpret.

3. Albumin-Globulin Ratio. The albumin-globulin ratios (A/G) are listed in Tables 20 and 21 and the percent distribution over several ranges are listed in Table 22. Strict interpretations of an A/G ratio cannot be given, but can only be used as a guideline to indicate abnormal serum protein patterns. The normal value for albumin-globulin ratio is considered to be in the 1.4 to 1.6 range. As can be seen in Table 22, less than 50% of the individuals have A/G ratios in this range with a very large percentage below 1.4. These data would suggest that either wide spread infection (which causes a decrease in A/G) or protein malnutrition may exist. It has been exceedingly difficult to biochemically ascertain the status of an individual in relation to protein deficiency unless that individual was severely deficient. These data do not support a severely deficient population but might be explained on the basis of mild deficiency.

The means of the A/G ratios listed for New Orleans in Table 20, and for Mississippi and Alabama in Table 21, have been compared and treated statistically even though little or no interpretation can be given on these values.

4. Conclusion on Serum Proteins. From the data observed on serum protein it would appear that in Mississippi and Alabama there is relatively little protein malnutrition as can be judged by these parameters. A very slight increase in protein malnutrition may be present in the New Orleans area. It is particularly interesting to note that

TABLE 20

COMPARISON OF GROUP MEANS FOR ALBUMIN-GLOBULIN RATIO FOR NEW ORLEANS SCHOOL CHILDREN

	MEAN	STAND DEV	T-TEST
Supplemented summer-68 vs.	1.41	0.27	0.07
Supplemented fall-68	1.41	0.27	
Supplemented summer-68 vs.	1.41	0.27	7.34[b]
Supplemented spring-69	1.77	0.32	
Supplemented summer-68 vs.	1.41	0.27	0.39
Control summer-68	1.44	0.37	
Supplemented fall-68 vs.	1.41	0.27	11.70[b]
Supplemented spring-69	1.77	0.32	
Supplemented fall-68 vs.	1.41	0.27	1.86
Control fall-68	1.35	0.28	
Supplemented spring-69 vs.	1.77	0.32	0.73
Control spring-69	1.80	0.40	
Control summer-68 vs.	1.80	0.40	4.29[b]
Control spring-69	1.44	0.37	
Control fall-68 vs.	1.80	0.40	10.70[b]
Control spring-69	1.35	0.28	
Control summer-68 vs.	1.44	0.37	1.15
Control fall-68	1.35	0.28	

a) $P < .05$
b) $P < .01$

TABLE 21

COMPARISON OF GROUP MEANS FOR ALBUMIN-GLOBULIN RATIOS

FOR NEW ORLEANS CONTROL, MISSISSIPPI AND ALABAMA

	MEAN	STAND DEV	T-TEST
Alabama fall-68 vs. Alabama spring-69	1.64 1.57	0.32 0.25	1.94
Alabama fall-68 vs. Mississippi fall-68	1.64 1.66	0.32 0.35	0.48
Alabama spring-69 vs. Mississippi spring-69	1.57 1.72	0.25 0.37	4.01[b]
Mississippi fall-68 vs. Mississippi spring-69	1.66 1.72	0.35 0.37	1.37
Alabama spring-69 vs. New Orleans spring-69	1.57 1.80	0.25 0.40	5.77[b]
Alabama fall-68 vs. New Orleans fall-68	1.64 1.35	0.32 0.28	7.25[b]
Alabama spring-69 vs. New Orleans fall-68	1.57 1.35	0.25 0.28	6.66[b]
Alabama fall-68 vs. New Orleans spring-69	1.64 1.80	0.32 0.40	3.38[b]
Mississippi fall-68 vs. New Orleans fall-68	1.66 1.35	0.35 0.28	7.97[b]
Mississippi spring-69 vs. New Orleans fall-68	1.80 1.35	0.40 0.28	9.15[b]
Mississippi fall-68 vs. New Orleans spring-69	1.66 1.80	0.35 0.40	2.78[b]
Mississippi spring-69 vs. New Orleans spring-69	1.72 1.80	0.37 0.40	1.60
Alabama+Mississippi fall-68 vs. New Orleans fall-68	1.65 1.35	0.34 0.28	9.18[b]
Alabama+Mississippi spring-69 New Orleans fall-68	1.64 1.35	0.32 0.28	9.29[b]

a) $P < .05$
b) $P < .01$

TABLE 22

PERCENT DISTRIBUTION OF ALBUMIN-GLOBULIN RATIO

		2.0	1.7 - 1.9	1.4 - 1.6	1.4 gms.
Orleans summer-68	Supplemented	0	15.4	38.5	46.2
	Control	4.2	25.0	25.0	45.8
Orleans fall-68	Supplemented	3.5	10.5	39.2	48.0
	Control	2.5	8.3	28.8	62.1
Alabama fall-68		9.6	32.9	40.4	24.1
Mississippi fall-68		14.5	33.6	29.8	24.4
Orleans spring-69	Supplemented	19.6	38.8	35.9	10.5
	Control	27.0	29.8	34.8	12.1
Alabama spring-69		4.3	26.6	47.5	24.5
Mississippi spring-69		18.2	29.5	40.9	14.4

those children supplemented with Product 19, in addition to one glass of milk per day, were remarkably more consistent in having adequate serum protein levels than those children who received only milk. Again, it should be pointed out that from these few determinations, it is impossible to adequately ascertain mild inadequacies in protein consumption.

E. Serum Vitamins

1. Serum Vitamin A. The mean levels for serum vitamin A in the children of the New Orleans Head Start group are well within the normal range (Table 23). The values change very little between summer and fall for the supplemented and control groups. In the supplemented group, there is a sharp rise in the mean vitamin A from the 31.96 µg.% found in summer to 30.2 µg. % in fall; up to 35.13 µg. % in the spring of 1969. A similar increase did not occur in the control group in spring and the mean vitamin A concentration remained essentially the same, that is, 31.1 µg.% in summer, 31.99 µg.% in fall, and a drop to 28.79 µg.% by spring 1969. The Kellogg Product 19, which was the only experimental difference between the control and the experimental groups, contains 4000 units of vitamin A per serving which is 1.6 times a Recommended Daily Allowance for this age child. The rise in the mean serum vitamin A content coincides with a decrease in the number of children in the supplemented group which had serum vitamin A values in the deficient range as shown in Table 24. In the New Orleans supplemented group, 9.1 and 10.1% of the children had serum vitamin A in the deficient category of less than 20 µg per 100 ml. of blood in the summer and fall of 1968. In spring, this value had decreased to 3.9%. It should be noted that the control group also fluctuated.

TABLE 23

COMPARISON OF GROUP MEANS FOR VITAMIN A LEVELS IN NEW ORLEANS SCHOOL CHILDREN

	MEAN (µg/100 ml)	STAND DEV	T-TEST
Supplemented summer-68 vs. Supplemented fall-68	31.96 30.20	7.58 11.96	0.99
Supplemented summer-68 vs. Supplemented spring-69	31.96 35.13	7.58 18.34	1.57
Supplemented summer-68 vs. Control summer-68	31.96 31.14	7.58 10.59	0.19
Supplemented fall-68 vs. Supplemented spring-69	30.20 35.13	11.96 18.34	3.49[b]
Supplemented fall-68 vs. Control fall-68	30.20 31.99	11.96 71.64	0.33
Supplemented spring-69 vs. Control spring-69	35.13 28.79	18.34 6.57	4.83[b]
Control summer-68 vs. Control spring-69	28.79 31.14	6.57 10.59	0.58
Control fall-68 vs. Control spring-69	28.79 31.99	6.57 71.64	0.60
Control summer-68 vs. Control fall-68	31.14 31.99	10.59 71.64	0.13

a) $P < .05$
b) $P < .01$

TABLE 24

PERCENT DISTRIBUTION OF SERUM VITAMIN A DATA

		Acceptable >30	Low 20 - 29	Deficient <20
Orleans summer-68	Supplemented	63.6	27.3	9.1
	Control	57.2	28.6	14.2
Orleans fall-68	Supplemented	48.3	41.5	10.1
	Control	32.4	49.7	17.9
Alabama fall-68		76.5	20.7	2.8
Mississippi fall-68		74.7	24.3	2.0
Orleans spring-69	Supplemented	63.3	32.8	3.9
	Control	50.1	42.5	7.5
Alabama spring-69		61.1	35.2	3.7
Mississippi spring-69		64.1	34.5	1.4

In summer of 1968, 14.2% of the children had serum vitamin A levels in the deficient range. This increased to 17.9% by the fall of 1968 and decreased to 7.5% in the spring. It is extremely difficult to judge, regardless of statistical evaluation, whether or not Product 19 was the sole factor in decreasing the serum vitamin A content. It should be noted that each child was given one half pint of milk per day in both the control and supplemented groups. Milk contains 350 units of vitamin A per 8 ounces and would represent a new source for this vitamin during the experimental period between fall and spring. It should also be noted that most experts do not agree that serum vitamin A levels between the range of 20 and 29 units per ml. of blood are unacceptable. They feel that these levels are found in well-nourished populations which exhibit no clinical signs of vitamin A deficiency. These signs usually appear only after serum levels of vitamin A are less than 20μg per 100 ml.

The mean vitamin A levels in Alabama and Mississippi are significantly higher than the New Orleans control group, particularly as compared to the fall group. They are not higher if mean values for the supplemented group are considered. There is considerable difference observed in Table 25, however, in the percent of the Mississippi and Alabama groups which are in the deficient range. Certainly from a vitamin A standpoint, it can be said that the rural and somewhat urban children of Mississippi and Alabama are significantly better off nutritionally than those of the urban New Orleans group for this age.

2. Serum Carotene. In all groups of children studies in both New Orleans and Mississippi-Alabama, serum carotene levels are in the adequate ranges (Tables 26, 27 and 28). It is clear, as a matter of

TABLE 25

COMPARISON OF GROUP MEANS FOR VITAMIN A FOR NEW ORLEANS CONTROL, MISSISSIPPI AND ALABAMA

	MEAN (µg/100 ml)	STAND DEV	T-TEST
Alabama fall-68 vs.	36.58	16.57	3.52[b]
Alabama spring-69	31.75	8.00	
Alabama fall-68 vs.	36.58	16.57	1.20
Mississippi fall-68	38.57	14.99	
Alabama spring-69 vs.	31.75	8.00	0.91
Mississippi spring-69	32.68	7.87	
Mississippi fall-68 vs.	38.57	14.99	4.26[b]
Mississippi spring-69	32.68	7.87	
Alabama spring-69 vs.	31.75	8.00	3.19[b]
New Orleans spring-69	28.79	6.57	
Alabama fall-68 vs.	36.58	16.57	0.84
New Orleans fall-68	31.99	71.64	
Alabama spring-69 vs.	31.75	8.00	0.04
New Orleans fall-68	31.99	71.64	
Alabama fall-68 vs.	36.58	16.57	6.25[b]
New Orleans spring-69	28.79	6.57	
Mississippi fall-68 vs.	38.57	14.99	1.20
New Orleans fall-68	31.99	71.64	
Mississippi spring-69 vs.	32.68	7.87	0.13
New Orleans fall-68	31.99	71.64	
Mississippi fall-68 vs.	38.57	14.99	7.40[b]
New Orleans spring-69	28.79	6.57	
Mississippi spring-69 vs.	32.68	7.87	4.63[b]
New Orleans spring-69	28.79	6.57	
Alabama + Mississippi fall-68 vs.	37.41	15.94	1.00
New Orleans fall-68	31.99	71.64	
Alabama + Mississippi spring-69 vs.	32.28	7.92	0.05
New Orleans fall-68	31.99	71.64	

a) $P < .05$
b) $P < .01$

TABLE 26

COMPARISON OF GROUP MEANS FOR CAROTENE LEVELS IN NEW ORLEANS SCHOOL CHILDREN

	MEAN (μg/100 ml)	STAND DEV	T-TEST
Supplemented summer-68 vs. Supplemented fall-68	127.7 107.8	44.29 39.94	2.04[a]
Supplemented summer-68 vs. Supplemented spring-69	127.7 130.0	44.29 40.88	0.23
Supplemented summer-68 vs. Control summer-68	127.7 119.1	44.29 35.43	0.52
Supplemented fall-68 vs. Supplemented spring-69	107.8 130.0	39.94 40.88	6.13[b]
Supplemented fall-68 vs. Control fall-68	107.8 107.0	39.94 76.80	0.14
Supplemented spring-69 vs. Control spring-69	130.0 119.5	40.88 43.28	2.43[a]
Control summer-68 vs. Control spring-69	119.5 119.1	43.28 35.43	0.02
Control fall-68 vs. Control spring-69	119.5 107.0	43.28 76.80	1.87
Control summer-68 vs. Control fall-68	119.1 107.0	35.43 76.80	0.84

a) $P < .05$
b) $P < .01$

TABLE 27

PERCENT DISTRIBUTION OF CAROTENE DATA

		Acceptable ≥ 40	Low < 40 (µg/100 ml)
Orleans summer-68	Supplemented	100	0
	Control	100	0
Orleans fall-68	Supplemented	98.5	1.5
	Control	97.2	2.8
Alabama fall-68		99.5	0.5
Mississippi fall-68		98.7	1.3
Orleans spring-69	Supplemented	100	0
	Control	97.5	2.5
Alabama spring-69		100	0
Mississippi spring-69		99.3	0.7

TABLE 28

COMPARISON OF GROUP MEANS FOR CAROTENE FOR NEW ORLEANS CONTROL, MISSISSIPPI AND ALABAMA

	MEAN (µg/100 ml)	STAND DEV	T-TEST
Alabama fall-68 vs. Alabama spring-69	154.4 145.2	50.40 38.18	1.82
Alabama fall-68 vs. Mississippi fall-68	154.4 138.2	50.40 55.52	2.85[b]
Alabama spring-69 vs. Mississippi spring-69	145.2 133.4	38.18 40.75	2.35[a]
Mississippi fall-68 vs. Mississippi spring-69	138.2 133.4	55.52 40.75	0.84
Alabama spring-69 vs. New Orleans spring-69	145.2 119.5	38.18 43.28	5.14[b]
Alabama fall-68 vs. New Orleans fall-68	154.4 107.0	50.40 76.80	7.08[b]
Alabama spring-69 vs. New Orleans fall-68	145.2 107.0	38.18 76.80	5.61[b]
Alabama fall-68 vs. New Orleans spring-69	154.4 119.5	50.40 43.28	7.20[b]
Mississippi fall-68 vs. New Orleans fall-68	138.2 107.0	55.52 76.80	4.27[b]
Mississippi spring-69 vs. New Orleans fall-68	133.4 107.0	40.75 76.80	3.96[b]
Mississippi fall-68 vs. New Orleans spring-69	138.2 119.5	55.52 43.28	3.30[b]
Mississippi spring-69 vs. New Orleans spring-69	133.4 119.5	40.75 43.28	2.89[b]
Alabama + Mississippi fall-68 vs. New Orleans fall-68	147.7 107.0	53.11 76.80	6.38[b]
Alabama+Mississippi spring-69 vs. New Orleans fall-68	138.5 107.0	40.01 76.80	5.03[b]

a) $P < .05$
b) $P < .01$

TABLE 29

COMPARISON OF GROUP MEANS FOR VITAMIN C LEVELS IN NEW ORLEANS SCHOOL CHILDREN

	MEAN (mg/100 ml)	STAND DEV	T-TEST
Supplemented summer-68 vs. Supplemented fall-68	0.77 0.44	0.24 0.26	14.00[b]
Supplemented summer-68 vs. Supplemented spring-69	0.77 0.83	0.24 0.20	2.55
Supplemented summer-68 vs. Control summer-68	0.77 0.80	0.24 0.25	0.90
Supplemented fall-68 vs. Supplemented spring-69	0.44 0.83	0.26 0.20	19.88[b]
Supplemented fall-68 vs. Control fall-68	0.44 0.40	0.26 0.23	1.56
Supplemented spring-69 vs. Control spring-69	0.83 0.57	0.20 0.26	11.32[b]
Control summer-68 vs. Control spring-69	0.57 0.80	0.26 0.25	8.41[b]
Control fall-68 vs. Control spring-69	0.57 0.40	0.26 0.23	6.29[b]
Control summer-68 vs. Control fall-68	0.80 0.40	0.25 0.23	15.38[b]

a) $P < .05$
b) $P < .01$

TABLE 30

PERCENT DISTRIBUTION OF VITAMIN C DATA

		Acceptable ≥ 0.2	Low 0.1 - 1.9	Deficient <0.1
Orleans summer-68	Supplemented	100	0	0
	Control	100	0	0
Orleans fall-68	Supplemented	99.6	0.4	0
	Control	100	0	0
Alabama fall-68		100	0	0
Mississippi fall-68		100	0	0
Orleans spring-69	Supplemented	100	0	0
	Control	100	0	0
Alabama spring-69		100	0	0
Mississippi spring-69		100	0	0

TABLE 31

COMPARISON OF GROUP MEANS FOR VITAMIN C FOR NEW ORLEANS CONTROL, MISSISSIPPI AND ALABAMA

	MEAN (mg/100 ml)	STAND DEV	T-TEST
Alabama fall-68 vs. Alabama spring-69	0.59 0.58	0.21 0.20	0.57
Alabama fall-68 vs. Mississippi fall-68	0.59 0.60	0.21 0.21	0.55
Alabama spring-69 vs. Mississippi spring-69	0.58 0.74	0.20 0.18	7.64[b]
Mississippi fall-68 vs. Mississippi spring-69	0.60 0.74	0.21 0.18	6.31[b]
Alabama spring-69 vs. New Orleans spring-69	0.58 0.57	0.20 0.26	0.49
Alabama fall-68 vs. New Orleans fall-68	0.59 0.40	0.21 0.23	8.60[b]
Alabama spring-69 vs. New Orleans fall-68	0.58 0.40	0.20 0.23	7.65[b]
Alabama fall-68 vs. New Orleans spring-69	0.59 0.57	0.21 0.26	0.99
Mississippi fall-68 vs. New Orleans fall-68	0.40 0.40	0.21 0.23	8.36[b]
Mississippi spring-69 vs. New Orleans fall-68	0.74 0.40	0.18 0.23	14.77[b]
Mississippi fall-68 vs. New Orleans spring-69	0.60 0.57	0.21 0.26	1.37
Mississippi spring-69 vs. New Orleans spring-69	0.74 0.57	0.18 0.26	7.10[b]
Alabama + Mississippi fall-68 vs. New Orleans fall-68	0.59 0.40	0.21 0.23	9.53[b]
Alabama + Mississippi spring-69 vs. New Orleans fall-68	0.65 0.40	0.21 0.23	12.01[b]

a) $P < .05$
b) $P < .01$

fact, in both the urban and rural areas, the mean carotene levels are approximately three times that which are considered low. It should be of interest in future studies, to determine why such high serum carotene levels are observed and yet inadequate levels of vitamin A exist. The need for further investigation to determine whether the carotene observed in the serum of these children is β carotene or other compound which cannot be converted to vitamin A.

3. Serum vitamin C. In all children studied, in both the urban population of New Orleans and rural and semi-rural populations of Mississippi and Alabama, nearly all of the children had acceptable vitamin C levels (Tables 29, 30 and 31). This would appear to indicate that there is very adequate nutrition as far as vitamin C is concerned in the children of this area. These data would support the data of the National Nutrition Survey in that there is relatively little vitamin C deficiency in children.

4. Conclusion of Serum Vitamins. In observation of children in the New Orleans area, vitamin A is the only serum vitamin which shows significant inadequate levels. Carotene and vitamin C in New Orleans, Mississippi and Alabama were in the adequate ranges.

It should be noted that it is generally considered that serum concentration of both vitamin A and C are not the most sensitive measure of the adequacy of these vitamins. Since it is part of the function of the blood to maintain hemostasis, the serum quite often does not reflect the body pools of the vitamin. This is particularly true of vitamin A. The more accurate way of measuring the vitamin A adequacy of an individual is through liver stores. However, biopsies of livers of normal children is not practical.

F. Summary

Hematological Data. A significant increase in the hemoglobin concentration was observed from the summer of 1968 at the beginning of the Head Start Program to the beginning of kindergarten. The data would suggest that the change had occurred from the breakfast and lunch program of Operation Head Start, but there are no control data available to confirm this (children which did not receive the food supplementation). The intervention with Kellogg's Product 19 did not have an effect on the hemoglobin status even though it contains 10 mg. of iron per serving. It must be concluded that either this quantity of iron is insufficient or it was not available for absorption for some reason.

Very little change was observed in Mississippi or Alabama in the distribution of the hemoglobin levels or in the mean values.

Hematocrits for the children of New Orleans, Mississippi and Alabama are within the normal range.

Serum Proteins. From the data observed on serum protein it would appear that in Mississippi and Alabama there is relatively little protein malnutrition as can be judged by these parameters. A very slight increase in protein malnutrition may be present in the New Orleans area. It is particularly interesting to note that those children supplemented with Product 19, in addition to one glass of milk per day were remarkably more consistent in having adequate serum protein levels than those children who received only milk. Again, it should be pointed out that from these few determinations, it is impossible to adequately ascertain mild inadequacies in protein consumption.

Serum Vitamins. In the observation of children in the New Orleans area, the only serum vitamin in which a significant amount of inadequate

levels were found was vitamin A. Carotene and vitamin C in New Orleans, Mississippi and Alabama were in the adequate ranges.

It should be noted that it is generally considered that serum concentrations of both vitamin A and C are not the most sensitive measure of the adequacy of these vitamins. Since it is part of the function of the blood to maintain hemostasis, the serum quite often does not reflect the body pools of the vitamin. This is particularly true of vitamin A. The more accurate way of measuring the vitamin A adequacy of an individual is through liver stores. However, biopsies of livers of normal children is not practical.

APPENDIX

The tables included in the Appendix will permit an examination of the number of individuals tested for each parameter for each school and the variation between the schools.

The data presented here are from a preliminary computer printout. Subsequent editing caused minor changes in the data which are presented in the body of the report. These editing changes do not substantially change the meaning of the data presented in the Appendix.

THE MEAN VALUES FOR HEMOGLOBIN FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig	10.85	0.86	79	11.05	1.21	82	11.71	0.89	82
Lawless	10.61	1.23	56	11.55	1.30	70	11.49	0.97	80
Jones	11.62	0.92	41	11.85	0.94	61	11.68	0.81	58
Hardin	10.90	0.85	23	11.78	0.96	56	11.73	0.74	43
TOTAL	10.95	1.05	199	11.51	1.17	269	11.64	0.88	263

THE MEAN VALUES FOR HEMOGLOBIN FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson	11.18	0.96	62						
Craig	11.13	0.97	75	10.73	1.18	57	11.76	0.92	64
Lawless	10.19	0.88	21	11.40	0.0	2			
Jones	11.57	0.81	75	12.17	0.77	68	11.58	0.84	76
Hardin	11.06	1.03	35	11.33	0.91	51	11.42	0.95	55
TOTAL	11.18	0.98	268	11.52	1.12	178	11.59	0.90	195

THE MEAN VALUES FOR HEMOGLOBIN FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND. DEV.	NUMBER	MEAN	STAND. DEV.	NUMBER
Morning Star	11.40	0.60	21	11.39	0.84	13
Albert Owens	11.98	0.81	19	11.73	0.89	16
St. Vincents	11.96	0.75	58	11.35	0.79	36
St. Marks	11.74	0.68	15	10.71	1.57	15
Hopewell	11.64	0.65	16	11.16	0.83	16
St. Mathew	11.77	0.79	38	11.79	0.74	33
Mt. Arart	11.41	1.05	30	11.18	0.70	19
Cottage Hill	11.59	0.66	15	11.35	1.11	11
Chastang	11.47	0.93	37	11.28	0.81	24
TOTAL	11.70	0.83	244	11.40	0.84	182

THE MEAN VALUES FOR HEMOGLOBIN FOR EACH CHILD CENTER IN MISSISSIPPI

	NOVEMBER 1968			MAY 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Back Bay Mission	11.31	0.77	27	11.37	0.83	26
Our Mother Sorrow	11.61	0.49	26	11.71	0.81	34
Camp Landons	11.79	0.75	25	11.14	0.68	25
Morning Star	12.06	0.92	23	11.82	0.58	19
East Side	11.87	0.70	27	11.91	0.59	21
Father Sweeney	11.45	1.32	32	11.41	0.80	28
TOTAL	11.78	1.87	159	11.54	0.77	152

THE MEAN VALUES FOR HEMATOCRIT FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig	36.75	2.93	79	36.82	2.69	83	35.92	2.45	82
Lawless	37.79	2.97	56	35.74	3.23	70	36.25	2.32	81
Jones	37.68	2.35	41	36.92	2.50	61	36.31	2.42	58
Hardin	36.09	2.26	23	37.18	2.49	56	37.02	2.03	43
TOTAL	37.16	2.81	199	36.64	2.80	270	36.59	2.35	264

THE MEAN VALUES FOR HEMATOCRIT FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson	37.03	2.78	62						
Craig	37.48	2.54	75	36.26	2.65	57	36.66	2.32	64
Lawless	36.86	2.92	21	35.50	0.71	2			
Jones	37.72	2.46	76	37.96	2.23	68	37.38	2.22	76
Hardin	36.43	2.95	35	36.69	2.48	51	36.02	2.88	55
TOTAL	37.26	2.68	269	37.02	2.53	178	36.76	2.51	195

THE MEAN VALUES FOR HEMATOCRIT FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Morning Star	35.6	1.77	21	36.2	2.17	13
Albert Owens	36.9	2.48	19	35.7	2.47	16
St. Vincents	37.1	2.42	58	35.0	2.48	36
St. Marks	35.8	1.47	15	33.4	4.65	14
Hopewell	35.8	2.23	16	35.3	2.84	16
St. Mathew	36.9	2.35	38	36.8	2.83	33
Mt. Arart	36.5	2.68	30	35.2	2.57	19
Cottage Hill	35.9	2.17	15	34.7	1.68	11
Chastang	35.6	2.29	37	36.7	3.00	24
TOTAL	36.4	2.37	244	35.7	2.73	181

THE MEAN VALUES FOR HEMATOCRIT FOR EACH CHILD CENTER IN MISSISSIPPI

	NOVEMBER 1968			MAY 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Back Bay Mission	36.0	2.09	27	36.2	2.02	26
Our Mother Sorrow	36.3	1.59	26	36.4	1.89	34
Camp Landons	36.1	1.83	25	35.4	1.89	25
Morning Star	36.7	1.64	22	37.6	1.50	19
East Side	35.0	1.99	27	37.0	1.88	21
Father Sweeney	35.9	2.89	32	35.9	1.89	28
TOTAL	35.9	2.12	158	36.3	1.96	152

THE MEAN VALUES FOR MCHC FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			April 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig	29.6	1.9	79	30.0	2.5	82	31.7	1.4	82
Lawless	28.0	2.1	56	32.3	2.0	70	31.7	1.5	80
Jones	30.8	1.4	41	32.1	2.2	61	32.2	1.5	58
Hardin	30.2	1.7	23	31.7	1.3	56	31.7	1.0	43
TOTAL	29.4	2.1	199	31.4	2.3	269	31.8	1.4	263

THE MEAN VALUES FOR MCHC FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson	30.2	1.6	62						
Craig	29.7	1.9	75	29.6	2.8	57	32.1	1.4	64
Lawless	27.7	2.0	21	32.1	0.6	2			
Jones	30.7	1.4	75	32.1	1.3	68	31.0	1.8	76
Hardin	30.4	1.7	35	31.4	1.4	51	31.7	1.2	55
TOTAL	30.0	1.9	268	31.1	2.19	178	31.5	1.57	195

THE MEAN VALUES FOR MCHC FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Morning Star	31.98	1.59	21	31.39	1.24	13
Albert Owens	32.39	1.40	19	32.82	1.22	16
St. Vincents	32.20	1.56	58	32.45	1.54	36
St. Marks	32.73	0.95	15	30.38	5.26	15
Hopewell	32.49	1.64	16	31.67	1.61	16
St. Mathew	31.90	1.50	38	32.09	2.26	33
Mt. Arart	31.21	1.52	30	31.82	1.70	19
Cottage Hill	32.27	0.83	15	32.58	2.07	11
Chastang	32.14	1.46	37	30.77	1.36	24
TOTAL	32.10	1.47	244	31.90	2.22	182

THE MEAN VALUES FOR MCHC FOR EACH CHILD CENTER IN MISSISSIPPI

	NOVEMBER 1968			MAY 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Back Bay Mission	31.37	1.37	27	31.37	1.39	26
Our Mother Sorrow	32.00	1.27	26	32.13	1.50	34
Camp Landons	32.60	1.45	25	31.46	1.04	25
Morning Star	32.63	1.46	23	31.13	0.94	19
East Side	33.94	2.02	27	32.11	0.82	21
Father Sweeney	31.76	1.84	32	31.75	1.17	28
TOTAL	32.30	1.80	158	31.70	1.24	152

THE MEAN VALUES FOR SERUM PROTEIN FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig	8.46	0.86	14	7.60	0.60	58	6.95	0.57	59
Lawless	7.13	0.81	28	7.06	0.61	66	7.06	0.44	75
Jones				7.11	0.48	49	7.20	0.47	70
Hardin				6.98	0.48	51	7.03	0.38	41
Total	7.57	1.04	42	7.19	0.62	224	7.07	0.48	245

THE MEAN VALUES FOR SERUM PROTEIN FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson									
Craig	8.23	0.83	13	7.52	0.60	39	6.77	0.41	48
Lawless	7.04	0.71	12	5.97	1.02	3	7.20	0.00	1
Jones				6.99	0.43	61	7.15	0.78	64
Hardin				6.98	0.44	48	5.75	0.85	51
TOTAL	7.66	0.97	25	7.10	0.56	151	6.60	0.93	164

THE MEAN VALUES FOR SERUM PROTEIN FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Morning Star	7.38	0.42	12	6.83	0.35	10
Albert Owens	7.41	0.36	18	7.20	0.46	13
St. Vincents	7.31	0.55	40	7.53	0.43	31
St. Marks	7.25	0.21	2			
Hopewell				7.50	0.45	15
St. Mathew	7.45	0.49	2	7.54	0.49	23
Mt. Arart	7.72	0.29	4	6.98	0.51	15
Cottage Hill	7.17	0.34	13	7.12	0.52	10
Chastang	7.41	0.40	30	7.41	0.44	21
TOTAL	7.35	0.45	128	7.31	0.51	150

THE MEAN VALUES FOR SERUM PROTEIN FOR EACH CHILD CENTER IN MISSISSIPPI

	NOVEMBER 1968			MAY 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Back Bay Mission	6.97	0.55	24	6.88	0.42	23
Our Mother Sorrow	7.07	0.58	26	6.98	0.39	31
Camp Landons	7.08	0.42	22	6.99	0.40	25
Morning Star	6.98	0.44	29	6.97	0.42	29
East Side	6.52	0.38	24	6.96	0.46	18
Father Sweeney	6.53	0.38	26	6.95	0.37	24
TOTAL	6.84	0.52	143	6.97	0.42	138

THE MEAN VALUES FOR ALBUMIN FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig	4.73	0.70	14	4.55	0.38	54	4.43	0.37	58
Lawless	4.20	0.59	25	4.18	0.34	34	4.43	0.38	69
Jones				4.02	0.41	43	4.52	0.31	69
Hardin				3.93	0.31	42	4.45	0.30	23
TOTAL	4.39	0.67	39	4.20	0.44	173	4.46	0.35	219

THE MEAN VALUES FOR ALBUMIN FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson									
Craig	4.52	0.59	12	4.48	0.39	35	4.32	0.32	42
Lawless	4.32	0.38	12	3.99	0.00	1	4.85	0.00	1
Jones				3.83	0.34	56	4.39	0.54	57
Hardin				3.94	0.35	42	3.65	0.56	46
TOTAL	4.42	0.50	24	4.04	0.45	134	4.14	0.59	146

THE MEAN VALUES FOR ALBUMIN FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Morning Star	4.32	0.30	12	4.12	0.25	10
Albert Owens	4.51	0.28	16	4.47	0.31	13
St. Vincents	4.45	0.35	32	4.52	0.32	26
St. Marks	4.43	0.36	2			
Hopewell				4.41	0.25	15
St. Mathew	4.64	0.37	2	4.32	0.34	22
Mt. Arart	4.81	0.29	3	4.34	0.29	15
Cottage Hill	4.57	0.42	12	4.53	0.33	10
Chastang	4.61	0.28	28	4.46	0.38	20
TOTAL	4.52	0.35	111	4.40	0.32	143

THE MEAN VALUES FOR ALBUMIN-GLOBULIN FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig	1.31	0.30	14	1.54	0.24	54	1.83	0.36	58
Lawless	1.46	0.25	25	1.41	0.26	34	1.74	0.35	69
Jones				1.33	0.25	43	1.74	0.26	69
Hardin				1.35	0.29	42	1.75	0.24	23
TOTAL	1.41	0.27	39	1.41	0.27	171	1.77	0.32	209

THE MEAN VALUES FOR ALBUMIN-GLOBULIN FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson									
Craig	1.26	0.39	12	1.51	0.25	35	1.80	0.35	42
Lawless	1.63	0.24	12	1.49	0.00	1	2.08	0.00	1
Jones				1.25	0.25	56	1.71	0.40	57
Hardin				1.35	0.29	42	1.89	0.41	46
TOTAL	1.44	0.37	24	1.35	0.28	132	1.80	0.40	141

THE MEAN VALUES FOR ALBUMIN-GLOBULIN FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Morning Star	1.45	0.31	12	1.57	0.26	10
Albert Owens	1.60	0.20	16	1.66	0.23	13
St. Vincents	1.61	0.25	32	1.54	0.22	26
St. Marks	1.59	0.21	2			
Hopewell				1.47	0.24	15
St. Mathew	1.67	0.06	2	1.40	0.25	22
Mt. Arart	1.68	0.33	3	1.68	0.21	15
Cottage Hill	1.86	0.56	12	1.81	0.28	10
Chastang	1.71	0.24	28	1.53	0.20	20
TOTAL	1.64	0.32	104	1.57	0.25	139

THE MEAN VALUES FOR ALBUMIN-GLOBULIN FOR EACH CHILD CENTER IN MISSISSIPPI

	NOVEMBER 1968			MAY 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Back Bay Mission	1.66	0.26	22	1.85	0.60	23
Our Mother Sorrow	1.83	0.42	26	1.65	0.27	30
Camp Landons	1.72	0.33	22	1.61	0.27	24
Morning Star	1.74	0.35	25	1.66	0.19	29
East Side	1.55	0.27	23	1.92	0.38	18
Father Sweeney	1.40	0.27	21	1.71	0.29	24
TOTAL	1.66	0.35	131	1.72	0.37	132

THE MEAN VALUES FOR VITAMIN A FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig				29.32	7.64	75	30.86	6.75	59
Lawless	32.05	7.75	21	32.78	17.78	77	44.66	29.96	67
Jones				30.70	7.34	59	30.30	7.57	66
Hardin	30.00	0.00	1	27.20	9.93	54	33.40	9.15	40
TOTAL	31.96	7.58	22	30.20	11.96	265	35.13	18.34	232

THE MEAN VALUES FOR VITAMIN A FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson									
Craig				27.16	12.09	61	27.48	7.17	56
Lawless	34.60	10.76	5	25.50	4.95	2			
Jones				26.77	8.26	66	29.63	6.41	54
Hardin	22.50	0.71	2	27.02	9.83	50	29.34	5.92	50
TOTAL	31.14	10.59	7	31.99	71.64	179	28.79	6.57	160

THE MEAN VALUES FOR VITAMIN A FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Morning Star	36.89	15.87	18	31.71	4.46	7
Albert Owens	46.82	47.83	17	29.50	6.78	8
St. Vincents	41.11	9.73	46	30.13	6.53	30
St. Marks	31.31	5.83	16	24.00	6.06	4
Hopewell	36.20	6.72	15	34.00	7.06	12
St. Mathew	35.56	7.02	32	30.65	6.36	20
Mt. Arart	35.67	10.25	27	36.00	14.05	5
Cottage Hill	32.73	7.34	15	31.00	2.16	4
Chastang	32.54	13.96	33	35.16	11.35	19
TOTAL	36.58	16.57	213	31.75	8.00	108

THE MEAN VALUES FOR VITAMIN A FOR EACH CHILD CENTER IN MISSISSIPPI

	NOVEMBER 1968			MAY 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Back Bay Mission	31.76	8.37	25	31.33	8.08	24
Our Mother Sorrow	42.88	11.09	24	33.59	8.48	32
Camp Landons	44.55	8.95	22	31.16	7.26	25
Morning Star	36.65	10.29	23	31.17	6.35	18
East Side	32.63	11.61	27	31.55	8.18	20
Father Sweeney	29.71	5.80	31	36.33	7.45	24
TOTAL	38.57	14.99	152	32.68	7.87	142

THE MEAN VALUES FOR CAROTENE FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig				103.7	42.07	76	130.3	44.65	59
Lawless	127.8	45.38	21	105.3	36.47	80	137.9	43.48	67
Jones				111.4	38.83	59	123.7	38.58	66
Hardin	126.0	0.0	1	113.3	43.05	54	126.8	32.72	40
TOTAL	127.7	44.29	22	107.8	39.94	269	130.0	40.88	232

THE MEAN VALUES FOR CAROTENE FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson									
Craig				112.0	119.34	62	110.9	39.80	56
Lawless	107.6	36.04	5	112.0	25.47	2			
Jones				99.0	31.77	66	111.0	36.66	54
Hardin	148.0	2.83	2	108.9	49.53	50	137.7	48.24	51
TOTAL	119.1	35.43	7	107.00	76.80	179	119.5	43.28	161

THE MEAN VALUES FOR CAROTENE FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Morning Star	163.8	49.97	18	149.3	33.55	7
Albert Owens	181.9	59.47	17	144.4	37.83	8
St. Vincents	165.2	48.28	46	135.2	44.33	30
St. Marks	134.4	23.55	16	140.3	53.27	4
Hopewell	163.1	41.11	15	145.0	32.33	12
St. Mathew	145.8	46.24	33	158.0	31.35	20
Mt. Arart	149.9	49.82	27	176.8	33.91	5
Cottage Hill	180.9	50.02	15	172.5	35.45	4
Chastang	126.1	56.07	33	134.4	34.35	19
TOTAL	154.4	50.40	214	145.2	38.18	240

THE MEAN VALUES FOR CAROTENE FOR EACH CHILD CENTER IN MISSISSIPPI

	NOVEMBER 1968			MAY 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Back Bay Mission	140.4	39.32	25	149.6	46.86	24
Our Mother Sorrow	139.9	42.19	24	134.8	39.10	32
Camp Landons	153.6	62.66	22	123.0	33.47	25
Morning Star	148.1	39.38	23	116.1	29.95	18
East Side	121.4	36.87	26	154.3	48.83	20
Father Sweeney	115.5	35.30	31	120.5	31.46	24
TOTAL	138.2	55.52	151	133.4	40.75	142

THE MEAN VALUES FOR VITAMIN C FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig	0.73	0.28	63	0.33	0.17	82	0.83	0.19	78
Lawless	0.83	0.23	46	0.53	0.29	80	0.81	0.20	75
Jones	0.77	0.25	39	0.58	0.28	59	0.77	0.22	76
Hardin	0.77	0.17	25	0.30	0.19	56	0.97	0.03	37
TOTAL	0.77	0.24	172	0.44	0.26	276	0.83	0.20	266

THE MEAN VALUES FOR VITAMIN C FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson									
Craig	0.79	0.26	59	0.40	0.20	62	0.52	0.26	61
Lawless	0.88	0.19	15	0.23	0.06	2			
Jones	0.78	0.26	63	0.48	0.26	61	0.62	0.28	65
Hardin	0.80	0.22	32	0.30	0.21	49	0.55	0.25	50
TOTAL	0.80	0.25	169	0.40	0.23	174	0.57	0.26	176

THE MEAN VALUES FOR VITAMIN C FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Morning Star	0.58	0.23	20	0.46	0.13	13
Albert Owens	0.51	0.19	18	0.42	0.17	16
St. Vincents	0.63	0.21	55	0.60	0.23	33
St. Marks	0.61	0.21	15	0.54	0.15	12
Hopewell	0.52	0.18	16	0.53	0.21	14
St. Mathew	0.59	0.20	36	0.62	0.19	31
Mt. Arart	0.71	0.16	29	0.49	0.12	12
Cottage Hill	0.58	0.19	15	0.61	0.16	11
Chastang	0.49	0.19	36	0.71	0.16	24
TOTAL	0.59	0.21	236	0.58	0.20	166

THE MEAN VALUES FOR VITAMIN C FOR EACH CHILD CENTER IN MISSISSIPPI

	NOVEMBER 1968			MAY 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Back Bay Mission	0.55	0.17	27	0.68	0.12	24
Our Mother Sorrow	0.60	0.21	22	0.83	0.17	32
Camp Landons	0.71	0.13	25	0.62	0.22	25
Morning Star	0.82	0.15	23	0.88	0.15	19
East Side	0.53	0.19	25	0.65	0.10	19
Father Sweeney	0.47	0.17	31	0.81	0.15	23
TOTAL	0.60	0.21	152	0.74	0.18	141

THE MEAN VALUES FOR CHOLESTEROL FOR EACH CHILD CENTER IN ORLEANS PARISH

	SUPPLEMENTED GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Craig	159.3	26.25	15	167.3	24.75	59	157.6	35.07	64
Lawless	155.7	33.85	30	158.0	29.69	65	163.00	25.99	70
Jones				172.2	29.97	44	173.21	27.14	56
Hardin				170.3	26.25	49	166.7	23.04	41
TOTAL	156.9	31.27	45	166.2	28.09	217	164.6	29.01	231

THE MEAN VALUES FOR CHOLESTEROL FOR EACH CHILD CENTER IN ORLEANS PARISH

	CONTROL GROUPS								
	JULY 1968			OCTOBER 1968			APRIL 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Henderson									
Craig	152.3	16.57	15	171.6	30.87	40	166.2	32.35	43
Lawless	162.5	38.47	12	138.0	27.00	3	175.0	0.0	1
Jones				163.2	23.88	54	162.2	27.62	67
Hardin				162.6	23.10	45	135.5	26.04	51
TOTAL	156.9	28.29	27	164.8	26.19	142	154.9	31.21	162

THE MEAN VALUES FOR CHOLESTEROL FOR EACH CHILD CENTER IN ALABAMA

	DECEMBER 1968			AUGUST 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Morning Star	180.5	20.61	10	180.8	26.14	10
Albert Owens	177.1	25.07	17	157.5	22.18	13
St. Vincents	181.0	24.83	37	171.5	26.90	31
St. Marks	175.0	49.50	2			
Hopewell				172.0	11.46	15
St. Mathew	195.0	42.72	3	165.6	25.32	26
Mt. Arart	178.8	20.57	4	180.7	22.90	15
Cottage Hill	179.1	22.67	16	157.1	20.27	10
Chastang	171.7	42.53	29	166.7	28.24	20
TOTAL	177.9	29.66	124	169.1	26.91	152

THE MEAN VALUES FOR CHOLESTEROL FOR EACH CHILD CENTER IN MISSISSIPPI

	NOVEMBER 1968			MAY 1969		
	MEAN	STAND DEV	NUMBER	MEAN	STAND DEV	NUMBER
Back Bay Mission	161.7	22.00	24	156.5	17.41	23
Our Mother Sorrow	174.4	36.35	25	162.5	27.59	32
Camp Landons	161.1	25.16	22	163.5	33.18	24
Morning Star	165.9	24.18	27	158.9	33.17	29
East Side	160.2	31.81	24	165.3	26.27	19
Father Sweeney	154.0	28.00	26	156.3	24.01	23
TOTAL	162.4	28.68	141	159.6	25.30	138