

## COMPARATIVE BIOCHEMICAL COMPOSITION OF COMMERCIALY IMPORTANT BRACHYURAN CRABS ALONG PAKISTAN COAST

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### ABSTRACT

This research was conducted to assess the nutritive quality of the edible tissues of crabs (Family: Portunidae) along the Pakistan coast. In recent years, crabs have already become commercially important seafood species worldwide that's why crab is sold at a high market price. In the present study, the biochemical composition of protein, carbohydrate, lipid, and moisture of four species of family Portunidae *Scylla serrata*, *Scylla olivaceae*, *Portunus pelagicus* and *P. sanguinolentus* was estimated. The selected four species were purchased from fish harbor for biochemical characterization. The variations in protein, carbohydrates and total lipid concentration were observed in the edible tissues of four species and the maximum lipid concentration was observed in *P. pelagicus* ( $1.72 \pm 0.12$  mg/g), in *S. olivaceae* ( $1.71 \pm 0.445$  mg/g) and minimum ( $1.43 \pm 0.245$  mg/g) was noticed in *Scylla serrata*. Whereas, the lipid percentage difference was detected among species and was highest (8.60%) and (8.58%) in *P. Pelagicus* and *S. olivaceae* respectively, and were lowest (7.17%) in *S. serrata*.

**KEY WORDS:** Edible crabs, Portunidae, Biochemical composition, Nutritive quality.

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### INTRODUCTION

It is, by and large acknowledged that fish and shellfish are imperative in a healthy, protected, nutritious and adjusted eating regimen and effectively edible for the reasons that it has next to no connective tissue. Consequently, the fish and shellfish are prescribed in numerous uncommon weight control plans. Seafood is broadly part with real classifications, Finfish and shellfish; most particularly seafood is a critical source of significant supplements, similar to minerals (iodine, zinc, iron, calcium and copper), vitamins, long chain n-3 poly-unsaturated fats and essential proteins having nine vital amino acids (Kris-Etherton *et al.*, 2002; Nesheim and Yaktine, 2007; Baklouti *et al.*, 2013).

Crustacean shellfish includes edible crabs are of great sources containing different minerals and amazing protein. Despite the fact that the wholesome arrangement of a few economically gathered types of crabs has been incompletely described. Shellfish contain essential nutrients which are appropriate for human consumption. The biochemical composition and nutritive quality of diverse invertebrate particularly edible crustaceans such as (crabs, shrimps) species have been accounted for different areas of the world (Adeyeye *et al.*, 2010; Moronkola *et al.*, 2011; Jimmy and Arazu, 2012; Omotayo *et al.*, 2013; Abdel-Salam, 2013).

The information of the complex mixture of compounds in edible organism is critical because of the nutritional quality of edible species along with their biochemical composition. Recently more up to date species ought to be suggested for human utilization when surveying the nutritive estimation of the species with respect to its nutritional benefits (Soundarapandian *et al.*, 2013).

An adequate supply of dietary protein is required for survival, development, propagation and keeping up a good health yet it is hard to acquire in the country. The study indicates the need and keeping in mind the end goal to protect the conditions as shellfish is one of the least expensive of these assets that can serve as an optional source of protein and mineral for human (Elegbede *et al.*, 2013).

Crab is a kind of shellfish that is a good source of great protein. The compositional understanding of crab meat is variable, relying on components based on sex, creature size, season, and cooking system. Due to the nutritional quality and delicacy of crab meat the crab fishery remain in high demand. A few types of crabs are an edible number however others are industrially vital for various feed industries. The crabs are progressively acknowledged as a potential nourishment hotspot for their delicacy and nutritional richness.

Around the world, fish and shellfish are the most critical source of protein in the human eating supplement. This protein is generally of high absorbability contrasted with another protein source. Shellfish contain all the essential amino acids in attractive amount required for the human utilization. Every one of these attributes takes the sea foods such as shellfish biochemical constituents to be classified as equal as chicken protein and better than egg whites and milk protein (Srivastava, 1999). Food specialists and individuals who have occupied the caloric substance of the sustenance for weight control additionally require data on the biochemical composition of the eating routine. The aim of this study is to estimate the biochemical composition like (Lipid, Protein, Carbohydrate, and Moisture) and also assess the nutritional quality of different edible Portunid crab species found in coastal waters of Pakistan.

## MATERIALS AND METHODS

The Samples of *Scylla olivaceae*, *Scylla serrata*, *Portunus pelagicus* and *Portunus sanguinolentus* were obtained from the Karachi fish harbor. The crabs were de-shelled with sharp forceps and the edible body parts (muscle tissues) were taken out. The evacuated tissues were oven dried at 70C° for 24 hours and homogenized with pestle and mortar and put away for biochemical estimations. The carbohydrate, protein, lipid and moisture contents were assessed following methodology.

The moisture content in the shellfish was determined by drying a known amount of tissues of shellfish in an oven at 75°C for 24 hrs. After drying, the variations (before and after) in tissue weight considered as the total quantity of moisture present in the tissues of shellfish. For the estimation of protein content, the Lowry method (Lowry *et al.*, 1951) was used and BSA was used as a standard. The total lipid content was estimated (Folch *et al.*, 1957). The Phenol-sulfuric acid method (Dubois *et al.*, 1956) was used for carbohydrate content and D-glucose used as a standard.

Descriptive statistics were calculated through Minitab 17. Quartile, minima and maxima were calculated and histograms were drawn to show the distribution features through SPSS. Analysis of variance (ANOVA) was calculated among species and biochemical composition. Pearson product-moment correlation was used to test the significance of correlations with the biochemical composition of shellfish.

## RESULTS AND DISCUSSION

The study of Biochemical composition is very important and has elemental importance for the nutritional consideration and assessment. The biochemical constituents in Crabs have been documented to differ by species, season, temperature, the size and stages of maturity of an individual and accessibility of diet or food (Baklouti *et al.*, 2013). Crabs, among various other invertebrates, considered as an essential shell fishery product (Fredrick *et al.*, 2013). In the present study the Proximate or nutritional composition (Proteins, Lipids, Carbohydrates and Moisture content) of the four commercially important edible shellfish belongs to family Portunidae was analyzed. The high value such as (3<sup>rd</sup> quartile) for all biochemical variables are far from the medians (Table 1) revealed the normal distribution, which can graphically be observed in histograms. As an example, histograms of protein, carbohydrate, lipid and moisture contents in shellfish species showed in Fig. 1.

**Table 1. Descriptive statistics of biochemical constituent in different species of Portunid crabs.**

Species	Variables	Min	Median	Max	1 <sup>st</sup> quartile	3 <sup>rd</sup> quartile
<i>P. pelagicus</i>	Carbohydrate	0.023	0.023	0.024	0.023	0.024
	Moisture	0.198	0.2405	0.265	0.207	0.252
	Lipid	1.447	1.7345	1.926	1.665	1.784
	Protein	0.077	0.2005	0.586	0.153	0.285
<i>P. sanguinolentus</i>	Carbohydrate	0.021	0.023	0.024	0.022	0.024
	Moisture	0.149	0.181	0.205	0.168	0.199
	Lipid	1.450	1.745	3.578	1.681	1.875
	Protein	0.034	0.172	0.235	0.045	0.226
<i>S. sarrata</i>	Carbohydrate	0.022	0.023	0.024	0.023	0.024
	Moisture	0.128	0.192	0.221	0.161	0.207
	Lipid	1.149	1.412	1.790	1.195	1.678
	Protein	0.161	0.220	0.231	0.153	0.285
<i>S. olivaceae</i>	Carbohydrate	0.022	0.023	0.024	0.023	0.024
	Moisture	0.159	0.193	0.244	0.171	0.207
	Lipid	1.132	1.652	2.304	1.316	2.160
	Protein	0.208	0.223	0.233	0.214	0.231

Proteins are essential macromolecules to sustain for life and serve as crucial functions in all living systems. Their functions are catalysis, transportation, give protection to the immune system, helps in generating movement, to control the nerve impulses and growth (Sudhaker *et al.*, 2011; Fredrick *et al.*, 2013). The protein contents in the crabs varied by the environmental conditions such as pollution and other factor such as collection of time, seasons and availability of food, etc. The proteins are essential for the continuation and stability of different processes of life and exist in large amount in all nutrients as the main component of organisms and human body (Okuzumi and Fujii, 2000).

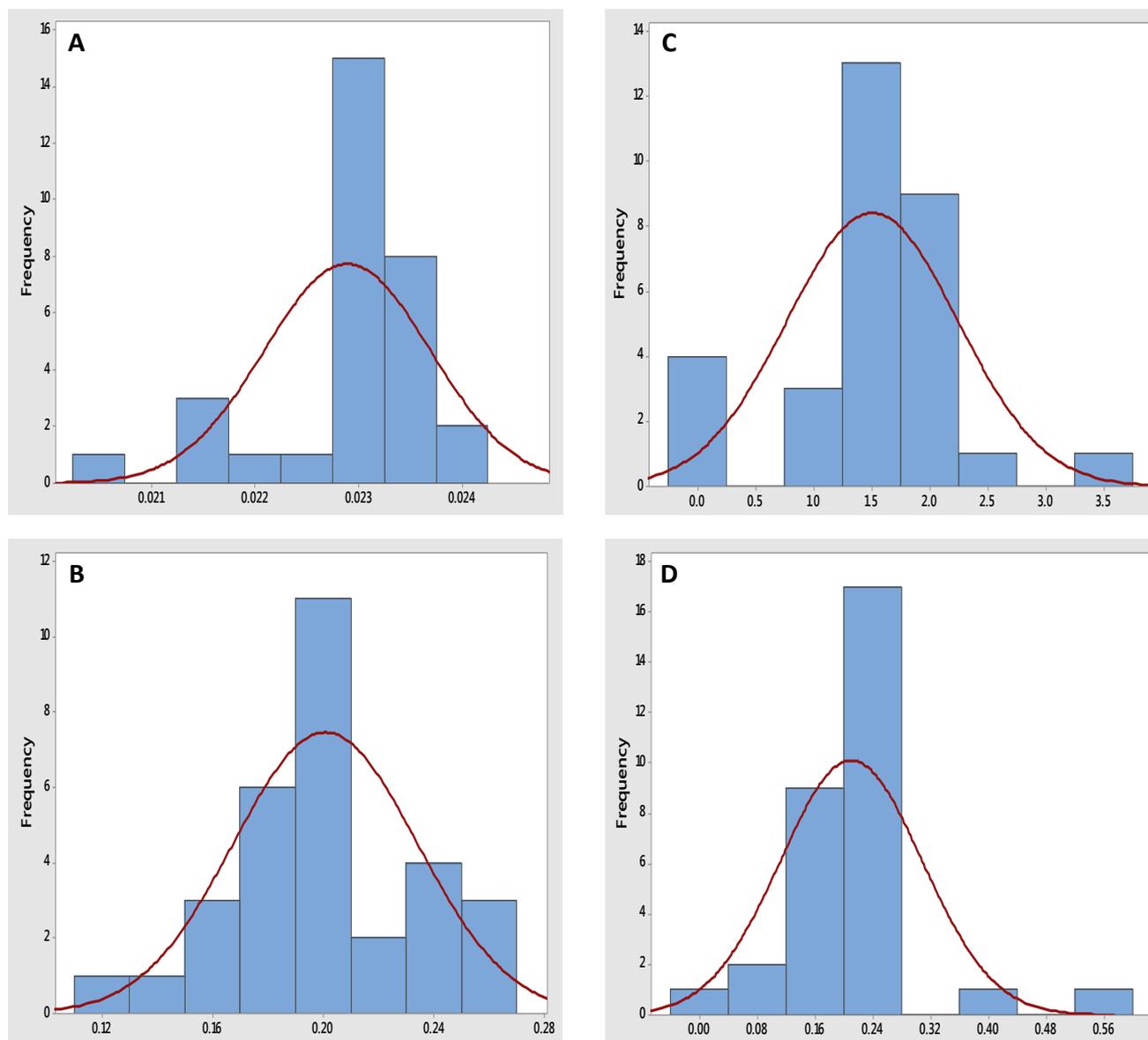


Fig. 1. Histogram showing normal distribution among species and biochemical variables, A (carbohydrate), (B) Moisture, (C) Lipid, (D) Protein.

In the present study, the percentage of protein in shellfish ranged in between 15% to 24%, the *P. pelagicus* (24.45%) consist of high-level protein, less in *S. serrata* (22.49%), *S. olivaceae* (22.15%) and lower in *P. sanguinolentus* (15.34%) was found (Fig. 2). No significant difference in protein concentrations was observed among species. Therefore, other studies also showed variation in protein content in different species of crabs, the level of protein 15.75% to 20.16% was in *P. vigil* (Radhakrishnan and Natarajan, 1979), 17.8% in *C. affinis* was observed (Vanconcelos and Braz, 2001). In *S. serrata*, the difference in protein contents of the body meat (20.11%) and claw meat (18.54%) were reported (Prasad and Neelakantan, 1989). The percent protein content in males 17.69% and in females 19.39% of *S. serrata* was reported (Zafar *et al.*, 2004). Further investigations testified the protein level in the body meat of male 11.60% and 19.92% body meat of female of *S. serrata* (Khan, 1992). The meat protein contents of *P. pelagicus* was also reported in previous studies and was (18.83 ± 0.23%) in males and (17.55 ± 0.23%) in females, respectively (Türeli *et al.*, 2000), 19.3% protein in *P. vigil* (Sudhaker *et al.*, 2011), the protein value in *S. tranquebarica* from various body organs was also reported as in body meat (65.48- 72.24%), claw meat (69.5 – 80.29%) and leg meat (69.47 – 74.7%) (Thirunavukkarasu, 2005). Kala and Chandran, 2014, stated that the protein content of marine crabs was higher as compared to the estuarine crabs. Due to the high level of protein in investigating crab species, confirmed their nutritional importance that they can be used as daily food items instead of fish or other seafood items and also used in infant to speed up their growth and development. Crab proteins also useful in the transportation of gas, building different components of organs and metabolism of organisms (Ackman and Mcleod, 1989; Omotayo, 2013). The increase in the requirement of proteins for human consumption has led to increase in or over exploitation of marine resources as the proteins of shellfish are easily digestible makes them valuable.

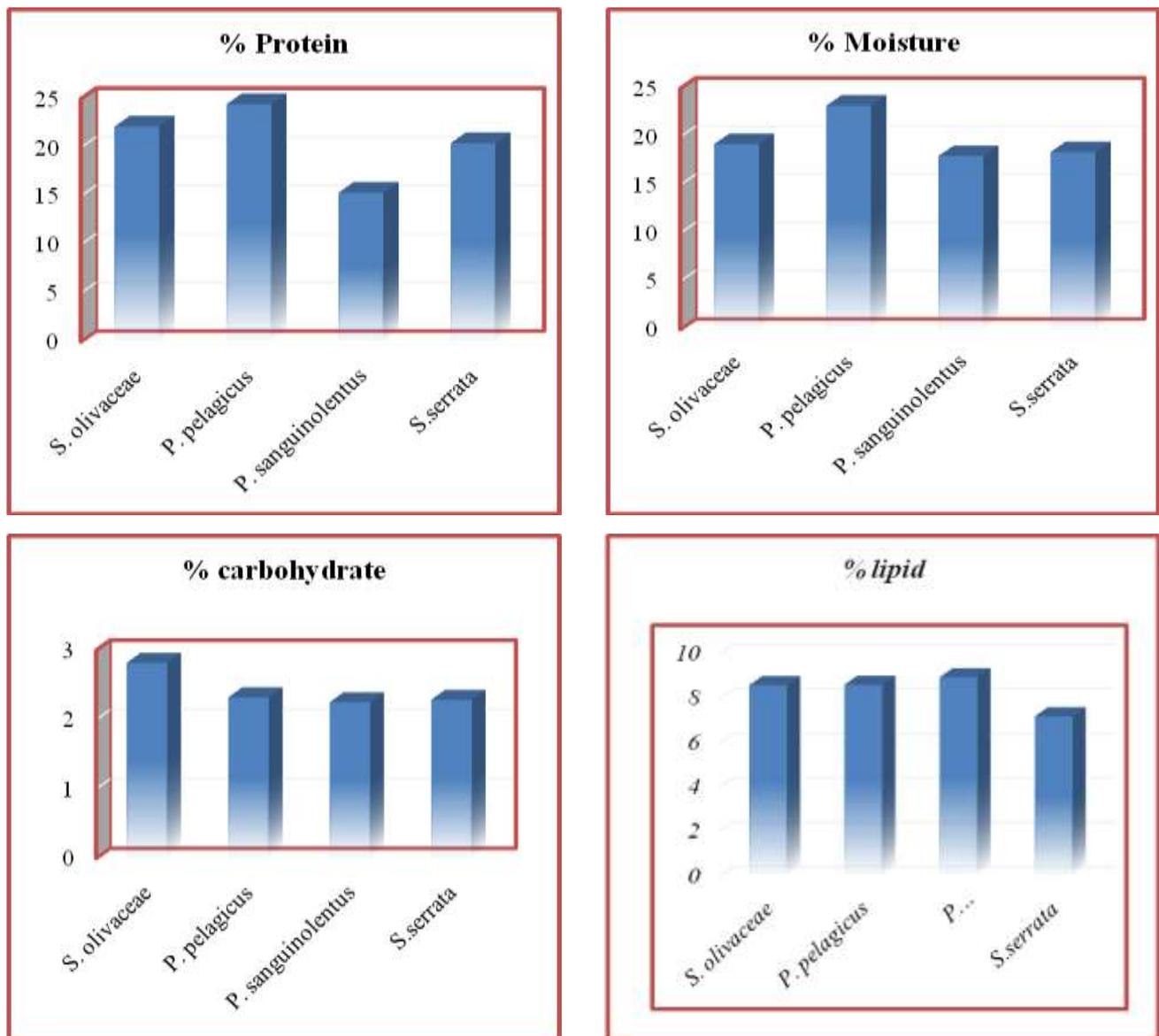


Fig. 2. Percent Biochemical composition of edible tissues in different species of Portunid crabs.

In the fishery products such as fish and shellfish the carbohydrates contain no dietary fiber. Most of the carbohydrates present in the form of glycogen and aldehyde derivatives of polyhydric alcohols. They also have glucose, sucrose, fructose, mono and disaccharides constituents (Okuzumi and Fujii, 2000). Carbohydrates make up only a slight proportion of total biochemical composition. The percentage of Carbohydrate (Fig. 2) value ranged from (2.2 to 2.82 %), although the highest value was observed in *S. olivaceae* (2.82%), *P. pelagicus* (2.32%) less in *S. serrata* (2.28%) and least in *S. olivaceae* (2.25%). No correlation was found among the species. The other studies in crab species suggested, that the content of carbohydrate in muscles of *P. vigil* ranged from 0.3 to 0.63% (Radhakrishnan and Natarajan, 1979). Sudhaker *et al.*, (2011) also revealed 1.57% of carbohydrate content in *P. vigil*, whereas 0.17% in the body meat of *S. Sheraton* and 0.24% in claw meat also found (Prasad and Neelakantan, 1989). The percent composition of carbohydrates ranged (0.16% - 0.55%) and (0.44 - 0.73%) in *P. pelagicus* and in *P. sanguinolentus* respectively (Radhakrishnan, 2000). The values of carbohydrate in body meat (0.59-2.23%), leg meat (0.76-2.76) and claw meat (0.68-2.87%) were reported in *S. tranquebarica* (Türel *et al.*, 2000).

The moisture content was ranged stuck between 17 to 23%. The high water content was observed in *P. pelagicus* (23.2%), *S. serrata* (18.4%) and the lowest value was observed in *P. sanguinolentus* (17.9%) as showed in Fig. 2A high significant variation ( $p > 0.01$ ) in moisture content was also found among species. The high moisture content (83.5%) in males and (79.5%) in females of *S. serrata* was examined (Zafar *et al.*, 2004), and high moisture contents, in an organism are characterized as a benefit due to its involvement in the balance of the marine organisms during the movements (Eddy *et al.*, 1974).

Lipids are also an important constituent of the diet, forms necessary parts of protoplasm, and vary from species to species (Parate, 2013). Lipid in crustaceans does not only reserve the food and organic energy, but also the major source of metabolic energy and also crucial to maintain the cellular integrity and are highly efficient source of energy because

they contain more energy as compared to the protein and carbohydrates (Nagabhushanam and Faroogii, 1982; Baklouti *et al.*, 2103; Kala and Chandran, 2014). In this present study, the variations in the total lipid concentration of four shellfish species also examined (Fig. 2). The lipid value ranged in between 8-9% among the tested four species, the maximum lipid concentration was found in *P. sanguinolentus*, less in *P. pelagicus* and least in *S. serrata*. No significant difference was found among species. The results of the earlier works are supporting the results of the present study. The lipid values in *P. vigil* (5.13% to 9.73%) were measured (Radhakrishnan and Natarajan, 1979). However in *C. smithii* the value of lipid was observed and varied from 6.2% to 7.6% and 1.5% in blue crab was recorded (Anonymous, 1999). The percent lipid content (1.65%) in body meat of *S. serrata* and 2.01% from claw meat was also measured (Prasad and Neelakantan, 1989). The lipid values 1.07% in the body meat and 1% of claw meat of *S. serrata* were assessed (Prasad and Neelakantan, 1989). In *P. sanguinolentus* lipid value varied from 3.8% to 5.5% (Radhakrishnan, 2000). The lipid contents ranged from 0.9% to 1.6% observed in the body meat, 1.83% to 2.06% in claw meat and 1.58% to 2.08% in the leg meat of *S. tranquebarica* was estimated (Thirunavuk karasu, 2005). The content of lipid in *C. lucifera* (1.65%) was observed lower 1.85% than the eye stalk ablated crabs. Consequently, there are some limitations of the present study due to the lack of availability of the current data on nutritional composition of edible muscle of Portunid crab species found in Pakistan, the results of the current are still of significant value, giving a species specific estimation of biochemical composition.

## CONCLUSION

This preliminary study indicated that the presence of high protein concentration in edible muscles of *P. pelagicus* and *S. olivaceae*, the elevation of protein and carbohydrate percentage in the edible muscles indicates their high nutritive quality and value. The high lipid content could be attributed to active feeding and optimum availability of food while low content due to low feeding intensity or low availability of food items. The edible muscles of Portunid crabs contain high amount of protein and less in carbohydrate and fat, these species of crabs needs to further studies on the characterization of proteins, carbohydrates and lipids, antioxidant enzymes and their properties of marine crustaceans, they may be used in some pharmaceutical industries and play an important role in specific health balanced foods, may also beneficial to prevent the nutritional deficiencies in humans being in the future.

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