

NATURAL RADIOACTIVE TRACES IN FOOD SUPPLEMENTS (ERGOGENIC) CONSUMED BY THE PUBLIC OF THE ACADEMIES

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ABSTRACT

The radioactive traces in food supplements (ergogenic) consumed mainly by the public of the academies were analyzed from the high-resolution gamma spectrometry. After researching in academies of Londrina-PR and São Paulo-SP about the main supplements used to increase the performance and muscle hypertrophy, it was decided to examine the three higher consumption of supplements, which were: Whey Protein, Albumin and BCAA (Branched-Chain Amino Acids), the last for branched-chain amino acids for athletes. For each of these supplements have been tested three brands that have the largest sales. The measurements were performed at the Laboratory of Environmental Radiometry, of the Radiation Metrology Center located on the Institute of Energy and Nuclear Research (IPEN-SP). The samples were measured by HPGe detector with beryllium window, model GX2520 Xtra, 25% relative efficiency and effective resolution of 1.85 keV for the energy of 1.33 MeV of ⁶⁰Co. The ⁴⁰K showed the highest levels of activity for all samples, ranging between 125 ± 5 and 270.1 ± 9.5 Bq/kg, with the exception of BCAA supplementation, which showed no such radionuclide. The radioactivity present in all analyzed supplement was within the international limits, allowing concluding that consumption of such goods pose no health risk derived from radiation.

1. INTRODUCTION

The aesthetically perfect body search and the healthy body culture absence have led the public to use excessively substances that can enhance, in a short period of time, its physical condition. The foods choice that makes part of the diet of physical activity practitioners and athletes is crucial for maintaining these individuals health. Exercise increases the body's energy demand, since energy corresponds directly to the individual's capacity to perform work [1, 2].

The food supplement presents a considerable consumption, with a major conflict between the proposed benefits and the harm that could be achieved by the indiscriminate use of these substances. According to the Sanitary Surveillance Coordination of the Health Ministry (Brasil, 1998), supplements are just combined or isolated vitamins and minerals (not part carbohydrates, proteins and lipids) and not exceeding 100% of Recommended Daily Intake (RDI) (Ordinance No 33 of January 13, 1998).

It is recommended for active individuals the protein ingestion of 1.2 to 1.4 g/kg.day. Athletes and individuals seeking to muscle hypertrophy have their needs met with the maximum of 1.8 g/kg.day. These needs would be covered, unless in special situations, a balanced diet [3].

There are also scientific studies with consistent information regarding the ergogenic benefits of amino acids such as supplementation, as well as about its possible side effects, present in several brands of supplements available on the market.

Based on the information on dietary supplements and its high rate of consumption, increase the interest in checking the radioactive traces in food supplements (ergogenic) consumed mainly by the public of the academies.

2. METHODOLOGY

The measurements were taken in the Environment Radiometry Laboratory of the Metrology Radiation Center at the Institute of Energy and Nuclear Research (IPEN-SP), using a high resolution gamma-ray spectrometry with a 25% relative efficiency, GX2520 XTRA model, with beryllium window. The effective resolution was of 1.85 keV for the energy of 1.33 MeV of ^{60}Co .

After researching in academies of Londrina-PR, in the main supplements shops for academy of São Paulo-SP and Londrina-PR, and with some physical education teachers about the main supplements used to increase the performance and muscle hypertrophy, it was decided to examine the three higher consumption of supplements, which were: Whey Protein, Albumin and BCAA (Branched-Chain Amino Acids), the last for branched-chain amino acids for athletes. For each of these supplements have been tested three brands that have the largest sales.

The supplement samples were homogenized, transferred into polyethylene bottles of 100 ml and slightly compressed in order to maintain the same density. All samples were prepared in triplicate, sealed and stored for approximately 30 days to ensure radioactive equilibrium in the series of ^{238}U and ^{232}Th . The counting time was 150,000 s.

For the calibration curve in efficiency it was used a standard solution of National Physical Laboratory, in the same samples geometry. This calibration curve was validated both in chemical composition and in density, important parameters for the reliability of results.

Two samples were measured, one sample of spinach (IAEA-330), an intercomparison exercise of the IAEA (International Atomic Energy Agency), a density close to the samples (0.5 to 0.7 g/cm³) and a milk powder (IAEA-321), a reference material from IAEA and base of most of the supplements tested, so similar in composition.

The validation was evaluated according to criteria of acceptability and accuracy of tests relating to international intercomparison between laboratories of the International Atomic Energy Agency for materials certification.

3. RESULTS

The activities for the analyzed brands of “Whey Protein” supplement were presented at the Table 1.

Table 1. Activities (A) and Minimum Detectable Activity (MDA) for the three analyzed brands of Whey Protein supplement.

Isotope	Whey Protein					
	A		B		C	
	A (Bq/kg)	MDA (Bq/kg)	A (Bq/kg)	MDA (Bq/kg)	A (Bq/kg)	MDA (Bq/kg)
⁴⁰ K	264.9 ± 9.5	≤ 21.6	270.1 ± 9.5	≤ 20.2	231 ± 8	≤ 20
²¹⁴ Pb	4 ± 1	≤ 3	3 ± 1	≤ 3		≤ 2.5
²¹⁴ Bi	3 ± 1	≤ 3		≤ 3		≤ 2.5

For all Whey Protein samples, there was only the presence of the ²¹⁴Pb and ²¹⁴Bi of ²²⁶Ra sub-series, in addition to ⁴⁰K. In Table 2 is presented the activities for the considered brands in the “Albumin” supplement.

Table 2. Activities (A) and Minimum Detectable Activity (MDA) for the three analyzed brands of Albumin supplement.

Isotope	Albumin					
	D		E		F	
	A (Bq/kg)	MDA (Bq/kg)	A (Bq/kg)	MDA (Bq/kg)	A (Bq/kg)	MDA (Bq/kg)
⁴⁰ K	226.5 ± 8.1	≤ 18.3	203.2 ± 7.5	≤ 18.6	125 ± 5	≤ 18
²¹⁴ Bi	3 ± 1	≤ 2		≤ 2	4 ± 1	≤ 2

In the Albumin supplement also there is the radionuclide ⁴⁰K. For ²¹⁴Bi, present in two of the three brands tested, the activity became very close to the minimum detectable activity. In Table 3 is presented the activities for the considered brands in the “BCAA” supplement.

Table 3. Activities (A) and Minimum Detectable Activity (MDA) for the three analyzed brands of BCAA supplement.

Isotope	BCAA					
	G		H		I	
	A (Bq/kg)	MDA (Bq/kg)	A (Bq/kg)	MDA (Bq/kg)	A (Bq/kg)	MDA (Bq/kg)
²¹² Pb		≤ 2	1.9 ± 0.4	≤ 1.8		≤ 2
²³⁴ Th		≤ 7	10 ± 3	≤ 6		≤ 8

The BCAA supplement showed the ²³⁴Th, line of the ²³⁸U, and the ²¹²Pb of the ²²⁸Th sub-series, with activity above the minimum detectable activity, both for only one of the analyzed brands.

Whey Protein is what presented the highest levels of ⁴⁰K, for all brands tested. For albumin, only the mark F showed a slightly lower activity, with 125 ± 5 Bq/kg compared with other samples. There was no activity for the ⁴⁰K above the MDA for the BCAA supplement.

In Table 4 is presented the results for samples that showed activity above the MDA, by natural series. The activities results for ²²⁶Ra sub-series were taken from the weighted average activities of radionuclides ²¹⁴Pb e ²¹⁴Bi, and for ²³⁸U, from the ²³⁴Th line. From ²¹²Pb it was estimated the ²²⁸Th activity, sub-series of ²³²Th.

Table 4. Median activities (Bq/kg), by series.

Sample	Series	
	²³⁸ U (²²⁶ Ra)	²³² Th (²²⁸ Th)
A	4 ± 1	
B	3 ± 1	
D	3 ± 1	
F	4 ± 1	
H	* 10 ± 3	1.9 ± 0.4

* ²³⁴Th line

4. CONCLUSIONS

It was observed that the minimum detectable activities (MDA) were very similar for radionuclide, when comparing the three brands of each supplement analysis.

The ⁴⁰K showed the higher levels of activity for all samples, ranging between 125 ± 5 and 270.1 ± 9.5 Bq/kg, with the exception of BCAA supplement absent from it. These results were expected, taking into account the composition of the samples, rich in

potassium. This fact was also verified in milk powder in the work [4], with activities between 43 and 474 Bq/kg in a decade of measurements.

The radioactivity present in all analyzed supplement was within the international limits, allowing concluding that consumption of such goods offers no health risk derived from radiation.

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