Summary of Bioavailability Study Results Comparing Foodform® Vitamins and Minerals with Ordinary (USP and FCC) Vitamins and Minerals

By IntraCell Nutrition Inc.

USP (and FCC) vitamins and minerals are the free-state chemicals used by vitamin companies to make supplements. USP vitamins and minerals are synthesized by a handful of pharmaceutical companies (Roche, Kodak, Takeda etc.) according to strict federal standards known as the USP (United States Pharmacopoeia) and the FCC (Food Chemicals Codex). Vitamin companies purchase these materials in bulk, blend them together into formulations, make tablets, capsules or powders, and market them under hundreds of brand names. They are also added to flour, breakfast cereals and other prepared foods. The vitamins sold as “natural” or “natural source” or “food based” in the health food store are the same USP (and FCC) vitamins and minerals sold in the drug store or supermarket. Only the labels are different. Supplements formulated with these free-state chemicals and mineral salts may be poorly utilized by the body. They are frequently misused and abused by a confused public. Excesses and therapeutic doses can cause toxic side effects and metabolic imbalances. Studies indicate that Foodform® Vitamins and Minerals, an alternative to USP and FCC vitamins and minerals, may provide a more natural form, lower toxicity and greater utilization.

VITAMINS AND MINERALS IN FOOD ARE NOT ISOLATED CHEMICALS

There is strong evidence that, in food, vitamins and minerals are not in a free state (isolated). They are bound up in highly-complex, macro-molecular structures of proteins, carbohydrates, lipids and other food factors—the “food matrix.” Abram Hoffer, M.D., Ph.D., wrote “Components [of food] do not exist free in nature; nature does not lay down pure protein, pure fat or pure carbohydrate. Their molecules are interlaced in a very complex three dimensional structure which even now has not been fully described. Intermingled are the essential nutrients such as vitamins and minerals, again not free, but combined in complex molecules.”

TAKING A NEW LOOK AT THE DIGESTION OF FOOD

Among scientists, it is commonly believed that, during digestion, food is completely broken down. This theory holds that, as part of the digestive process, vitamins and minerals become isolated from the food matrix prior to absorption and then somehow become re-combined into the highly complex structures utilized by the body.

The research team that developed Foodform® vitamins and minerals did not accept the common belief that vitamins and minerals are completely broken off from the food matrix during digestion. This was because their experience in isolating constituents of plants in order to assay them made it abundantly clear that plants do not break apart easily, as evidenced by the steps (e.g., application of heat and acids) necessary to break them apart. It seemed unlikely, therefore, in the conditions of the stomach (temperature, acidity etc.) that vitamins and minerals could be completely broken away from the substances in the food matrix.

Perhaps the substances in the food matrix to which vitamins and minerals are bound, or with which they are associated, work with them in some way to help them perform their functions more efficiently. Since humans evolved on foods, not on free-state chemicals, it seems reasonable to conclude that it is the larger, more complex structures containing the nutrient, rather than the isolated nutrient, that the body wants.

It is important to remember that USP vitamins were originally developed to be used as drugs, to treat symptoms of nutritional deficiency diseases. But what if it were possible to develop nutrients which would provide the body with the concentrated nourishment it needs to help prevent susceptibility to disease...as a healthy food would do? This line of reasoning was the theoretical basis for the development of Foodform® Vitamins and Minerals.

Therefore, while most scientists and chemists start with foods and then isolate away...
the desired nutrient or constituent from the food matrix so an analog of it can be synthesized, the decision was made to start with the isolated or synthesized nutrient and try to develop a method to put it back into the food matrix (containing proteins, lipids, carbohydrates and bioflavonoids).

THE MANUFACTURING PROCESS FOR FOODFORM® VITAMINS AND MINERALS

After several years of research and development, two proprietary processes were developed with the intention of converting the commercially available USP and FCC isolates into a more natural form. One process is for vitamins (except vitamin D-3) and the other process is for minerals and vitamin D-3.

Foodform® Vitamins are produced by combining free-state USP and FCC vitamins with active vegetable and yeast concentrates, under specific conditions, providing them an opportunity to react with the constituents of the food matrix. The concentrate must have a natural “affinity” for the vitamin being processed (citrus with vitamin C, alfalfa with vitamin K, carrot with vitamin A and Beta Carotene, etc.). The vitamin is then spray dried and assayed for potency. If resulting batches have varying potencies, they are blended together to arrive at a standard potency.

The process for Foodform® Minerals and Foodform® Vitamin D-3 uses a process of growing the mineral in active yeast. Saccharomyces cerevisiae (baker’s yeast) is added to water and cultured. The mineral (or vitamin D-3) is fed to the active, growing yeast. After a period of growth and digestion, proteolytic enzymes are added to break the cell walls of the yeast. In the case of certain minerals the insoluble cell walls are removed. The finished product is spray dried and assayed for potency. All finished batches, with various resulting potencies, are blended to arrive at a standard potency.

As part of a rigid quality control program, detailed microbiological tests are performed on each batch of Foodform® Vitamins and Minerals to insure purity.

PRODUCTS CONTAINING USP VITAMINS AND MINERALS BLENDED WITH NATURAL BASES

In health food stores, supplements are often sold which contain USP vitamins and minerals blended with bee pollen, spirulina, herbs, rice and other foods, and labeled “food based”, “whole food vitamins”, “whole food concentrates”, “complete nutritional systems”, “vitamins with whole food concentrates”, “rose hips vitamin C”, B vitamins “fortified” with yeast, etc.

These are not the same as Foodform® vitamins and minerals. Simply mixing USP vitamins and minerals with food bases in a blender does not change them from being free-state USP vitamins and mineral salts. The body is not fooled.

ARE FOODFORM® VITAMINS AND MINERALS BOUND?

It is our opinion that the proprietary processes used to produce FOODFORM® nutrients result in vitamins and minerals which have become bound or associated in some way to constituents of the food matrix. However, this is difficult to prove to a scientific certainty.

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THE USE OF ANIMAL STUDIES HAS BEEN ELIMINATED

During the past twelve years, independent researchers have performed both human and animal studies on Foodform® raw material ingredients. This was, and still is the customary scientific procedure for doing studies and is also often required by the FDA, with regard to toxicity studies, in order to insure the public safety.

In recent years, out of respect for the rights of the animal subjects, there has been a growing movement away from animal testing. IntraCell Nutrition fully supports this more compassionate view. Therefore our current policy is not to utilize animals for any future testing.

The results of some of the studies done in the past have been published recently, and more may be published in the future in order to make this data available for evaluation by the scientific community. However, there has not been any funding of new animal studies on Foodform® vitamins and minerals during the past several years.

CONCLUSIONS

These studies may not conform to peer review standards. Therefore, the results are not conclusive. The studies indicate there may be overall increased absorption and retention of Foodform® Vitamins and Minerals. Foodform® Trace Minerals also showed decreased toxicity.

A report on these studies, A New Nutrient Bio-Availability Innovation by HealthComm, Inc., directed by Jeffrey S. Bland, Ph.D., concludes that this animal and human research indicates Foodform® vitamins and minerals “...may represent a significant improvement in bioavailability and tissue retention of specific nutrients.
The clinical implication of these observations could be of significance in facilitating proper nutrient utilization in individuals who suffer from a variety of nutrient malabsorption problems or who require optimal potentiation or nutrient availability. We believe this biological study research is an exciting beginning. As time goes on we hope to have larger studies performed to yield results which are of greater statistical significance.

SUMMARY OF STUDY RESULTS

The following is a summary of the results (protocols available) of some of the many individual vitamin and mineral studies on human and animal subjects. Also presented are the results of a multiple vitamin/mineral growth study on weanling animals.

The term “absorption” refers to the relative increase over baseline in the amount of the vitamin or mineral in the blood. The term “retention” refers to the relative increase in the amount stored in the liver.

The graphs of the results of the studies performed at University of Scranton by Dr. Joe A. Vinson et al. show the data, as provided by the researchers, which indicates comparative levels by assigning the USP group an arbitrary value of 100% bioavailability and plotting the Foodform® group’s relative level.

The graphs of the results of the studies performed at New Jersey College of Medicine and Dentistry by Dr. Herman Baker and Dr. Oscar Frank show the data, as provided by the researchers, which plots the mean Δ% increase over base line of the vitamin in the blood, for Foodform® and USP, at various times over a 24 hour period.

The reference for each study is given on pages 6 and 7 at the end of this bulletin. Also shown is information pertaining to where many of the studies have been presented and/or published.

The list of references also includes physiological studies performed at University of Scranton. These studies were performed in the interest of scientific curiosity and to investigate the physiological utilization of Foodform® nutrients.

We are proud that some of these physiological studies have been published in prestigious, peer-review journals such as Diabetes (the journal of the American Diabetes Association) and The American Journal of Clinical Nutrition.

No drug claims are made or implied on our products.

MULTIVITAMIN–MULTIMINERAL BIOAVAILABILITY STUDY

Baby Animal Growth Study, (Fig. 2):
Foodform® group showed significant weight gain reflecting normal, healthy growth of baby animals. The USP group showed growth well below the weight accompanying normal, healthy growth levels.

FOODFORM® VITAMIN A

Animal Study, (Fig. 3):
1.54 times more absorbed into blood than USP
Animal Blood Toxicity Study:
Both Foodform® and USP showed depressed values of parameters indicating toxicity. However, the Foodform® group had slightly less depressed values than USP, implying less toxicity for Foodform® Vitamin A.

Human Study,:
2.58 times more absorbed into blood than USP after 2 hours

FOODFORM® VITAMIN B-1

Animal Study, (Fig. 4, 5):
1.38 times more absorbed into blood than USP
1.27 times more retained in liver than USP

FOODFORM® VITAMIN B-2

Animal Study, (Fig. 6, 7):
1.49 times more absorbed into blood than USP
1.92 times more retained in liver than USP
Human Study, (Fig. 8):
1.76 times more absorbed into blood than USP after 2 hours,
1.70 times more after 4 hours, 1.76 times more after 8 hours

FOODFORM® VITAMIN B-6

Animal Study, (Fig. 9, 10):
2.54 times more absorbed into blood than USP
1.56 times more retained in liver than USP
Human Study, (Fig. 11):
1.29 times more absorbed into blood than USP after 2 hrs, 1.35 times more after 4 hrs
FOODFORM® VITAMIN B-12
Animal Study 22 (Fig 12, 13):
2.56 times more absorbed into blood than USP
1.59 times more retained in liver than USP
Human Study 21 (Fig 14):
1.90 times more absorbed into blood than USP
after 2 hrs, 1.66 times more after 24 hrs

FOODFORM® NIACINAMIDE
Animal Study 11 (Fig 12, 13):
3.94 times more absorbed into blood than USP
1.7 times more retained in liver than USP

FOODFORM® PANTOTHENIC ACID
Human Study 16 (Fig 17):
1.38 times more absorbed into blood than USP after 4 hrs,
1.57 times more after 8 hrs

FOODFORM® FOLIC ACID
Animal Study 10 (Fig 18, 19):
1.07 times more absorbed into blood than USP
2.13 times more retained in liver than USP

FOODFORM® BIOTIN
Human Study 15 (Fig 20):
1.06 times more absorbed into blood than USP after 4 hrs,
1.19 times more after 8 hrs

FOODFORM® VITAMIN C
Animal—Short Term Study 19 (Fig 21):
1.48 times more absorbed into blood than USP
Animal—Long Term Study 18 (Fig 22):
1.33 times more absorbed into blood than USP
Human Study 14 (Fig 23, 24):
1.35 times more absorbed into blood than USP
Human Study 13 (Fig 25):
1.55 times more absorbed into blood than USP
1.74 times more absorbed into red blood cells than USP
Human Study 12 (Fig 26):
5.01 times more absorbed into blood than USP after
2 hours, 5.86 times more after 4 hrs, 7.88 times more after 8 hrs, 18.37 times more after 12 hrs

FOODFORM® VITAMIN D-3
Analytical Study 13:
It was found that Foodform® Vitamin D-3 contains
significant amounts of vitamin D metabolites—the active
pro-hormone (25-hydroxy D-2 and D-3) and the active
hormone (1, 25-dihydroxy D-2 and D-3)
**FOODFORM® VITAMIN E**
Animal Study 23 (Fig. 26):
- 2.6 times more retained in liver than d alpha tocopheryl acid succinate

Human Study 24:
- 7.04 times more absorbed into blood than USP after 2 hours

**FOODFORM® CALCIUM**
Human Study 25 (Fig. 27):
- 2.97 times more bioavailable than calcium gluconate, 8.79 times more than calcium carbonate

Human Study 26:
- 3.18 times more bioavailable than calcium gluconate

**FOODFORM® MAGNESIUM**
Human Excretion Study 27:
- 1.83 times more excreted than magnesium oxide, 1.45 times more than amino acid chelate, 2.08 times more than magnesium glycinate

**FOODFORM® IRON**
Animal Study 28 (Fig. 28):
- 1.01 times more absorbed into blood than ferrous sulfate, 1.77 times more than amino acid chelate
- 1.21 times more retained in liver than ferrous sulfate, 1.68 times more than amino acid chelate

**FOODFORM® COPPER**
Animal Study 29 (Fig. 29):
- 1.29 times more absorbed into blood than copper sulfate, 1.42 times more than copper gluconate
- 1.85 times more retained in liver than copper sulfate, 1.42 times more than copper gluconate

Human Study 30:
- 1.44 times more absorbed into blood than copper sulfate, 1.43 times more than copper gluconate

**FOODFORM® MANGANESE**
Animal Study 31 (Fig. 30):
- 1.56 times more absorbed into blood than manganese sulfate
- 1.63 times more retained in liver than manganese sulfate

**FOODFORM® ZINC**
Animal Study 32 (Fig. 31):
- 1.72 times more absorbed into blood than zinc sulfate, 1.71 times more than amino acid chelate
- 1.87 times more retained in liver than zinc sulfate, 1.45 times more than amino acid chelate

Animal Study 33 (Fig. 32):
- 6.46 times more absorbed into blood than zinc gluconate, 3.11 times more than zinc orotate
- 3.68 times more retained in liver than zinc gluconate, 1.50 times more than zinc orotate

Human Study 34:
- 1.75 times more absorbed into blood than zinc sulfate, 1.58 times more than zinc gluconate
FOODFORM® MOLYBDENUM
Animal Study (Fig. 33):
6.28 times more absorbed into blood than ammonium molybdate
16.49 times more retained in liver than ammonium molybdate

FOODFORM® GTF CHROMIUM
Animal Toxicity Study:
FOODFORM® GTF Chromium was found to be virtually non-toxic,
whereas inorganic chromium is highly toxic (see Merck Index) plus it may be
against the Delaney Clause as it has been found to cause cancer in animals.

Human Studies:
Two published human studies indicate that the GTF Complex may be present
in highly significant amounts.

FOODFORM® SELENIUM
Animal Study (Fig. 34):
1.22 times more absorbed into blood than sodium selenite
2.26 times more retained in liver than sodium selenite
Animal Toxicity Study:
Foodform Selenium was approximately 3 times less toxic than sodium selenite.
Sodium selenite is approximately 8 times more toxic when based on the Merck Index.

Human Study:
1.22 times more absorbed into blood than sodium selenite

FOODFORM® VANADIUM
Animal Toxicity Study:
Foodform Vanadium had low toxicity,
similar to inorganic vanadium pentoxide.

FOODFORM® GERMANIUM
Animal Study (Fig. 35):
2.88 times more retained than germanium oxide,
5.30 times more than germanium sesquioxide

Fig 33.
Fig 34.
Fig 35.

REFERENCES
   - published in HEALTH WORLD, Vol 2, No 4
3. Joe A. Vinson, Ph.D., "Comparison of the Bioavailability of Combination Vitamin and Mineral Supplements",
   University of Scranton, Scranton, PA.
4. Joe A. Vinson, Ph.D., "Vitamin A Toxicity Study", University of Scranton, Scranton, PA.
5. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Vitamin A, College of Medicine and Dentistry of New Jersey, Newark, NJ.
6. Joe A. Vinson, Ph.D., "Bio-Availability of Vitamin B-1", University of Scranton, Scranton, PA.
7. Joe A. Vinson, Ph.D., "Comparative Riboflavin Bioavailability Study", University of Scranton, Scranton, PA.
8. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Vitamin B-2, College of Medicine and Dentistry of New Jersey, Newark, NJ.
10. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Vitamin B-6, College of Medicine and Dentistry of New Jersey, Newark, NJ.
11. Joe A. Vinson, Ph.D., "Bio-Availability of Vitamin B-12", University of Scranton, Scranton, PA.
12. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Vitamin B-12, College of Medicine and Dentistry of New Jersey, Newark, NJ.
14. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Pantothenic Acid, College of Medicine and Dentistry of New Jersey, Newark, NJ.
15. Joe A. Vinson, Ph.D., "Bio-Availability of Folic Acid", University of Scranton, Scranton, PA.
16. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Biotin, College of Medicine and Dentistry of New Jersey, Newark, NJ.
17. Joe A. Vinson, Ph.D., "Short-Term Bio-Availability of Various Forms of Vitamin C", University of Scranton, Scranton, PA.
18. Joe A. Vinson, Ph.D., "Comparative Bioavailability of Synthetic and Natural Vitamin C in Guinea Pigs.
19. Joe A. Vinson, Ph.D., "Comparative Bioavailability of Synthetic and Natural Vitamin C in Humans", University of Scranton, Scranton, PA.
20. Joe A. Vinson, Ph.D., "Human Supplementation with Different Forms of Vitamin C", University of Scranton, Scranton, PA.
21. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Vitamin C, College of Medicine and Dentistry of New Jersey, Newark, NJ.
23. Joe A. Vinson, Ph.D., "Bio-Availability of Vitamin E", University of Scranton, Scranton, PA.
24. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Vitamin E, College of Medicine and Dentistry of New Jersey, Newark, NJ.
25. Joe A. Vinson, Ph.D., “Comparison of Calcium Absorption”, University of Scranton, Scranton, PA.
26. Joe A. Vinson, Ph.D., “Comparison of Different Forms of Calcium on Blood Pressure of Normotensive Young Males”, University of Scranton, Scranton, PA.
27. Joe A. Vinson, Ph.D., “Comparison of the Absorption of Different Forms of Magnesium”, University of Scranton, Scranton, PA.
30. Joe A. Vinson, Ph.D., “Comparative Human Bioavailability of Copper”, University of Scranton, Scranton, PA.
33. Joe A. Vinson, Ph.D., “Rad Zinc Bioavailability Study”, University of Scranton, Scranton, PA.
34. Joe A. Vinson, Ph.D., “Comparative Human Bioavailability of Zinc”, University of Scranton, Scranton, PA.
36. Joe A. Vinson, Ph.D., “Chromium Toxicity Study”, University of Scranton, Scranton, PA.
presented at Trace Elements '80, International conference Helsinki, Finland, December 1980.
presented at School of Pharmacy of the University of Paris, January 1980.
presented at Hospital of the University of Reims, Reims, France, published, New York, 1981.
presented at School of Pharmacy of the University of Antwerp, Antwerp, Belgium, February 1982.
presented at International Symposium on Lipid Metabolism, Brugge, Belgium, October 1981.
presented at School of Nutrition, University of Nancy, Nancy, France, March 1982.
presented at The Royal Pharmaceutical Society of Madrid, Madrid, Spain, April 1982.
-published in Symposium on Selenium in Biology and Medicine, Beijing, China, June 1984, under the title “Relative Bioavailability of Inorganic and Natural Selenium.”
41. Joe A. Vinson, Ph.D., “Relative Human Bioavailability of Sodium Selenite and High Selenium Yeast”, University of Scranton, Scranton, PA.
presented at Fourth International Symposium on Selenium in Biology and Medicine, Tubingen, West Germany, July 1988.
42. Joe A. Vinson, Ph.D., “Vanadium Toxicity Study”, University of Scranton, Scranton, PA.
ADDITIONAL STUDIES AND PAPERS ON FOODFORM® VITAMINS AND MINERALS
44. Joe A. Vinson, Ph.D., “Vitamin A Skin Absorption Study”, University of Scranton, Scranton, PA.
45. Joe A. Vinson, Ph.D., “Human Supplementation with Antioxidents”, University of Scranton, Scranton, PA.
published in Medical Science Research, 1992, No. 20, pgs. 145-146.
presented at Hospital Widal, Paris, France, June 15, 1989, under the title “Reduction of Lipid Peroxides by Vitamins in Vitro and In Vivo in Man.”
46. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Vitamin B-1, College of Medicine and Dentistry of New Jersey, Newark, NJ. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Nicotinamide, College of Medicine and Dentistry of New Jersey, Newark, NJ. Drs. Herman Baker and Oscar Frank, Human Absorption Study on Folic Acid, College of Medicine and Dentistry of New Jersey, Newark, NJ.
47. Joe A. Vinson, Ph.D., “Comparison of Natural and Synthetic Vitamin C on the Formation of Sugar Caractacs”, University of Scranton, Scranton, PA.
presented at the Department of Ophthalmology, Capital Hospital, Beijing, China, June 1984.
presented at Symposium on Biological Sciences, University of East Anglia, Norwich, England, August 1988, titled “The Effect of Synthetic and Natural Vitamin C on Caractacs and Diabetes in Animals and Man.”
50. Joe A. Vinson, Ph.D., “In Vitro and In Vivo Reduction of Epithelial Oxidation by Ascorbic Acid”, University of Scranton, Scranton, PA.
presented at Department of Biological Sciences, University of East Anglia, Norwich, England, August 1988, titled “The Effect of Synthetic and Natural Vitamin C on Caractacs and Diabetes in Animals and Man.”
-published in Symposium on Selenium in Biology and Medicine, Beijing, China, June 1984, under the title “Relative Bioavailability of Inorganic and Natural Selenium.”
presented at Trace Elements '89, Helsinki, Finland, December 1981, titled “Bio-availability of Trace Elements-Comparison of Natural and Synthetic Forms.”
55. Joe A. Vinson, Ph.D., “Mechanism and Effect of Copper Supplementation on Body Lipids”, University of Scranton, Scranton, PA.
presented at International Congress on Diet & Nutrition, Tel Aviv, Israel, February 1983.
presented at Conference on Advanced Glycosylation End Products by Vitamins and Nutrients, National Institute of Health and Medical Technology, National Institute of Health, Beltsville, Maryland, August 1988.
presented at School of Nutrition, University of Nancy, Nancy France, March 1982.
58. Joe A. Vinson, Ph.D., “Effect of Copper Yeast on Adjuvant-Induced Arthritis”, U. of Scranton, Scranton, PA.
59. Joe A. Vinson, Ph.D., “Human Skin Absorption of Copper Yeast”, University of Scranton, Scranton, PA.
60. Joe A. Vinson, Ph.D., “Human Skin Absorption of Zinc Yeast”, University of Scranton, Scranton, PA.
64. Joe A. Vinson, Ph.D., “Lithium Toxicity Study”, University of Scranton, Scranton, PA.
65. Joe A. Vinson, Ph.D., “In Vivo Inhibition of Glycation and Advanced Glycosylation End Products by Vitamins and Nutrients”, University of Scranton, Scranton, PA.