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The Effect of Multivitamin-Trace Mineral versus Placebo Supplementation upon the Height-Weight Ratio (Ponderal Index)

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Summary: Two hundred forty-six presumably healthy soldiers participated in a study designed to measure the effect of a multivitamin-trace mineral versus placebo supplement upon the height-weight ratio (ponderal index) and weight per se. Weight and height were determined initially and 24 weeks later following a military training program. One hundred twenty-three subjects received a daily placebo supplement. Another 123 participants (matched by ponderal index initially with the placebo group) were supplied a daily multivitamin-trace mineral capsule indistinguishable from the placebo. For the entire sample given the placebo, there was a statistically significant increase in ponderal index (decrease in weight). For the total group given the multivitamin-trace mineral additive, there was also a statistically significant increase in ponderal index (decrease in weight). However, the change in the multivitamin-trace mineral group was statistically significantly greater than in the placebo group.

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Introduction

The literature is replete with evidence suggesting that overweight is a common problem [1, 3]. With regard to dietotherapy, principal attention has been directed to calories and fat intake and, more recently, carbohydrate consumption. As far as can be determined from a literature search, there are no controlled studies demonstrating the possible effects of vitamins and trace minerals upon weight.

The purpose of this report is to analyze, in a double-blind system, the effect of multivitamin-trace mineral supplements upon weight in terms of height. Specifically, this report is designed to resolve *three* questions: 1. What is the effect of multivitamin-trace mineral versus placebo supplementation upon the height-weight ratio (ponderal index)? 2. Does the initial height-weight ratio (ponderal index) alter the results? 3. What is the significance of the findings in terms of weight irrespective of height?

Method of Investigation

The participants in this study were students in Officer Candidate Companies (90th and 91st) at Fort Benning, Georgia. The observations described in this report were made on the 432 students beginning with the inception of training (on 28 January 1967 for Class 40-67 and on 4 February 1967 for Class 42-67) and continued for 24 consecutive weeks to its termination and graduation.

Upon admission to the training program, each student's height and weight were determined. Immediately thereafter, the group was randomly subdivided. One subgroup received a placebo supplement throughout the training period; the other group was administered an indistinguishable multivitamin-trace mineral preparation (Table 1). At the termination of the program, height and weight were again recorded.

Tab. 1: Multivitamin-trace mineral supplement

Vitamin A	7.5 mg (25 000 units)
Vitamin D	10 mcg (400 units)
Thiamine hydrochloride	10 mg
Riboflavin	5 mg
Niacinamide	100 mg
Pyridoxine hydrochloride	5 mg
Cobalamine (vitamin B ₁₂)	6 mcg
Calcium pantothenate	20 mg
Ascorbic acid	200 mg
Iron (as sulfate)	10 mg
Copper (as sulfate)	1 mg
Iodine (as calcium iodate)	0.15 mg
Manganese (as sulfate)	1 mg
Magnesium (as oxide)	5 mg
Zinc (as sulfate)	1.5 mg

By means of a formula (height divided by the cube root of the weight, the ponderal index can be derived. The utility of this instrument has already been described [2].

For purposes of this study, it was possible to match according to *initial* ponderal index 123 subjects receiving placebo supplementation and an equal number administered the multivitamin-trace mineral preparation. Hence, this report deals with 246 members in the 24-week training program.

Results

Question One: Table 2 shows the two subgroups (placebo versus multivitamin-trace mineral), the sample sizes, the initial and final mean ponderal indices and the standard deviations, the mean percentage changes in ponderal index during the training program, the t and P values. Four points warrant emphasis concern

Tab. 2: Effect of multivitamin versus placebo supplementation upon ponderal index

Initial groups	Sample size	Initial PI	Final PI	% change	t	P
Entire sample						
Placebo	123	12.75 ± 0.38	12.79 ± 0.36	+0.3	2.495	<0.050*
Multivitamin-trace mineral .	123	12.75 ± 0.38	12.83 ± 0.37	+0.6	5.553	<0.001*
PI <12.7						
Placebo	46	12.39 ± 0.21	12.46 ± 0.21	+0.6	3.309	<0.005*
Multivitamin-trace mineral .	46	12.39 ± 0.21	12.49 ± 0.24	+0.8	6.134	<0.001*
PI 12.7+						
Placebo	77	12.97 ± 0.28	12.98 ± 0.29	+0.1	0.575	>0.500
Multivitamin-trace mineral .	77	12.97 ± 0.28	13.02 ± 0.28	+0.4	2.927	<0.005*

* Statistically significant difference of the means

ning the entire placebo sample. First, it is obvious that the mean ponderal index, for the entire sample, in the two groups initially is precisely the same. Second, it is clear that the ponderal index rose from 12.75 to 12.79 during the training period in the placebo supplemented group. Third, this suggests an increase in the ponderal index of 0.3 per cent which means an overall weight loss. Fourth, the statistical significance of these findings is shown by a t value = 2.495 which is significant at the 5 per cent confidence level. Thus, it would appear that, with placebo supplementation during training, there is weight loss in terms of height on a mean basis in this group of presumably healthy young men.

Two points deserve special consideration for the therapeutic group. First, an examination of the multivitamin-trace mineral group indicates that there is an increase in the ponderal index (12.75 to 12.83) with a mean percentage rise of 0.6.

Thus, there is also in this group a decrease in weight in terms of height as judged by this change. Second, the fact that this difference is statistically significant is underlined by the $t = 5.553$ and a $P < 0.001$. Hence, in answer to the first question, there is also a statistically significant increase in ponderal index (suggesting a decrease in weight in the light of height) in the group of subjects supplied with the multivitamin-trace mineral preparation.

Question Two: An examination of the raw data indicates very clearly that not all subjects increased in ponderal index. Hence, it was felt wise to reexamine the data in terms of the initial ponderal index. In other words, the question should be asked whether the observations noted in the entire group hold true for those students with high versus relatively low ponderal indices. Table 2 provides the answer to that question. It will be noted that, in the relatively heavy subjects as judged by a ponderal index less than 12.7, there is a statistically significant increase in ponderal index in both groups. In contrast, in the relatively lighter subjects characterized by a ponderal index of 12.7+, there is only a statistically significant increase in the group treated with the multivitamin-trace mineral supplement. Hence, in answer to the second question, in relatively heavy subjects, the ponderal index increases irrespective of the supplement. However, in the relatively lighter subjects, the increase of the ponderal index occurs only following multivitamin-trace mineral supplementation.

Question Three: The final problem to be resolved is whether the changes previously reported in ponderal index can also be reflected in weight change irrespective of height. Table 3 summarizes the data regarding the effect of placebo versus multivitamin-trace mineral supplementation upon weight. It will be noted that, for the entire sample, there is a statistically significant reduction in weight of approximately 0.6 per cent in the placebo group (mean = one pound loss) and 1.2 per cent (mean = two pounds loss) in the multivitamin-trace mineral category. Attention is directed to the fact that the changes are statistically significant in both groups. Mention should also be made that the change with the multivitamin-trace mineral is double that observed with the placebo. It will be further noted in Table 3 that the difference with regard to weight in the subgroups is essentially that described for the ponderal index. Specifically, in the heavier subjects, there is a statistically significant reduction of weight of 1.7 and 2.2 per cent in the placebo and multivitamin-trace mineral groups, respectively. In contrast, in the lighter subjects, there is no weight change with the placebo and a reduction of 1.2 per cent with the multivitamin-trace mineral supplement. Hence, in answer to the third question, the observations reported for ponderal index are very similar to those observed with weight.

Tab. 3: Effect of multivitamin versus placebo supplementation upon weight

Initial groups	Sample size	Initial weight	Final weight	% change	t	P
Entire sample						
Placebo	123	171 ± 19	170 ± 17	-0.6	3.060	<0.005*
Multivitamin-trace mineral .	123	173 ± 18	171 ± 17	-1.2	5.704	<0.001*
PI <12.7						
Placebo	46	179 ± 20	176 ± 18	-1.7	3.360	<0.005*
Multivitamin-trace mineral .	46	181 ± 19	177 ± 17	-2.2	5.628	<0.001*
PI 12.7+						
Placebo	77	166 ± 17	166 ± 16	0.0	1.040	>0.200
Multivitamin-trace mineral .	77	169 ± 17	167 ± 15	-1.2	3.085	<0.005*

* Statistically significant difference of the means

Discussion

As far as can be determined, this study is the first attempt to analyze the effect of multivitamin-trace mineral versus placebo supplementation upon weight per se and weight in terms of height (ponderal index).

The evidence indicates that, for the entire samples, there is a statistically significant increase in ponderal index suggesting weight loss during the training period. This is further corroborated by weight measurement irrespective of height.

The fact that weight was lost with placebo supplementation indicates an effective variable in the training environment (*e. g.*, exercise). The point now to be resolved is whether the multivitamin-trace mineral exerts an additional effect over and above that shown with the placebo. Table 4 shows, for the entire samples, that there is indeed a statistically significant difference in the ponderal index between the two groups. In other words, the greater increase in the ponderal index in the multivitamin-trace mineral group suggests that the supplement exerts an effect over and above the ponderal index group in the placebo group.

The additional point should be made that the observations with ponderal index (height-weight) do not obtain when weight is considered alone (Table 4). In other words, the different effect of the multivitamin-trace mineral versus placebo is only evident when weight change is viewed in terms of height.

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Tab. 4

Initial groups	Sample size	Mean percentage change ponderal index	t	P
Entire sample				
Placebo group	123	+0.3	2.257	<0.05*
Multivitamin-trace mineral group	123	+0.6		
Initial groups	Sample size	Mean percentage change weight	t	P
Entire sample				
Placebo group	123	-0.6	1.812	>0.050
Multivitamin-trace mineral group	123	-1.2		

* Statistically significant difference.

References

1. MAYER, J.: Overweight: causes, cost and control. Englewood Cliffs, Prentice-Hall, Inc. (1968).
2. SELTZER, C. C.: New England J. Med. 274, 254 (1966).
3. WYDEN, P.: The overweight society. William Morrow and Company, New York (1965).

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