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Case Report

Study of the Influence of Juice Drinks with Collagen on The In Vivo Blood Parameters

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Abstract

During the vital activity of the organism, nutrients are continuously consumed, which perform plastic and energy functions. The source of nutrients is a variety of foods, consisting of a complex of complex proteins, fats and carbohydrates, which in the process of digestion turn into simpler substances that are absorbed by the body. At the moment there is a shortage of dietary protein. This problem is social and medical in the modern world, since the presence or absence of a balanced diet in terms of protein does not allow a biological organism to develop normally. Proteins of human connective tissues perform the most important plastic functions, they are also considered to be the proteins of youth, beauty and health. However, for its sufficient biosynthesis, vitamin C is required in the required amount to convert proline to hydroxyproline, or replenish hydroxyproline due to digestible forms of collagen. The functions of collagen in the body are diverse, one of the main ones is participation in digestion, the violation of which is the cause of diseases such as gastritis and ulcers. For the prevention and treatment of such diseases, liquid collagen-containing food products in the form of functional drinks are very useful. The liquid form of collagen for drinking is absorbed by the body at levels of over 90%, which is unattainable when collagen is taken in tablet or capsule form. We have developed recipes for a new range of juice products based on fruit and vegetable raw materials, enriched with tomato, beef, pork and fish collagen of plant and animal origin. The optimal amount of this biological additive in drinks was determined, while ensuring the required quality of products, and the preservation of its active properties was studied. Also, studies were carried out on juice products with collagen supplement "in vivo".

Keywords: vitamin; eosinophils; plateletcrit

Introduction

The desire to improve the quality of life, as well as the resistance to various diseases, makes people change their diet and choice of foods and drinks that not only satisfy the body's natural needs - hunger, thirst - but also provide additional health benefits. One of the modern ingredients that allows you to transfer food products into the category of functional, to position it as healthy, is hydrolyzed collagen. It is a pure protein and an essential protein in the body, containing a complex of amino acids, including 8 essential ones, that is, those that the human body cannot synthesize on its own. Like soluble milk protein, hydrolyzed collagen is a so-called "fast" protein; already half an hour after entering the stomach, it is absorbed and shows its nutritional properties.

The main advantage of this type of collagen is its natural soluble form, i.e., when extracted from the substrate, this component is obtained in the form of a hydrate. This greatly simplifies the technology and improves the security status. Recently, the use of collagen in the production of functional products, various dietary supplements for sports, preventive and everyday use is gaining more and more popularity. Collagen used as additives has a neutral taste and smell, therefore it can be used also in relation to the technology of liquid food products. Functional drinks are increasingly appearing on the consumer market today. Liquid foods are particularly useful in the development of specialty and health foods. Juice-containing drinks, nectars, contain many useful biologically active components - vitamins, minerals, and the addition of collagen

to them will increase the nutritional value of these products. When using collagen in juices and drinks, it is necessary to take into account its amount and the active acidity of the product, which affects the process of its swelling, which will certainly affect the organoleptic characteristics of drinks [1].

Our study was devoted to the development of recipes for juice-containing fruit and vegetable drinks using various types of animals and vegetable collagen. The main goal of the study was to ensure the minimization of the influence of collagen on the organoleptic and physic-chemical characteristics of the developed formulations of finished products while maintaining its beneficial biological active properties. The following research tasks were solved:

1. The range and organoleptic characteristics of different types of collagens of animal and vegetable origin - tomato, beef, pork and fish - were studied.

2. The features of various types of collagens were studied for the possibility of their use in juice products. The mass fraction of collagen in finished juice-containing products was determined, which is 5% and allows you to get a drink in terms of quality in accordance with the regulatory document.

3. The degree of preservation of a biologically active protein supplement in finished juice products (fractional and amino acid composition) was studied, which allowed to determine the preferred type of collagen. It has been determined that the most acceptable type of collagen for the enrichment of juice-containing products is animal collagen - beef.

4. Formulas of juice-containing products with collagen have been developed - these are fruit and vegetable and berry, blended nectars and drinks with pulp.

5. The organoleptic and physicochemical indicators of the quality of finished juice drinks enriched with collagen and their compliance with the requirements of regulatory and technical documentation were studied [2, 3].

Also, clinical studies of blended fruit and vegetable and berry drinks enriched with collagen - nectars and juice products with pulp "in vivo" were carried out.

Materials and Research Methods

In vivo studies of juice-containing products with collagen supplements were carried out on laboratory animals. As laboratory animals, nonlinear white rats were used, which were sexually mature animals at the age of 6-8 months and weighing 180-200 g. All animals were divided into 4 groups of 10 pieces each. The first 3 groups of animals were injected with nectar "Beet-mango-apple" with the addition of collagen of plant and animal origin, beef, tomato, pork, respectively, made according to the recipe presented in table 1.

Prescription component	The ratio of the components in the finished product, %		
	Group No.1	Group No.2	Group No.3
Concentrated apple juice	5,6	5,6	5,6
Concentrated beet juice	15,5	15,5	15,5
Concentrated mango puree	10,0	10,0	10,0
Sugar syrup (sugar)	8,9	8,9	8,9
Citric acid	0,07	0,07	0,07
Beef collagen	5,0	-	-
Tomato collagen	-	5,0	-
Pork collagen	-	-	5,0
Water	brought up to 1000 l	brought up to 1000 l	brought up to 1000 l

Table 1: Recipe for nectar "Beet-Mango-Apple"

The group of animals No.4 was the control. This group of animals was injected with physiological saline. When administered, the animals in the control group experience the same stress as the animals in the research groups.

At the end of the ten-day period of the introduction of these solutions into the indicated groups of laboratory animals, the following analyzes were carried out to determine their functional state:

Clinical blood parameters (26 indicators):

- WBC (white blood cells) - the absolute content of leukocytes;

- RBC (red blood cells - red blood cells) - the absolute content of erythrocytes;

- HGB (Hb, hemoglobin) - the concentration of hemoglobin in whole blood;

- HCT (hematocrit) - hematocrit;

- PLT (platelets - blood plates) - the absolute content of platelets

- MCV - average erythrocyte volume;

- MCH - the average content of hemoglobin in a single erythrocyte in absolute units;

- MCHC - the average concentration of hemoglobin in the erythrocyte mass;

- MPV (mean platelet volume) - average platelet volume;

- PDW - relative width of platelet distribution by volume;

- PCT (plateletcrit) - thrombocyte;

- LYM (LY) (lymphocyte) - the absolute content of lymphocytes;

- MXD (MID) - the absolute content of a mixture of monocytes, basophils and eosinophils;

- NEUT (NE) (neutrophils) - the absolute content of neutrophils;

- MON (MO) (monocyte) - the absolute content of monocytes;

- EOS - absolute content of eosinophils;

- BAS - the absolute content of basophils;

- IMM - absolute content of immature granulocytes;

- ATL - the absolute content of atypical lymphocytes;

- GR (GRAN) - the absolute content of granulocytes;

- MCHC = HGB / HCT - the average concentration of hemoglobin in the erythrocyte;

- RDW – Red cell Distribution Width - coefficient of variation of the average volume of erythrocytes;

- RDW - CD - relative width of distribution of erythrocytes by volume, standard deviation;

- RDW - CV - relative width of distribution of erythrocytes by volume, coefficient of variation;

- P-LCR - large platelet ratio;

- ESR (ESR) - erythrocyte sedimentation rate.

Results and discussion

Investigation of the effect of collagen supplementation in beverages on blood counts

The results of studies on the averaged values of blood parameters and the range of their change for group No.4, control animals, which were injected with saline instead of a juice-containing solution, are shown in table. 2.

Blood parameter	Reference values	Experimental values
RBC	6,49 -7,79	7,22
HGB	130-145	138
HCT	0,386 - 0,419	0,40
MCV	54,1-59,8	56,82
MCH	18,1 - 20,1	19,15
MCHC	332- 352	342,83
RDW-CV	8,9-10,3	9,25
RDW-SD	21-22,7	21,97
PLT	250 -909	557,33
PCT	0,0009 - 0,0049	0,0033
MPV	7,6 - 7,9	7,76
PDW	10,0 - 11,5	11,0
P-LCC	39-118	79,16
P-LCR	13,0 - 15,7	14,41
WBC	6,25 - 13,6	7,54
NEU	0,23 - 7,37	2,66
LYM	3,92 - 4,98	4,37
MON	0,05 - 0,42	0,14
EOS	0,15 - 0,75	0,33
BAS	0,03 - 0,24	0,08
LIC	0,01 - 0,16	0,05

Table 2: Indicators of blood analysis of animals of the control group No.4

Since similar blood parameters of experimental animals were measured in other groups, their comparison will reveal the effect of collagen supplements in juice drinks on the physiological state of the studied animals. Table 3, the following comparison is made.

Parameter	Group No.1	Group No.2	Group No.3
RBC	7,79	7,74	8,23
HGB	143,60	147,71	155,57
HCT	0,43	0,44	0,45
MCV	54,72	56,78	54,57
MCH	18,48	19,09	18,89
MCHC	337,2	336,29	345,71
RDW-CV	9,2	9,36	9,24
RDW-SD	21,66	22,30	21,69
PLT	617,20	556,43	617,86
PCT	0,004	0,004	0,005
MPV	7,36	7,29	7,71
PDW	10,04	9,60	10,99
P-LCC	68,60	58,14	84,71
P-LCR	11,22	10,74	13,89
WBC	6,71	5,81	6,61
NEU	1,80	1,60	2,49
LYM	4,64	3,92	3,88
MON	0,07	0,08	0,07
EOS	0,08	0,13	0,07
BAS	0,11	0,07	0,08
LIC	0,01	0,01	0,02

Table 3: Comparison of indicators of blood analysis of different groups of animals

An analysis of the comparison of the results obtained allows us to conclude that the introduction of both a juice drink of the basic recipe and a juice drink made according to recipes enriched with collagen of various origins to animals leads to changes in some blood parameters of experimental animals. Table 4 shows that the deviation of these single blood parameters is in different cases - from + 7.5% to -80.0%.

Parameter	Norm (average baseline)	Group No.1	Deviation from the norm,%	Group No.2	Deviation from the norm,%	Group No.3	Deviation from the norm,%
RBC	7,22					8,23	+13,9
HGB	138,0					155,57	+17,6
HCT	0,40	0,43	+7,5	0,44	+10,0	0,45	+12,5
PDW	11,0			9,60	-12,7		
P-LCR	14,42			10,74	-25,5		
WBC	7,55			5,81	-23,1		
EOS	0,33	0,08	-75,8				
LIC	0,05	0,01	-80,0	0,01	-80,0		

Table 4: Deviation of single indicators of blood analysis of different groups of animals from the basic indicators

However, such deviations arise when comparing the corresponding blood parameters in the groups of animals with the corresponding average baseline in the contol group of animals No.4.

Table 2 shows the range of changes in each indicator of the blood test in the control group of animals No.4. If we compare the isolated blood parameters in each group of experimental animals, taking into account their range of change in the control group, then the difference in almost all the noted indicators in all groups will not exceed from 2.6% to 7.4%. This difference does not exceed the accuracy of the methods for determining all the parameters under consideration [4] and, therefore, the data obtained on the blood composition of experimental animals after the introduction of a juice-containing drink without and with collagen additives of various origins practically do not differ from the control values. This is what is illustrated by the data given in table. 5.

Parameter	Norm (average baseline)	Group No.1	Deviation from the norm,%	Group No.2	Deviation from the norm,%	Group No.3	Deviation from the norm,%
RBC	6,49 -7,79					8,23	5,6
HGB	130-145					155,57	7,29
HCT	0,386 - 0,419	0,43	2,60	0,44	5,0	0,45	7,40
PDW	10,0 - 11,5			9,60	4,0		
P-LCR	13,0 - 15,7			10,74	17,0		
WBC	6,25 - 13,6			5,81	7,0		
EOS	0,15 - 0,75	0,08	46,70				
LIC	0,01 - 0,16	0,01	0	0,01	0		

Table 5: Deviation of single indicators of blood analysis of different groups of animals from the basic indicators, taking into account their range of change

Only 2 of the given 8 indicators do not fall into the specified range of deviations. These are: P-LCR - coefficient of large platelets; EOS is the absolute content of eosinophils. Both indicators are very dangerous when the normative values are exceeded, since they may indicate significant problems associated with ischemic heart disease and the occurrence of blood clots [5], as well as chronic pathologies of the gastrointestinal tract and malignant diseases [6].

However, in our case, both indicators do not exceed the indicated limits, but, on the contrary, are somewhat lower. Such deviations are possible in the presence of stressful situations in experimental animals. The introduction of solutions to animals for ten days, of course, were stressful conditions and a decrease, rather than an increase in the P-LCR and EOS indices, indicates that the injected solutions do not affect the blood parameters [7].

Conclusions

The presented results show that the introduction to animals of both a juice-containing drink of the basic recipe and a juice-containing drink made according to recipes enriched with collagen of various origins leads to changes in some blood parameters. At the same time, the difference in almost all the noted indicators in all groups will not exceed from 2.6% to 7.4%. This difference does not exceed the accuracy of the methods for determining all the parameters under study. Therefore, the obtained data on the composition of the blood of experimental animals after the introduction of a basic drink and a drink containing collagen, practically do not differ from the control values. Out of the above 8 indicators, only 2 do not fall within the specified range of deviations. These are: P-LCR - large platelet ratio; EOS - absolute content of eosinophils. But their values are below the normative limits, which is associated with the presence of stressful situations in animals during research.

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