SIFT DESK

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Blood parameters in rats (Rattus norvegicus) fed a new food (L3P) produced in laboratory of Physiology, Pharmacology and Pharmacopoeia (Abidjan/Côte d'Ivoire)

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Research

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CITATION

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ABSTRACT

Aim of study is to evaluate the impact of a new food (L3P=Laboratory of Physiology, Pharmacology and Pharmacopoeia) produced in our laboratory on growth of Wistar rats. To do this, conduct of rats with dietary trials were performed. In this setting, two groups of 36 rats were fed for 28 days with two types of food. One consists of granules (Control Faci®) and the other, a new food (L3P). A measurement of some zootechnical parameters during the experiment combining with a determination of blood parameters was carried out.

Results of study were indicated that rats with the new food were presented an increase of body mass compared to control food. In addition, significant differences were reported between rats of all ages. Haematological parameters rates such as platelet, hemoglobin, and lymphocyte were significantly increased in young rats. In addition, for all of determined biochemical parameters in our study, only transaminases, total protein, and potassium of rats were indicated significant differences between groups of rats according their age. Results were revealed a significant nutritional effect of the new food in comparison with the control food Faci®.

Keywords: New food; Rats (*Rattus norvegicus*); Zootechnical parameters; Blood parameters

INTRODUCTION

The rat and the mouse represent more than 90% of the mammals used in biomedical research. The rat is in second position just after the mouse (Fiore et al 1992. Laroche et al., 1999). It represents about 20% of the total number of laboratory mammals (Barnett, 2002). In United States, more than four million rats are used in the laboratory each year (Holmes et al., 1998, Mutai, 2000). It is therefore necessary to pay particular attention to this laboratory animal at the level of its diet. In the laboratory, its diet is standard-

ized, complete and marketed by large feed groups. In some countries rats are conventionally fed pellet sold on the markets. But according to his study entitled: "Laboratory tests are distorted," ralini (2013) says that food laboratory rats from five continents, usually considered balanced and hygienic is often contaminated. This study reveals that over 13 common samples of dry food for rats, from nine countries, residues of 262 pesticides, 22 GMOs (genetically modified organisms), 4 heavy metals, 17 dioxins and furans, and 18 PCBs (polychlorinated biphenyls) were found. Faced with this control, the monitoring of the laboratory rat diet and especially the high cost of granules, African laboratories considering alternatives. Thus, for some time now, the Laboratory of Animal Physiology, Pharmacology and Pharmacopoeia has used a formula for feeding rats, which originally came from the work of Cameroonian Fokou (1996) but was modified for the purposes of originality. This modified food named L3P consists of local products found on the markets or food scraps. It has been observed in rats fed this food, rapid reproduction with considerable litters. In view of these observations, it appears essential to appreciate the effect of this food on the blood biological parameters of rats of our laboratory.

In this vein, general objective of our work is to assess the impact of the provision of a novel food in the growth of Wistar rats to allow its possible use in food in the breeding of laboratory rats. This study mainly aims to explore the potential blood and Animal changes in rats fed with L3P food. Specifically, it is:

- compare the standard granulated feed with the L3P experimental feed to indicate the one that best improves the desired blood and zootechnical parameters in animals;

- specify the age group of rats with the best blood and zootechnical parameters during feeding;

MATERIAL AND METHODS

Animals

Animal material consisted of albino rats of Wistar strain (*Rattus norvegicus*) of different body weight according to age. These rats had free access to water, food and acclimatized to conditions of animal husbandry of the Laboratory of Physiology, Pharmacology and Pharmacopoeia (L3P) of Nangui Abrogoua University (Abidjan/Cote d 'Ivory). Animals were daily exposed to 12 hours of light (day) and 12 hours of darkness (night) with their bedding renewed every other day. A total of 36 rats including 18 males and 18 females were used. They were divided into two groups of 18 rats each, according to two types of food, subdivided into subgroups of six rats each, according to three selected age groups. Three different subgroups of rats aged one, two and three months were formed in each subgroup. The mean body weight was 47.41 g at one month, 103.16 g at two months and 134.83 g at three months. Males and females of 2 and 3 months were separated to prevent breeding.

Food trials

For the first group, experimental food (new food L3P) was used. It was consisted of a mixture (Table I) of bakery bread flour (44.5%); crushed yellow corn (25%); fish meal (16%); yellow soy flour previously roasted at a mild temperature (14%); cooking salt (0.5%). To this set, a little water in order to form a homogeneous mixture of more or less rounded food paste was added (640 ml of water per 1 kg) (Figure 1). The second control group was fed a ration composed of pellets. This food is a standard formulation, presented in the form of granules purchased on the market of the "Faci® brand" of the following composition: Corn, derived from cereals cakes, copra and cotton, premix, molasses limestone (Table I).

Figure 1. Photography of L3P Food

Table 1. Composition of tested food

New food L3P		Control food Faci®	
Bread powder (g)	44.50	Crude protein (%)	15
Crushed maize (g)	25	Crude fat (%)	3.5
Fish powder (g)	16	Cellulose (%)	12
Soy powder (g)	14	Mineral (%)	9
Moringa powder (g)	0	Calcium (%)	1
Salt (g)	0.50	Phosphore (%)	0,9
		Sodium (%)	0,3
		Vitamin A (U.I/Kg)	15000
		Vitamin D3 (U.I/Kg)	3000
		Vitamin E (mg/Kg)	10

Blood sampling and parameter dosing

Initial blood samples were taken by caudal puncture before submitting different feeds to groups of animals at day 0. After 28 days of observation, other blood samples were also taken. Blood samples collected in EDTA tubes were used to perform full blood count (CBC) by a high performance automatic hematological analyzer on the Sysmex Xt 2000i.

Biochemical parameters were assayed on serum obtained after centrifugation of whole blood. Assays were one din accordance with the requirements of the SPINREACT S.A. kit reagents. Glucose was measured directly with blood using the Accu-chek® glucometer following the glucose oxidase method (Tietz, 1987). Biochemical analyzes of rat sera involved markers such as total proteins, triglycerides and creatinine. Electrolytic markers including chlorine, sodium and potassium as well as liver enzymes (ASAT/TGO and ALAT/TGP) were also measured.

Statistical analysis

Statistical analysis of data was performed using the GraphPad Prism 5.01 software (San Diego, California, USA). Results were given as mean associated with standard error of mean (M ± SEM). In addition, the one-way analysis of variance test (ANOVA 1) was carried out for multiple comparisons of the mean values for various blood parameters with the Turkey-Kramer test. Statistical significance was set at $p < 0.05$ for expression of results.

RESULTS

Body mass variation of animals

Results relating to evolution of animals weight, after 28 days of experimentation according to type of food, were presented in Table II. Analysis of this table were showed a significant increase in body weight of study rats. This increase in animal mass was greater for L3P food. Thus, we observed in rats of 1 month, a gain weight of 99 g and 60.2 g respectively for the group fed experimental diet and the one subjected to the standard food. In 2-month-old rats, a gain of 79 g and 50 g respectively for the group fed the experimental food and the one with the standard food. For 3-month -old rats, a weight gain of 78 g and 36 g respectively for the group with the experimental feed and that fed the standard food.

Changes of blood parameters between different foods for each group of animals

Results of analysis showed significant differences between the two types of food in rats of all ages. Platelet, hemoglobin, neutrophils lymphocyte and monocytes rates were significantly increased in 1-month-old rats. In this vein, the number of blood platelets is higher in rats fed experimental food L3P (Table III) compared to the standard food (915 ± 130 10^9/L vs 996 ± 63.80 10^9/L). However, the rate of neutrophils and monocytes showed a significant decrease in low-age animals. Among the hematological parameters showed significant changes, some did not indicate any significant difference between the two

types of food. These were hemoglobin, lymphocyte, neutrophil, and monocyte levels in the low age rats. In middle-aged rats, a significant increase was recorded for white blood cell, red blood cell, platelet, hemoglobin and lymphocyte levels (Table III). However, neutrophils and monocytes showed a significant decrease in the study in middle-aged rats. With exception of platelet levels that were elevated in standard feed rats compared to experimental feed, other haematological variables were similar between two foods.

For animals with a higher age, a significant difference was observed in white blood cells, platelets, hemoglobin and neutrophils. The evolution has been increasing for first three haematological parameters. But, the last haematological index recorded a decreasing variation. In addition, only platelets were increased more in standard fed animals than in experimental diet.

Table II. Weight change of animals by type of food during food trial

Groups of rats	Tested food			P_1 values	Control food			P_2 values	P_3 values	P_4 values
	Day 0	Day 28	Gain weight		Day 0	Day 28	Gain weight			
Month 1 (g)	43 ± 2.35	142 ± 11.4	99	< 0.05	51.8 ± 3.38	112 ± 6.37	60.2	< 0.05	> 0.05	< 0.05
Month 2 (g)	102 ± 4.71	181 ± 16.7	79	< 0.05	103 ± 3.84	153 ± 7.49	50	< 0.05	> 0.05	< 0.05
Month 3 (g)	138 ± 10.51	216 ± 24.6	78	< 0.05	133 ± 8.16	169 ± 17.4	36	< 0.05	> 0.05	< 0.05

P1: p values for an intra-group comparison of rats between initial (Day 0) and final (Day 28) periods for tested food
P2: p values for an intra-group comparison of rats between initial (Day 0) and final (Day 28) periods for control food
P3: p values for an inter-group comparison of rats at initial period (Day 0)
P5: p values for an intergroup comparison of rats in final period (Day 28)

Table III. Evolution of blood parameters according to type of food in young rats

Blood parameters	Day 0	Day 28		P values
		CF	TF	
White blood cells (10^9/L)	10.20 ± 1.49	12.10 ± 1.25	10.50 ± 0.86	> 0.05
Red blood cells (10^{12}/L)	5.81 ± 0.32	6.87 ± 0.32	6.45 ± 0.31	> 0.05
Platelets (10^9/L)	698 ± 146	915 ± 130	996 ± 63.80	< 0.001
Hemoglobin (g/dl)	13.50 ± 0.47	15.80 ± 0.38	15.50 ± 0.45	< 0.05
Hematocrit (%)	39.60 ± 1.17	44.50 ± 1.43	46.20 ± 1.01	> 0.05
MCV (fl)	60.40 ± 0.40	64.20 ± 1.82	67.80 ± 0.70	> 0.05
MHC (pg)	25.40 ± 1.29	23.80 ± 0.60	24 ± 0.26	> 0.05
MCHC (g/dl)	33 ± 0.63	35 ± 0.52	35 ± 0.52	> 0.05
Neutrophils (%)	19.80 ± 0.80	12 ± 1.21	12.70 ± 0.33	< 0.05
Eosinophils (%)	3.40 ± 0.75	2.17 ± 0.17	2.67 ± 0.33	> 0.05
Basinophils (%)	0 ± 00	0 ± 00	0 ± 00	-
Lymphocytes (%)	67 ± 3.58	82.30 ±1.05	81.20 ± 0.48	< 0.05
Monocytes (%)	9.80 ± 2.65	3.33 ± 0.33	3.50 ± 0.22	< 0.05
Blood glucose (g/l)	0.93 ± 0.16	0.82 ± 0.11	0.75 ± 0.01	> 0.05
Creatinine (g/L)	9.75 ± 1.18	8.50 ± 0.43	5.83 ± 0.31	> 0.05
TGO/AST (U/L)	409 ± 83	331 ± 30.8	480 ± 45.50	< 0.05
TGP/ALT (U/L)	54.80 ± 9.85	155 ± 5.57	225 ± 45.80	< 0.05
Total Protein (g/L)	98.50 ± 34.90	74 ± 1.44	76 ± 1.73	< 0.05
Total Cholesterol (µmol/L)	0.86 ± 0.09	1.13 ± 0.06	0.88 ± 0.03	> 0.05
Triglycerides (g/L)	1.12 ± 0.25	0.67 ± 0.04	0.72 ± 0.12	> 0.05
Na (mEq/L)	145 ± 1.71	140 ± 0.88	138 ± 2.63	> 0.05
K (mEq/L)	7.88 ± 0.23	3.82 ± 0.08	4.45 ± 0.28	< 0.05
Cl (mEq/L)	109 ± 1.44	101 ± 1.25	101 ± 1.35	> 0.05

CF: Control food ; TF : Tested food

For all of biochemical parameters determined in our study, only transaminases, total protein, and potassium content of rats reported significant differences to varying degrees. In all rats of all ages, transaminases have evolved more and more. Conversely, potassium decreased during our investigation. Total proteins showed reduced levels in both low and high age rats. However, middle-aged rats reported increasing levels of total protein. Transaminases were elevated in low-age rats fed the L3P experimental food compared to the standard food. However, high total protein levels were revealed in middle and high-fed rats fed standard feed compared to the experimental feed (Tables IV and V).

Table IV. Evolution of blood parameters according to type of food in middle age rats

Blood parameters	Day 0	Day 28		P values
		CF	TF	
White blood cells (10^9/L)	5.16 ±1.61	11.90 ±1.39	10.0±1.20	< 0.05
Red blood cells (10^{12}/L)	4.95 ± 0.265	6.66 ± 0.24	7.30± 0.441	< 0.05
Platelets (10^9/L)	508 ± 27.20	949 ± 74.80	915± 105	< 0.01
Hemoglobin (g/dl)	12.80 ± 0.51	16.10 ± 0.60	16.3 ± 0.451	< 0.05
Hematocrit (%)	36.50 ± 2.10	47.70 ± 0.84	48.0± 1.03	> 0.05
MCV (fl)	57.80 ± 1.11	66.50 ± 0.99	67.0± 0.577	> 0.05
MHC (pg)	23.50 ± 0.65	24.50 ± 0.22	24.0± 0.258	> 0.05
MCHC (g/dl)	32.30 ± 1.31	34.70 ± 0.33	35.2± 0.401	> 0.05
Neutrophils (%)	20.30 ± 2.32	12.70 ± 0.33	11.5± 0.719	< 0.05
Eosinophils (%)	2.50 ± 0.29	2.50 ± 0.22	2.67± 0.333	> 0.05
Basinophils (%)	0 ± 00	0 ± 00	0±00	-
Lymphocytes (%)	71.50 ± 2.99	81 ± 0.37	80.3± 1.15	< 0.05
Monocytes (%)	6.25 ± 1.18	3.17 ± 0.31	5.33± 0.989	< 0.05
Blood glucose (g/l)	1.36 ± 0.32	0.85 ± 0.11	0.73 ± 0.01	> 0.05
Creatinine (g/L)	9.75 ± 1.65	6.83 ± 0.79	8.33 ± 0.56	> 0.05
TGO/AST (U/L)	166 ±37.70	458 ± 71.70	368 ± 19.80	< 0.05
TGP/ALT (U/L)	42.30 ± 5.30	241 ± 40.40	119 ± 9.59	< 0.05
Total Protein (g/L)	63.50 ± 2.33	71.50 ± 2.59	77.70 ± 1.56	< 0.05
Total Cholesterol (µmol/L)	0.78 ± 0.09	1.18 ± 0.07	0.78 ± 0.07	> 0.05
Triglycerides (g/L)	0.97 ± 0.33	0.75 ± 0.06	0.89 ± 0.19	> 0.05
Na (mEq/L)	142 ± 0.48	141 ± 1.86	143 ± 0.75	> 0.05
K (mEq/L)	7.90 ± 0.27	4.25 ± 0.17	4.60 ± 0.38	< 0.05
Cl (mEq/L)	107 ± 0.41	103 ± 1.17	101 ± 1.58	> 0.05

CF : Control food ; TF : Tested food

Table V. Evolution of blood parameters according to type of food in older age rats

Blood parameters	Day 0	Day 28		P values
		CF	TF	
White blood cells (10^9/L)	18.20 ± 2.86	12.80 ± 1.59	10.20 ± 1.15	< 0.05
Red blood cells (10^{12}/L)	6.10 ± 0.33	6.89 ± 0.49	6.41 ± 0.25	> 0.05
Platelets (10^9/L)	489 ± 23.30	995 ± 34.40	952 ± 29.7	< 0.001
Hemoglobin (g/dl)	13.90 ± 0.14	16 ± 0.69	15.20 ± 0.44	< 0.05
Hematocrit (%)	41.90 ± 0.67	48.50 ± 2.19	46.20 ± 0.79	> 0.05
MCV (fl)	61.50 ± 0.53	64.80 ± 1.17	67 ± 1.13	> 0.05
MHC (pg)	27.10 ± 1.52	23.70 ± 0.33	23.80 ± 0.31	> 0.05
MCHC (g/dl)	34.30 ± 0.42	34.70 ± 0.49	34.30 ± 0.42	> 0.05
Neutrophils (%)	15 ± 0.38	13.80 ± 1.08	11.80 ± 0.40	< 0.05
Eosinophils (%)	2.29 ± 0.18	2 ± 0.26	2.83 ± 0.17	> 0.05
Basinophils (%)	0 ± 0	0 ± 00	0 ± 00	-
Lymphocytes (%)	77.30± 1.23	80.30 ± 1.09	79.80 ± 0.70	> 0.05
Monocytes (%)	5.43 ± 0.97	3.83 ± 0.703	6 ± 0.68	> 0.05
Blood glucose (g/l)	0.83 ± 0.03	0.72 ± 0.03	0.71 ± 0.01	> 0.05
Creatinine (g/L)	9.43 ± 1.13	12 ± 3.70	9.17 ± 0.60	> 0.05
TGO/AST (U/L)	198 ± 20.40	426 ± 32.80	342 ± 69.80	< 0.01
TGP/ALT (U/L)	40 ± 3.32	169 ± 20.10	117 ± 10.40	< 0.05
Total Protein (g/L)	86.30 ± 4.92	72.30 ± 3.07	74.30 ± 0.62	< 0.05
Total Cholesterol (µmol/L)	1.11 ± 0.06	0.97 ± 0.04	1.13 ± 0.13	> 0.05
Triglycerides (g/L)	1.44 ± 0.37	0.87 ± 0.09	0.73 ± 0.13	> 0.05
Na (mEq/L)	144 ± 1.61	142 ± 1.37	140 ± 0.99	> 0.05
K (mEq/L)	8.26 ± 0.18	4.27 ± 0.12	4.30 ± 0.14	< 0.05
Cl (mEq/L)	111 ± 2.41	103 ± 0.97	101 ± 1.90	> 0.05

CF : Control food ; TF : Tested food

Variation in blood parameters at day 28 between in different rat groups according to type of food

The set of haematological parameters determined in rats of all ages subjected to the standard food showed no significant difference at the 28th day of the study. However, the platelet count was significantly different between the animals in the study. In this context, older rats reported a higher platelet count compared to other animal groups (Table VI). At the experimental food level, only platelets and monocytes showed a significant difference between the three groups of animals. In this sense, the young rats had a high number of platelets. In contrast, older animals reported higher monocyte levels than the other two groups of animals (Table VII).

Tables VI and VII were presented biochemical parameters evolution in rats by age within each food. For both types of food, only creatinine and transaminases showed significant differences between groups of animals. Thus, high-age rats fed either standard or experimental feeds had higher creatinine levels than the other two groups of animals. In contrast, both types of transaminases were increased more in middle -aged rats for standard food (Table VI). For the experimental feed, high levels of both enzymes were observed in small animals compared to other groups of animals (Table VII).

Table VI. Mean values of blood parameters in rats fed the control diet on day 28

Blood parameters	Different groups of rats			p Values
	Age 1	Age 2	Age 3	
White blood cells (10^9/L)	12.10 ± 1.25	11.90 ± 1.39	12.80 ± 1.59	> 0.05
Red blood cells (10^{12}/L)	6.87 ± 0.32	6.66 ± 0.24	6.89 ± 0.49	> 0.05
Platelets (10^9/L)	915 ± 130	949 ± 74.80	995 ± 34.4	<0.001
Hemoglobin (g/dl)	15.80 ± 0.38	16.10 ± 0.60	16 ± 0.69	> 0.05
Hematocrit (%)	44.50 ± 1.43	47.70 ± 0.84	48.50 ± 2.19	> 0.05
MCV (fl)	64.20 ± 1.82	66.50 ± 0.99	64.80 ± 1.17	> 0.05
MHC (pg)	23.80 ± 0.60	24.50 ± 0.22	23.7 ± 0.33	> 0.05
MCHC (g/dl)	35 ± 0.52	34.70 ± 0.33	34.70 ± 0.49	> 0.05
Neutrophils (%)	12 ± 1.21	12.70 ± 0.33	13.80 ± 1.08	> 0.05
Eosinophils (%)	2.17 ± 0.17	2.50 ± 0.22	2 ± 0.26	> 0.05
Basinophils (%)	0 ± 00	0 ± 0	0 ± 00	-
Lymphocytes (%)	82.30 ± 1.05	81 ± 0.37	80.30 ± 1.09	> 0.05
Monocytes (%)	3.33 ± 0.33	3.17 ± 0.31	3.83 ± 0.703	> 0.05
Blood glucose (g/l)	0.82 ± 0.11	0.85 ± 0.11	0.72 ± 0.03	> 0.05
Creatinine (g/L)	8.50 ± 0.43	6.83 ± 0.79	12 ± 3.70	< 0.05
TGO/AST (U/L)	331 ± 30.80	458 ± 71.70	426 ±32.80	< 0.05
TGP/ALT (U/L)	155 ± 5.57	241 ± 40.40	169 ± 20.10	< 0.05
Total Protein (g/L)	74 ± 1.44	71.50 ± 2.59	72.30 ± 3.07	> 0.05
Total Cholesterol (µmol/L)	1.13 ± 0.06	1.18 ± 0.07	0.97 ± 0.04	> 0.05
Triglycerides (g/L)	0.67 ± 0.04	0.75 ± 0.06	0.87 ± 0.09	> 0.05
Na (mEq/L)	140 ± 0.88	141 ± 1.86	142 ± 1.37	> 0.05
K (mEq/L)	3.82 ± 0.08	4.25 ± 0.17	4.27 ± 0.12	> 0.05
Cl (mEq/L)	101 ± 1.25	103 ± 1.17	103 ± 0.97	> 0.05

CF : Control food ; TF : Tested food

Table VII. Mean values of blood parameters in rats fed the experimental diet on day 28

Blood parameters	Different groups of rats			P Values
	Age 1	Age 2	Age 3	
White blood cells (10^9/L)	10.50 ± 0.86	10 ± 1.20	10.20 ± 1.15	> 0.05
Red blood cells (10^{12}/L)	6.45 ± 0.31	7.30 ± 0.44	6.41 ± 0.25	> 0.05
Platelets (10^9/L)	996 ± 63.80	915 ± 11	952 ± 29.7	< 0.01
Hemoglobin (g/dl)	15.50 ± 0.45	16.30 ± 0.45	15.20 ± 0.44	> 0.05
Hematocrit (%)	46.20 ± 1.01	48 ± 1.03	46.20 ± 0.79	> 0.05
MCV (fl)	67.80 ± 0.70	67.0± 0.58	67 ± 1.13	> 0.05
MHC (pg)	24 ± 0.26	24.0 ± 0.256	23.80 ± 0.31	> 0.05
MCHC (g/dl)	35 ± 0.52	35.20 ± 0.40	34.30 ± 0.42	> 0.05
Neutrophils (%)	12.70 ± 0.33	11.50 ± 0.72	11.80 ± 0.40	> 0.05
Eosinophils (%)	2.67 ± 0.33	2.67 ± 0.33	2.83 ± 0.17	> 0.05
Basinophils (%)	0 ± 00	0 ± 00	0 ± 00	-
Lymphocytes (%)	81.20 ± 0.48	80.30 ± 1.15	79.80 ± 0.70	> 0.05
Monocytes (%)	3.50 ± 0.22	5.33 ± 0.99	6 ± 0.68	< 0.05
Blood glucose (g/l)	0.82 ± 0.11	0.85 ± 0.11	0.72 ± 0.03	> 0.05
Creatinine (g/L)	8.50 ± 0.43	6.83 ± 0.79	12 ± 3.70	< 0.05
TGO/AST (U/L)	331 ± 30.80	458 ± 71.70	426 ±32.80	< 0.05
TGP/ALT (U/L)	155 ± 5.57	241 ± 40.40	169 ± 20.10	< 0.05
Total Protein (g/L)	74 ± 1.44	71.50 ± 2.59	72.30 ± 3.07	> 0.05
Total Cholesterol (µmol/L)	1.13 ± 0.06	1.18 ± 0.07	0.97 ± 0.04	> 0.05
Triglycerides (g/L)	0.67 ± 0.04	0.75 ± 0.06	0.87 ± 0.09	> 0.05
Na (mEq/L)	140 ± 0.88	141 ± 1.86	142 ± 1.37	> 0.05
K (mEq/L)	3.82 ± 0.08	4.25 ± 0.17	4.27 ± 0.12	> 0.05
Cl (mEq/L)	101 ± 1.25	103 ± 1.17	103 ± 0.97	> 0.05

CF : Control food ; TF : Tested food

DISCUSSION

The study reveals a significant increase in body mass of the rats studied. This increase in body weight is greater with experimental food L3P than with standard food. It results from the composition of the test food, particularly its nutrient content, which ensures an adequate intake favorable to the growth of the rats (Dean and Edwards, 1985). These results are similar to those of Duff et al (2000) who showed the effect of improved feed consumption on Wistar rat growth. In fact, the L3P food contains soy in addition to the other components which is an appreciable source of protein (40%), carbohydrates (38%), lipids (18%) and mineral salts (18%). It has a relatively low content of saturated fat (about 15%) and is rich in unsaturated fats, ie 61% of polyunsaturated fatty acids (Fukushima, 1991). What makes a food soy increasingly consumed in France (Gaétane; 2005). In addition to soybeans, tested food contains cereals (corn, wheat). Because of its large quantity (25%), maize is commonly used for animal feed, and is the main source of energy for the diet because of its high levels of starch and fatty acids (Bouafou, 2007). Globally, cereals are the largest source of dietary protein (50 -60%). Among animal proteins consumed are those from fish which are proteins considered to have a high nutritional value due to their high polyunsaturated fatty acid content (Daniels et al, 2004). Several authors have suggested that replacing some of the animal proteins with plant proteins, particularly soy, could improve poor kidney function and nutritional status (Anderson, 1998).

Increase in haematological parameters in the animals in this study could be explained by the presence of the various nutritive components contained in the L3P food. Given the significant presence in soy that is scientifically proven, macronutrients and micronutrients including vitamins (B, A, E, and minerals such as iron, iodine, and isoflavones (Souci et al, 2008; Setchell and Cassidy 1999, Messina 1999, Ringler and Dabich 1979).

For all of biochemical parameters determined in our study, only transaminases, total protein, and potassium content of rats reported significant differences to varying degrees. In all rats of all ages, transaminases are evolving. However, we observe high total protein levels in middle and high-fed rats fed standard feed compared to the experimental feed (Abel et al., 2004).

We have little information on the elimination of enzymes from the circulation (Massarrat, 1965). For the rat, the lower nutritional quality of some proteins (eg gluten) will be compensated when the food contains a high enough content to cover the amino acid requirements of the animal (Dean and Edwards, 1985). This is the case with our experimental food which, in addition to soy, contains about 44.5% of bread powder and therefore of gluten, which would explain its nutritional quality (Hymowitz et al, 1972). Knowing that an enzyme is a biological catalyst and that its presence allows the acceleration of a chemical reaction, its decrease does not necessarily explain the presence of a pathology in a subject. The lowering of cholesterol levels could be explained by the effect of substances such as saponins and other phytoconstituants present in soybeans (Hoie et al., 2005). In fact, according to several studies, the consumption of soy would lead to a drop in cholesterol levels (Sidhu and Oakenfull, 1986, Francis et al, 2002).

Therefore, the decrease in cholesterol observed in our study can not be explained by the influence of the environment. It is the consequence of the composition of the L3P food in saponins contained in soybean. Saponins have a cholesterol-lowering effect (Oakenfull and Sidhu, 1990). A meta-analysis of 38 controlled intervention studies published in 1995 showed that the substitution of animal protein with soy protein induces a significant decrease in triglycerides, total cholesterol and low density lipoprotein (LDL) without affecting the high density lipoproteins (HDL) (Anderson et al., 1995). The blood glucose level in the rats in our study is similar to the reference value. But, it decreases with the use of the experimental food compared to the standard food. This decrease in serum glucose concentration may be indicative of strong lipogenesis (Massanes et al., 1999).

Our study found at the end of the experiment, the increase in creatinine levels, triglycerides, cholesterol in rats fed test food compared to rats fed pellets. This rate has decreased compared to day 0. This result

proves that the food should be advised because according to Messer, (1995). The work of this author has revealed that an increase in the serum triglyceride concentration may be indicative of hyperlipemia, cholestasis, pancreatitis, exudative enteropathy, nephrotic syndrome, administration of glucocorticoids, or hypercorticism. When assessing the toxicity of a substance, the fall in serum triglycerides indicates a non-toxic effect of the substance (Belier and Michaux, 2007).

Cholesterol also contributes to the development of the nervous system and the formation of vitamin D (Velde, 2010). An increase in level of total cholesterol is a risk factor for atherosclerosis and cardiovascular diseases that contribute significantly to mortality. So a decrease leads to a good functioning of the heart muscle. Following the administration of a drug, an increase in TGP results in liver damage. However, a decrease indicates a good functioning of the liver (Fortier, 2007).

CONCLUSION

Our prospective study on blood biological parameters in rats (Rattus norvegicus) submitted to a modified food at the Laboratory of Physiology, Pharmacology and Pharmacopoeia revealed a significant increase in body weight of the rats in the study. This increase in body weight is greater with the L3P test feed than with the pellets.

The haematological and serum biochemical parameters of these rats are normal in comparison with those of the controls. Exploration by assaying the blood biological parameters of the rats that consumed the experimental feed indicates a significant difference compared to the standard (commercially available) food in rats of all ages.

This difference is more significant in platelets, transaminases and creatinine. The rats would be well fed by the new food that would promote a good nutritional metabolism. It will then be necessary to consider other means of their exploration for more precision. In light of the results obtained we can say that our food has a nutritional effect more interesting than the reference food "Faci" trade on the growth of wistar rats and more advantageous in terms of cost. This study deserves to be pursued by an investigation of monitoring and control of all the biological blood parameters for evaluation of nutritional status over a longer period of time with a high number of rats since weaning.

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