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Human placenta processed for encapsulation contains modest concentrations of 14 trace minerals and elements

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ABSTRACT

Maternal placentophagy has recently emerged as a rare but increasingly popular practice among women in industrialized countries who often ingest the placenta as a processed, encapsulated supplement, seeking its many purported postpartum health benefits. Little scientific research, however, has evaluated these claims, and concentrations of trace micronutrients/elements in encapsulated placenta have never been examined. Because the placenta retains beneficial micronutrients and potentially harmful toxic elements at parturition, we hypothesized that dehydrated placenta would contain detectable concentrations of these elements. To address this hypothesis, we analyzed 28 placenta samples processed for encapsulation to evaluate the concentration of 14 trace minerals/elements using inductively coupled plasma mass spectrometry. Analysis revealed detectable concentrations of arsenic, cadmium, cobalt, copper, iron, lead, manganese, mercury, molybdenum, rubidium, selenium, strontium, uranium, and zinc. Based on one recommended daily intake of placenta capsules (3300 mg/d), a daily dose of placenta supplements contains approximately 0.018 ± 0.004 mg copper, 2.19 ± 0.533 mg iron, 0.005 ± 0.000 mg selenium, and 0.180 ± 0.018 mg zinc. Based on the recommended dietary allowance (RDA) for lactating women, the recommended daily intake of placenta capsules would provide, on average, 24% RDA for iron, 7.1% RDA for selenium, 1.5% RDA for zinc, and 1.4% RDA for copper. The mean concentrations of potentially harmful elements (arsenic, cadmium, lead, mercury, uranium) were well below established toxicity thresholds. These results indicate that the recommended daily intake of encapsulated placenta may provide only a modest source of some trace micronutrients and a minimal source of toxic elements.
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Abbreviations: AI, adequate intake; As, arsenic; Cd, cadmium; Co, cobalt; Cu, copper; Fe, iron; Hg, mercury; ICP-MS, inductively coupled plasma mass spectrometry; Mn, manganese; Mo, molybdenum; Pb, lead; ppb, part per billion; ppm, part per million; Rb, rubidium; RDA, recommended dietary allowance; Se, selenium; Sr, strontium; U, uranium; Zn, zinc.

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1. Introduction

Maternal placentophagy, the postpartum ingestion of placental tissue and fluid by the mother, is a ubiquitous behavior among terrestrial mammalian species [1–3]. Humans represent a conspicuous exception to this rule, which is especially noteworthy given that the behavior is widespread among other primate species. Although written reference to medicinal placentophagy can be traced back nearly 5 centuries in Traditional Chinese Medicine [4], there is a distinct lack of evidence in the ethnographic literature to support claims that maternal placentophagy has been practiced by any human population as a longstanding or routine behavior [1,2]. Despite this lack of evidence to support a custom of maternal placentophagy in any culture, beginning in the late 1960s and early 1970s, recorded instances of human maternal placentophagy began to emerge in popular culture and in the scientific literature [5]. Placentophagy supporters rely on anecdotal evidence to illustrate the benefits of ingesting one's placenta postpartum and claim that it provides a host of benefits including improvements in postpartum mood, lactation, energy, and postpartum recovery, among other claims [6]. In 2013, Selander et al [7] reported the results of an Internet survey in which 189 women's experiences with postpartum placentophagy were investigated. The most frequently self-reported benefits of placentophagy were improved mood, increased energy, improved lactation, and decreased postpartum bleeding. Although 31% of the responses reported some adverse effects of placenta ingestion, these were minor and most frequently related to the unpleasant aftertaste or smell of the capsules (the form in which most women reported ingesting placenta). In addition, 98% of the women in this survey reported that they would engage in placentophagy again after the birth of another child. It is important to note that although this is the most comprehensive study to date of women's experiences with placentophagy, the responses were collected through convenience sampling limited to women with Internet access who chose to respond to the survey, and therefore, the results are not representative of the larger US or worldwide population of women who engage in the practice.

Despite claims that placentophagy provides benefits to the postpartum mother, little scientific research has investigated these anecdotal self-reports. Placentophagy advocates' claims include purported nutritional benefits [7,8], including a rich source of elemental micronutrients such as iron (Fe). To our knowledge, few studies have been conducted assessing the nutritional composition of human placenta. Snyder et al [9] determined the average percent of water, protein, fat, and ash content of human placenta. Other studies have assessed concentrations of micronutrients such as zinc (Zn) [10,11] Fe, copper (Cu), calcium [12], and selenium (Se) [13]. Phuapradit and colleagues [14] analyzed selected nutrients and hormones in heat-dried placentas from 30 Thai mothers. Hormone analysis included estradiol, progesterone, testosterone, and human growth hormone, whereas the nutrient analysis included percent macronutrients (protein and fat) and select micronutrients, including Fe, Zn, Cu, manganese (Mn), and magnesium.

Similarly, the potential health risks of human maternal placentophagy, including the content of potentially toxic elements in dehydrated and encapsulated human placenta, have been the subject of little to no scientific research. Previous studies that analyzed human placenta as a biomarker of toxic exposure are of relevance here, however. Beyond facilitating the exchange of gases and nutrients between the mother and fetus, the placenta also acts as a partial barrier to prevent some harmful substances from passing to the developing fetus [15]. Although some substances pass through this barrier with relative ease, the organ is known to accumulate other toxicants across pregnancy including some micronutrient and toxic elements. In 2001, Iyengar and Rapp [16] reviewed the published data regarding concentrations of trace toxic elements in human placenta to assess the organ's utility as a biomarker to identify toxic exposure. They found that although lead (Pb), mercury (Hg), and nickel seem to easily pass through the organ to the fetus, arsenic (As) is partially impeded and cadmium (Cd) is prevented from crossing the placental barrier to an even greater degree. Their findings for Pb, Hg, and Cd are similar to those of Schramel and colleagues [17], indicating that of these toxic elements, Cd would present the highest risk for placental accumulation. More recently, Sakamoto et al [11] investigated concentrations of Hg (both methylmercury and inorganic Hg), Pb, Cd, Se, Zn, and Cu in freeze-dried chorionic tissue from the placenta and umbilical cord from 48 Japanese mother-child pairs at birth. Their findings revealed significantly higher concentrations of all elements except for methylmercury in placental vs cord tissue. Of all of the elements examined in the study, however, the placenta provided the strongest barrier to Cd, which suggests that placental tissue can provide a good indication of maternal exposure to this toxic element during pregnancy. In addition, analysis of toxic elements in maternal and fetal cord blood is frequently used to assess exposure across pregnancy, and placental accumulation can be determined indirectly through these analyses [for examples, see 11,18–20].

The accumulation of toxic elements in the placenta is of concern considering the increasing popularity of placentophagy which is touted by proponents as a natural and beneficial postpartum practice [6]. If the placenta does in fact retain some harmful elements in sufficiently high concentrations that persist throughout the processing and encapsulation process, these elements would then be ingested by the mother and could potentially adversely impact her health or the health of her newborn through exposure to contaminated breast milk. Research suggests that some toxic elements that may be retained by the placenta can not only elicit harmful effects such as nausea and vomiting in sufficiently high, acute doses but also function as endocrine disruptors [21,22]. For example, Piasek et al [23] investigated the effects of smoking on placental metal concentrations by evaluating the placentas of 56 women for concentrations of Pb, Fe, Zn, and Cu and assessed progesterone levels as well. They found that among mothers who self-identified as smokers, not only were Cd levels elevated but Fe and progesterone levels were depressed, suggesting a relationship between increased Cd exposure and decreased Fe availability and progesterone production. If exposure to toxic elements does have the ability to

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impact endocrine function or the availability of essential micronutrients, it is important to understand whether ingestion of placenta postpartum may present this type of exposure.

Because the placenta is known to retain some beneficial micronutrients and potentially harmful toxic elements at parturition and because these substances are heat stable, we hypothesized that dehydrated placental tissue prepared for encapsulation and ingestion would contain detectable concentrations of these elements. To determine the concentration of potentially beneficial micronutrients and harmful toxic elements that we hypothesized would be present in encapsulated placenta, 28 placentas were processed using standard placenta encapsulation techniques and equipment by a Placenta Benefits LTD certified encapsulation provider. Samples from the processed tissue were analyzed for 14 selected elements using inductively coupled plasma mass spectrometry (ICP-MS) analysis. Maternal daily intake of identified elements in processed placenta capsules in this sample was then estimated based on the daily intake guidelines for encapsulated placenta that are recommended by a prominent US placenta encapsulation provider, Placenta Benefits, LTD [8].[1]

2. Methods and materials

2.1. Placenta donors

All methods were approved by the Institutional Review Board and Institutional Biosafety Committee at the University of Nevada, Las Vegas, and written informed consent was obtained from all individual participants included in this study. Processed placenta samples were collected from 28 healthy female donors between the ages of 20 and 38 (mean age = 29.9) years in the Las Vegas area who had decided previously to ingest their placenta postpartum and who did not smoke during pregnancy. More than half of the donors were primiparous (15; 53.6%), and the remaining donors had given live birth 2 (6; 21.4%), 3 (4; 14.3%), or 4 times (3; 10.7%). For participant demographic characteristics, see Table 1. Placenta processing and encapsulation services were provided through the study to ensure a standardized process. Information about donors' diet and nutritional supplementation during pregnancy was collected through self-report during the 36th week of pregnancy. Three donors (10.7%) reported a specialized diet during pregnancy: 2 (7.1%) reported a vegetarian or mostly vegan diet, and 1 (3.6%) reported a gluten-free diet with reduced legume and dairy consumption (commonly referred to as a *paleolithic diet*). All donors reported taking at least 1 type of nutritional supplement during pregnancy, and the majority reported taking a prenatal or multivitamin supplement (n = 25; 89.3%). Other supplements taken by donors during pregnancy include docosahexaenoic acid or fish oil, other vitamin or mineral supplements, herbal and whole food supplements, and probiotics.

Table 1 – Demographic characteristics of placenta donors [a]

	n [b]	% [c]
Ethnicity		
White	22	78.6
Hispanic/Latina	4	14.3
African American	1	3.6
American Indian/Alaska Native and white	1	3.6
Education		
High school or equivalent	1	3.6
Some college	9	32.1
Bachelor's degree	8	28.6
Master's degree	7	25.0
Doctoral degree	1	3.6
Vocational/technical school	1	3.6
Some college and vocational/technical school	1	3.6
Marital status		
Married/domestic partnership	24	85.7
Single/not living with partner	3	10.7
Divorced	1	3.6
Income		
$20,000-$30,000	3	10.7
$30,001-$40,000	5	17.9
$40,001-$50,000	3	10.7
$50,001-$60,000	2	7.1
$60,000-$70,000	2	7.1
$70,001-$80,000	2	7.1
Over $80,001	10	35.7
Declined to state	1	3.6

[a] N = 28.
[b] Values are number of individuals per category.
[c] Values are percentage of total number of donors.

2.2. Sample collection

Per standard practice, all placentas were processed in the donor's home within 4 days of birth by a trained placenta encapsulation provider. In cases of home births (n = 6), the placenta was refrigerated before processing. Placentas resulting from hospital births (n = 22) were transported by the donor from the birth site to the donor's home. These placentas were frozen by the hospital and thawed at the donor's home. After thawing and before processing, each placenta was rinsed thoroughly and all membranes were removed. The organ was then steamed with a Placenta Benefits LTD proprietary blend of herbs, based on Traditional Chinese

[1] The dosage amount used in this study (3300 mg/d) is based on the recommendation of the placenta encapsulation provider, Placenta Benefits LTD, who processed the samples that were analyzed in this study. Placenta Benefits LTD recommends a maximum daily intake of 2 "00"-sized capsules 3 times daily, where each capsule contains approximately 550 mg of processed, dehydrated, and ground placental tissue [8]. This amount is also in agreement with the dosage recommended by Enning [24], and both recommendations are consistent with, and reported as being derived from, Traditional Chinese Medicine dosage recommendations of "dried human placenta" (*zi he che*) found in the Chinese *Materia Medica*. This Traditional Chinese Medicine text recommends a (powdered) dose of 1.5-4.5 g (median, 3.0 g) [25].

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Medicine preparation methods[2] [24,25], until thoroughly cooked (internal temperature of 160°F) and dehydrated until fully desiccated (8-10 hours) using a food dehydrator (Excalibur 2400). The dehydrated tissue was then pulverized and homogenized using a food processor (Magic Bullet model MB1001C). Although the form in which placenta is ingested (eg, raw, cooked into a meal, taken as a supplement) varies among placentophagic mothers, and the dehydration and encapsulation process itself varies among encapsulation provider, the preparation method outlined above represents a typical method in which placentas are processed for encapsulation, which is the most commonly reported form of postpartum placenta ingestion according to Selander et al [7]. All 28 placentas in this sample were processed using the proprietary preparation method of Placenta Benefits LTD, a Las Vegas–based company that specializes in placenta encapsulation and provides training for placenta encapsulation providers.

2.3. Sample preparation

To evaluate the elemental content of encapsulated placenta, approximately 500 mg of processed tissue was collected from each placenta (mean = 491.2 ± 10.9 mg; range = 465.6-513.0 mg), and the samples were digested following the microwave digestion procedures of United States Environmental Protection Agency (USEPA) method 3052 [27]. Each sample was added to a microwave vessel followed by 9 mL of concentrated nitric acid (69% nitric acid), 1 mL of hydrogen peroxide (30% hydrogen peroxide), and 3 mL of hydrofluoric acid (51% hydrofluoric acid). This combination of reagents was ideal for the digestion of these sample matrices [11,17]. In addition, 2 mL of hydrochloric acid (36% hydrochloric acid) and 0.8 mL of 100 μg/mL gold (III) chloride were added to the microwave vessels to protect the integrity of Hg during digestion as well as the ICP-MS instrument, according to USEPA method 6020A [28]. Lyophilized whole blood provided by Seronom (SERO210105 lot #: 1406263) was used as standard reference material and as part of the laboratory quality control protocol. The lyophilized whole blood was dissolved following instructions provided by the manufacturer. For each set of 8 placenta samples, a standard reference material (whole blood) and a reagent blank (containing only reagents, no sample) were added and digested in a Milestone Ethos D Microwave digestion system following this program: 250 W for 2 minutes, 0 W for 2 minutes, 250 W for 6 minutes, 400 W for 5 minutes, and then 650 W for 5 minutes. After the digestion, the samples were allowed to cool for approximately 4 hours and then centrifuged, and the supernatant was transferred to 50-mL centrifuge tubes and diluted to a final volume of 40 mL using pure water before analysis.

2.4. ICP-MS method

Element analysis was performed on an Agilent Technologies 7700x Series ICP-MS following USEPA method 6020A [28] for As, Cd, cobalt (Co), Cu, Fe, Pb, Mn, Hg, molybdenum (Mo), rubidium (Rb), Se, strontium (Sr), uranium, (U), and Zn. Calibration standards (0.01, 0.1, 1, 20, 100, 500, and 2500 parts per billion [ppb] and 10 parts per million [ppm]) were prepared from stock High-Purity standards and used to calibrate the ICP-MS. The 500-ppb, 2500-ppb, and 10-ppm standards were prepared for Cu, Fe, and Zn because of their known high concentrations in the placental tissues and the whole blood control. Initial and continuing calibration checks were performed to ensure the accuracy and consistency of the instrument performance. Four reagent blanks were digested and analyzed with the samples. The method detection limits were calculated as 3 times the standard deviation of the 4 reagent blanks [29,30]. Per EPA method 6020A [28], the lowest nonzero standard concentration should be considered the lower limit of quantitation; in our case, it is 0.01 ppb (μg/L), which is verified by calibration verification standards (with 70%-130%). Four subsamples of the control standard (blood) were digested and analyzed with the samples as part of the quality control protocol. Results of the control recovery were all within provider certified range or within the USEPA limit (80%-120%). All samples were analyzed in duplicate according to USEPA method 6020A 9.10.1 [28].

2.5. Statistical analyses

Means and standard deviations (in parts per million) for the 28 placenta samples were calculated for each element and are presented in Table 2. The concentration range in the placenta samples for each element is presented as well. The means and standard deviations were used to calculate the average daily intake (in milligrams) of each element in a dose of 3300 mg of encapsulated placenta and the percentage of the Recommended Daily Allowance (RDA) or Adequate Intake (AI) of each micronutrient that would be provided by a daily intake of 3300 mg encapsulated placenta, as well as the maximum daily intake of each element in 3300 mg of encapsulated placenta based on the maximum concentrations found in these samples (Table 3).

3. Results

All 14 of the evaluated elements were detected in each of the 28 placenta samples, with the exception of Hg, which was detected in 24 (85.7%) of the samples, indicating that this element either was not present in the tissue or was present in concentrations that were below the limit of detection using ICP-MS analysis. Only 7 elements had a maximum concentration greater than 1 ppm, including Cu (7.81; mean = 5.58 ± 1.14), Fe (1185.18; mean = 664 ± 161.40), Mn

[2] Because Placenta Benefits LTD adds unspecified "herbs" to the steam bath water during processing, it is possible that element concentrations in this study were affected by these substances. A previous unpublished pilot study using less sensitive, x-ray fluorescence analysis, however, compared concentrations (in parts per million) of 15 elements in 7 placentas steamed with herbs (Placenta Benefits LTD method), and 6 without herbs, before dehydration. Of the 15 elements, only Fe, Rb, Sr, and Zn were detected in the dehydrated tissue. *t* test (P= .05) revealed no statistically significant differences in any detected element concentrations between placentas steamed with and without herbs. These findings suggest that the substances added to the steam bath water using the Placenta Benefits LTD method have minimal effects on the analyzed trace mineral and element concentrations in placentas processed for encapsulation [26].

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Table 2 – Concentration of 14 elements in processed placenta samples [a]

Element	Range (ppm)	Concentration (ppm) [b]
As	0.02-0.07	0.03 ± 0.01
Cd	0.01-0.04	0.02 ± 0.01
Co	0.01-0.19	0.04 ± 0.03
Cu	3.30-7.81	5.58 ± 1.14
Fe	440.86-1185.18	664.38 ± 161.40
Pb	0.01-0.1	0.05 ± 0.02
Mn	0.33-1.95	0.75 ± 0.44
Hg [c]	0.00-0.05	0.01 ± 0.01
Mo	0.02-0.04	0.03 ± 0.00
Rb	4.23-12.14	8.03 ± 1.93
Se	1.16-2.48	1.51 ± 0.27
Sr	0.73-24.21	4.47 ± 4.22
U	0.00-0.03	0.01 ± 0.01
Zn	40.65-63.59	54.63 ± 5.60

[a] N = 28.
[b] Values are means ± SD.
[c] Four samples contained concentrations below the limit of detection.

(1.95; mean = 0.75 ± 0.44), Rb (12.14; mean = 8.03 ± 1.93), Se (2.48; mean = 1.51 ± 0.27), Sr (24.21; mean = 4.47 ± 4.22), and Zn (63.59; mean = 54.63 ± 5.60) (Table 2).

Among the detected elements with highest potential micronutrient value, Fe was found in the highest concentration in this sample. The mean measured concentration of Fe (664 ppm) suggests that dehydrated placental tissue may provide a modest but beneficial source of this essential micronutrient to mothers who ingest placenta capsules during the postpartum period. Given the Fe concentrations in dehydrated placenta reported here, encapsulated placenta would provide, on average, approximately one fourth of the RDA for Fe (9 mg/d) among lactating women (age 19-50 years) based on placenta supplement intake recommendations provided by PBi of approximately 3300 mg/d during the first week postpartum [8]. Based on the present analysis, a woman taking 3300 mg/d of dehydrated, encapsulated placenta would receive approximately 2.2 mg of heme Fe daily, or the equivalent Fe content of 3 oz of sardines, constituting a "good" source of Fe based on Food and Drug Administration percent daily value standards for lactating women. Examples of foods corresponding to a "high" source of dietary heme Fe based on percent daily value include 3 oz of canned oysters (5.7 mg) and 3 oz of pan-fried chicken liver (11 mg) [31]. By comparison, the commercially available oral heme Fe supplement Proferrin ES contains 12 mg of elemental, heme Fe per tablet, with recommended instructions to take 1 tablet up to 3 times per day. Oral Fe supplements using nonheme (ie, plant-based) Fe sources (eg, ferrous fumarate, carbonyl Fe) are much less readily absorbed than heme Fe (3% to 20% vs 15% to 35%, respectively [32,33]), and this is reflected in the significantly higher amounts of nonheme Fe (≥30 mg per tablet) typically found in these supplements. It should be noted that the

Table 3 – Estimated maternal intake of 14 elements in recommended daily dose of encapsulated placenta [a]

Element	Daily intake from placenta capsules [a] (mg) [b]	%RDA/AI in placenta capsules [a,c] [34,35]	Maximum daily intake from placenta capsules [a,d] (mg)	Maximum %RDA/AI in placenta capsules [a,c,d] [34,35]	Maternal RDA/AI [34,35]	Oral UL/MRL [36,37]
As	<0.001	–	<0.001	–	–	0.005 mg/(kg d) (MRL-acute exposure) [36]
Cd	<0.001	–	<0.001	–	–	0.0005 mg/(kg d) (MRL-intermediate exposure) [36]
Co	<0.001	–	0.001	–	–	0.01 mg/(kg d) (MRL-intermediate exposure) [36]
Cu	0.018 ± 0.004	1.4% RDA	0.026	2.0% RDA	1.3 mg/d [34]	10 mg/d (UL) [34]
Fe	2.19 ± 0.533	24% RDA	3.910	43% RDA	9 mg/d [34]	45 mg/d (UL) [34]
Pb	<0.001	–	<0.001	–	–	No MRL established [37]
Mn	0.002 ± 0.001	0.1% AI	0.006	0.2% AI	2.6 mg/d (AI) [34]	11 mg/d (UL) [34]
Hg [e]	<0.001	–	<0.001	–	--	No oral MRL established for elemental Hg [36]
Mo	<0.001	0.2% RDA	<0.001	0.3% RDA	0.05 mg/d [34]	2.0 mg/d (UL) [34]
Rb	0.027 ± 0.006	–	0.040	–	–	–
Se	0.005 ± 0.000	7.1% RDA	0.008	11.7% RDA	0.07 mg/d [35]	0.4 mg/d (UL) [35]
Sr	0.015 ± 0.014	–	0.080	–	–	2.0 mg/(kg d) (MRL-intermediate exposure) [36]
U	<0.001	–	<0.001	–	--	0.002 mg/(kg d) (MRL-acute exposure) [36]
Zn	0.180 ± 0.018	1.5% RDA	0.210	1.7% RDA	12 mg/d [34]	40 mg/d (UL)[34]

Abbreviations: UL, upper tolerable level; MRL, minimal risk level.
[a] Based on a recommended daily intake of 3300 mg/d of dehydrated encapsulated placenta [8].
[b] N = 28; values are means ± SD.
[c] Values are percentage of RDA/AI.
[d] Based on the maximum concentration detected in placenta samples in this study.
[e] n = 24.

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amount of Fe in commercially available oral Fe supplements is typically not sufficient to treat Fe deficiencies such as Fe deficiency anemia. Rather, these supplements are generally recommended as a means of preventing Fe deficiency from developing in the first place, especially among women of reproductive age and those who are pregnant [31] (Table 3).

Cu, Se, and Zn are other micronutrients that were detected in all 28 of the processed placenta samples with concentrations greater than 1 ppm and for which there are RDA or AI guidelines for lactating women. Based on the average concentrations in these placenta samples, the recommended daily intake of encapsulated placenta would provide only about 1.4% of the RDA for Cu, 1.5% of the RDA for Zn, and 7.1% of the RDA for Se. Among the remaining elements, none of which have recommended dietary intakes, only Rb and Sr were detected in all 28 placenta samples with an average concentration greater than 1 ppm, and concentrations for these 2 elements were well below established toxicity thresholds based on estimated exposure from the recommended daily intake of encapsulated placenta (Table 3).

4. Discussion

The results of this study support the research hypothesis; therefore, the hypothesis was accepted. The results suggest that dehydrated, processed, encapsulated placenta may provide a beneficial source of some elemental micronutrients (eg, Fe, Se, Cu, and Zn). These findings also indicate that although some elements detected in these placenta samples have no well-established health benefits (eg, Co) or may primarily be considered toxicants (eg, Pb), the detected levels of the elements in this study were well below the established toxic thresholds based on estimated intakes from PBi-recommended guidelines for encapsulated placenta prepared according to this encapsulation provider's preparation method [8].

The relatively low concentrations of selected toxic elements (ie, As, Cd, Hg, Pb, U) in samples from the present study are welcome findings given the trend of placenta encapsulation and oral supplementation among a small but growing number of women in the United States and other industrialized countries. These findings are also consistent with the results of previously cited studies using placental tissue as a biomarker for toxic exposure [16].

These results should, however, be interpreted with caution for several reasons. Firstly, this analysis included only the selected elements identified above. Other potentially toxic inorganic substances and persistent organic pollutants (eg, polychlorinated biphenyls) which may accumulate in placental tissue and could pose health risks to placentophagic mothers, their newborns, or both were not included in the present study. Secondly, the placenta donors in this study were recruited via a convenience sampling method, and the majority was of higher socioeconomic status and took nutritional supplements during pregnancy. These donors therefore do not constitute a representative sample for the Las Vegas area or more broadly. This is important because various individual lifestyle factors, such as socioeconomic status, diet, and cigarette smoking, are known to affect elemental exposure, uptake, and distribution. Geographic location may also impact exposure to these elements; therefore, the results of this pilot analysis may not be generalizable to women outside of this sample drawn from the Las Vegas metropolitan area. In addition, because the placenta samples used in this study were processed for encapsulation and were prepared according to the preparation method of only 1 encapsulation provider, these results may not be generalizable to placenta supplements prepared by other encapsulation providers or placenta ingested in other forms (eg, raw or cooked into a meal).

Although the levels of trace minerals and elements in human placental tissue have been reported in the scientific literature, this is the first study in which concentrations of these substances have been reported for dehydrated human placenta prepared as a postpartum supplement. The data from this study suggest that postpartum placenta supplements may provide only a modest source of the beneficial micronutrients Cu, Fe, Se, and Zn. The data also indicate that the maximum recommended dose of placenta capsules may contain only negligible amounts of the potentially harmful elements As, Cd, Pb, Hg, and U. Given the growing number of women electing to ingest their placentas postpartum and the increasing attention given to this practice in the media, it is important not only to evaluate the claims that this behavior provides benefits to the postpartum mother but also to assess the potential risks of the practice to ensure that it is safe for both the mother and the newborn infant. Future investigation of the concentrations of micronutrients, toxic elements, and other environmental contaminants in dehydrated human placental tissue is currently warranted.

Conflict of interest

This study was made possible, in part, by the collaboration between the study authors and Placenta Benefits LTD, a human placentophagy information and advocacy Web site and encapsulation service provider. Placenta Benefits LTD encapsulation providers were paid their standard fee for the placenta encapsulation services they provided to study participants. No Placenta Benefits LTD personnel were involved in any part of the study design, data collection, data analysis, or manuscript preparation. None of the study authors have any financial interest in Placenta Benefits LTD or any other human placentophagy advocacy or services entity. Results reported in this study should not be construed as an endorsement of the practices, methods, or recommendations of Placenta Benefits LTD.

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