The effects of pollen and protein extracts on selected blood factors and performance of athletes

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The use of dietary supplements by athletes searching for the slight physiological edge over their opponents in competition is a fairly common practice. Pollen extract (PE), pure bee pollen (BP), and protein extract (PRE) preparations, extolled for their performance improvement characteristics, have recently been popularized by a number of world class athletes, their coaches, and trainers, and reported in several newspaper and magazine articles. [3 4 5 19 20 21 22] These articles report subjective opinion and heuristic observations and lack the credibility of scientific experimentation. While considerable evidence has been presented that PE is successful in the treatment of prostatis,[1 2 8 26] bleeding stomach ulcers,[10] and increases resistance to colds and respiratory infections, little has been done experimentally to validate claims related to improvement of athletic performance. The daily dosage in the majority of the studies mentioned adhered to the manufacturer's labeled prescription (four to six tablets per day), with the length of the experiments ranging from three to 36 days,[18 26] eight to twelve weeks,[9 18] and as long as ten months.[17]

While Nuttila[22] claimed that the purpose of PE ingestion was to increase red blood cells in athletes and thus facilitate the transport of oxygen, Millar[21] reported that no direct correlation was established between PE ingestion and Hgb increase. However, Nuttila attributed the increase in Hgb concentration found among Finnish runners to the effects of PE and high protein diet. Steben et al.[27] studied the effects of a BP on selected blood factors and performance of varsity college swimmers and found no significant differences in Hgb and Hct levels among the groups studied. Since evidence presented by Rose[25] indicated the possible incidence of the muscular weakness and lethargy of hypokalamia among collegiate varsity distance runners in spite of otherwise good aerobic fitness, it was conjectured that the addition of potassium (K^+) to the diet in a palatable form would alleviate the condition. Steben found that BP did not significantly improve K^+ levels in the blood over other groups studied.

Fijalkowski[9] found a large, but non-significant, difference in the improvement of work capacity in weightlifters using PE. Steben[27] found that the use of PE did not result in any significant difference in performance of swimmers over that of the control group.

There are also conflicting ideas on the necessity of a PRE in the athlete's diet. Poortmans[24] indicated that protein is not used as a primary energy source when caloric supply is sufficient. It is a generally accepted fact that the major function of protein is to sustain cell growth and maintain various body tissues. Jormakka[13] indicated a PRE should be a supplement to the low protein diets that are normal in Third World countries. It seems that the presence of high quality protein foods, which contain all of the known amino acids, would be sufficient to maintain cell construction and would not be metabolized as an energy source unless an inadequate caloric intake was present.

The PRE used in this study (reported by the manufacturer A. B. Cernelle, to contain quick absorbable free amino acids and low molecular peptides) was also used in Fijalkowski's 14 day weight training study which attributed the increase Hgb content of the blood to the supplement. However, in his study the experimental group received both the PRE and PE-Pollitab in a dosage "according to the producers instruction" (sic),[9] either of which could have been responsible for the increase. No other studies have been found which compare the use of a protein supplement with changes in performance.

The purpose of this study was to validate and further investigate the question of whether normal training over a period of time rather than food supplements was primarily responsible for improved performance of endurance athletes who ingest normal diets. Specific biochemical parameters of blood serum K, Hgb, and Hct values were selected for investigation of their possible influence on prevention of the tiring effects of hypokalamia and improvement of oxygen carrying ability of the blood, respectively.

Procedure

The placebo double blind experiment was undertaken at Catholic High School of Baton Rouge, Louisiana, with 18 male cross country runners for twelve weeks during the Fall Semester, 1977. The runners were randomly divided into three diet groups. Individuals in the first group orally ingested four PE capsules daily before breakfast. A similar procedure prescribing four placebo capsules was followed by members of group two, while the individuals of group three took four PRE capsules. The rational for the prescription was based on recommended daily dosages suggested on the label of the product bottle and also found in the producer's monographs.

At the beginning and the conclusion of the experiment, blood samples were drawn from each individual for three consecutive days before practice. Serum K^+ levels were analyzed by an Instrument Lab flame photometer, with Hgb and Hct levels determined by a Cotter S automatic Counter. All of the runners took their meals, except for lunch, at home and were advised to dine as normally accustomed.

The runners preceded their formal training with a voluntary summer program of slow, long mileage work. Formal training at the inception of the experiment consisted of 70 miles of over distance type work per week conducted on the road and cross country trails, gradually evolving into 100 miles per week of faster pace work. Near the end of the 12 week experiment, 40 percent of the mileage was negotiated with Fartlek style training and a limited amount of race pace interval type work. Prior to the State Meet, and the conclusion of the season and the experiment, the overall volume was reduced to 60 miles per week. Pre and post performance tests consisted of determining the average velocity for a three mile run conducted on the same surveyed and permanently marked cross country course. Split times were provided to assist the runners in the judgment of pace at the mile and two mile posts in both time trials and provided the information for change in performance.

The data which consisted of the serum K^+ mEq/L, Hgb gm, Hct %, and performance yds/ sec (velocity) for average three mile run performance were statistically treated with a split plot ANOVA with diet and pre-post measures as the main and split plot respectively. Probability was reported at the .05 and .01 levels of significance.

Analysis of samples of materials used in the study were reported to determine concentrations of minerals germane to the blood analysis. If PE and PRE is reputed to directly or synergistically help an individual become more enduring, then levels of K^+ and Fe, to assist in modifying the possible fatigue effects of hypokalemia and enhance the increased oxygen carrying characteristics of Hgb and Hct concentration respectively, should be found in relatively high concentration (Table 1).

TABLE 1.—*Chemical analysis of diet treatments.*

Sample	Fe ppm/capsule	K^+ ppm/capsule
PE, 365 mg*	100.0	2000.0
Placebo, 350 mg*	30.0	120.0
PRE, 360 mg*	4500.0	280.0

*Mean of the contents of ten capsules.

Findings

An ANOVA (Table 2) with diet and pre and post measures as the main and split plot respectively, found no significant differences among the diet groups in blood levels of K^+, Hgb and Hct. Significant pre and post differences were found in blood levels of K^+ and Hgb. Pre versus post for performance was highly significant. The analysis in performance was nonsignificant and diet x pre and post measure interaction was nonsignificant for all variables.

While the ANOVA found significant pre and post differences in blood levels of K^+ and Hgb, they cannot be attributed to the diet supplements since the analysis found no significance among the diet groups in blood levels of K^+, Hgb, and Hct. The difference in K^+ was negative yet within normal blood level limits (Table 3). An earlier study[27] conducted for eight weeks suggested that an extended experiment might sustain Rose's observation that hypokalemia could appear in endurance athletes at the conclusion of arduous season and might be moderated by the inclusion of K^+ bearing foods in the diet. The results of our study did not support the inclusion of pollen extracts or protein extract food supplements in normal diets for maintenance of K^+ levels and prevention of hypokalemia.

The fact that the analysis found a significant difference in Hgb and not in Hct is difficult to explain. Table 2 reveals that Hct just missed being significant, even though once a rule of evidence is set up concerning significance, a nonsignificant result should not be considered important. An increase of hematocrit to optimal levels should be associated with an increased blood volume and hemoglobin concentration.[7 14 23] The increased hematocrit could then help

TABLE 2.—*Split Plot ANOVA with diet as the main plot; Pre-post measure as the split plot.*

Analysis of variance	DF	Mean square	F
For K^+ mEq/L			
Diet	2	.054	N.S.
Error A	15	.108	
Pre-post measure	1	.188	5.909*
Diet x pre post measure	2	.048	N.S.
Residual	15	.032	
Corrected total	35	.071	
For Hgb gm			
Diet	2	.093	N.S.
Error A	15	.573	
Pre-post measure	1	1.562	7.560*
Diet x pre post measure	2	.070	N.S.
Residual	15	.208	
Corrected total	35	.435	
For Hct %			
Diet	2	1.897	N.S.
Error A	15	5.436	
Pre-post measure	1	5.290	4.514 N.S.
Diet x pre-post measure	2	.041	N.S.
Residual	15	1.172	
Corrected total	35	3.094	
For average velocity yds/sec			
Diet	2	.080	N.S.
Error A	15	.752	
Pre-post measure	1	1.000	75.000**
Diet x pre post measure	2	.010	N.S.
Residual	15	.013	
Corrected total	35	.362	

*$P_{.05}$ 4.45 C 1 and 15 df.
**$P_{.01}$ 6.20 C 1 and 15 df.

TABLE 3.—*A summary of data for diet, blood, and performance measures.*

Diet	Pre-post Measure	No.	Mean velocity (V̄) yds/sec	SD	K+ 3.3-5.5 mEq/L	SD	Hgb 14-18 gm	SD	Hct 41-42 %	SD
Pollen	Pre	6	4.700	.548	4.150	.234	13.233	.156	38.817	.987
	Post	6	5.067	.625	4.150	.485	13.783	.999	39.700	2.559
Placebo	Pre	6	4.650	.653	4.250	.234	13.367	.216	38.700	1.410
	Post	6	4.917	.725	4.050	.152	13.617	.426	39.350	1.249
Protein	Pre	6	4.767	.532	4.150	.197	13.750	.720	39.417	2.278
	Post	6	5.133	.609	3.917	.117	14.200	.576	40.183	1.888
Pre-post measure										
	Pre	18	4.706	.517	4.183	.209	13.450	.528	38.978	1.537
	Post	18	5.039	.605	4.039	.291	13.867	.693	39.744	1.833
Diet										
	Pollen	12	4.883	.567	4.150	.348	13.508	.776	39.258	1.824
	Placebo	12	4.793	.644	4.150	.206	13.491	.333	39.025	1.258
	Protein	12	4.950	.553	4.033	.188	13.975	.636	39.800	1.948
Overall means		36	4.872	.593	4.111	.263	13.658	.650	39.361	1.734

oxygen transport, and it is unlikely that any slight increase in blood viscosity would place any restriction on the efforts of cardiac output to assist oxygen uptake capabilities. Conversely, the combination of continued lysis of red blood cells due to vigorous exercise in any individual over a long period of time, even with a normal diet, could be reflected in decreased hemoglobin and hematocrit levels. An examination of Table 3 reveals, with the exception of the post mean values for the protein supplement diet, Hgb and Hct values remained slightly below normal levels. Whether this suggests that teen-age athletes may need to add protein or iron bearing foods to their normal diet is problematical since the study found similar values in subjects who did and did not use the protein supplement.

Summary

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The effect of pollen and protein extracts on selected blood factors and performance of athletes.

Volunteer (18) male high school cross country runners were randomly subdivided into three diet groups for a twelve week, placebo, double blind design, nutrition-performance experiment. Diets 1, 2, and 3 supplemented normal diets with daily ingestion of four pollen extract, four placebo, and four protein extract capsules respectively. Blood samples drawn from each individual before and after the experiment were analyzed for serum K, Hgb, and Hc levels. The mean velocity of a pre and post three mile run conducted on the same course was the performance measure. An ANOVA, with diet and pre and post measures as the main and split plot respectively, found no significant differences among the diet groups in blood levels of K, Hgb, and Hct. Significant pre and post differences were found in blood levels of K and Hgb. Pre versus post for performance was highly significant. The analysis to compare diets for differences in performance was nonsignficant, and diet x pre-post measure interaction was nonsignificant for all variables. The findings failed to uncover any advantage in taking pollen or protein extracts for improvement or maintenance of K, Hct, and Hgb blood levels or improvement in performance.

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