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Potential of *Pilsbryoconcha exilis* Clam Floss as a Protein and Amino Acid Source for Stunting Prevention in Pregnant Women

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ABSTRACT

Introduction: Stunting in children is associated with low concentrations of protein and amino acids in blood serum, which can potentially be prevented by consuming essential nutrients during pregnancy. Pilsbryoconcha exilis clam, highly available in Morowali, Central Sulawesi, is currently used to produce floss dishes. This study aimed to calculate the potential of protein and amino acids in clam floss (Pilsbryoconcha exilis) as an alternative dish to prevent stunting in pregnant women. **Methods**: This quantitative descriptive study compared the Recommended Dietary Allowances (RDA) for pregnant women with the content analysis of clam floss (Pilsbryoconcha exilis). Protein analysis was conducted using the AOAC method, while amino acid analysis was performed using HPLC. **Results**: The potential protein intake from clam floss was 223.07 g/kg body weight per day. The essential and non-essential amino acid content in clam floss (g/kg body weight per day) was as follows: histidine (5.47), isoleucine (3.62), leucine (5.04), lysine (4.8), methionine + cystine (9.65), phenylalanine + tyrosine (3.67), threonine (3.51), tryptophan (50.3), and valine (3.85). **Conclusion**: The potential of protein and amino acids in clam floss is concluded to be an average of 223.07 g/day and 9.98 g/kg body weight per day, respectively. Clam floss could serve as an alternative dish for pregnant women to prevent stunting. Further research considering in-vivo evaluations is encouraged.

INTRODUCTION

Stunting is devastating result of poor nutrition in utero and in early childhood (UNICEF et al., 2023). Stunting is characterized by a decline in motor and cognitive function, as well as behavioral and immune disorders, and has also been implicated in 14% of child deaths worldwide. Survivors tend to demonstrate reduced physical work capacity, increased risk of high body fat/obesity, and cardiovascular disease in adulthood (Huey & Mehta, 2016). Based on the results of Basic Health Research in 2018, the prevalence of stunting in children aged 0-23 months in Indonesia was 12.8% (Litbangkes, 2018). However, the age-specific incidences in Central Sulawesi were 11.7%, 9.2%, and 15.3% for 0-5, 6-11 and 12-23 months old babies, respectively. The method used to overcome this phenomenon involves nutritional intervention, which can reduce this rate by only 20% (Prendergast & Humphrey, 2014). Therefore, the best solution is to prevent being born with stunting, which can be achieved by providing complete nutrition during pregnancy.

The nutritional needs of pregnant women are expected to be met, especially in term of protein and amino acids content. These are to be consumed at an average concentration of 75-89 gr, according to age groups, and increased each consecutive semester (Kemenkes, 2019; Stobaugh et al., 2016). In addition, protein needs in the first, second, and third trimesters were approximately 1.1, 1.2, and 1.52 grams per kg BW, respectively (Elango & Ball, 2016).

In addition, there is a need to consider complete amino acids in the diet. Based on research conducted by Semba et al., (2016), children with stunting have very low blood serum concentrations of essential amino acids, including tryptophan, isoleucine, leucine, valine, methionine, threonine, histidine, phenylalanine, and lysine; conditional essential amino acids, including arginine, glycine, glutamine; and non essential amino acids, such as asparagine, glutamate, and serine, compared to healthy children. The total requirement of the essential variety for pregnant women is 87.7 mg (Wu, 2016), possibly fulfilled through the consumption of protein and amino acid sources. They are often derived from animal and vegetable sources, and clams have been identified as a high animal resource.

Based on the Food Composition Table, the clam meat protein content was 14.4g in 100g of material (Kemenkes, 2018). *Pilsbryoconche exilis* is of freshwater origin, with high availability in the North Morowali district, Central Sulawesi, Indonesia. Moreover, floss or shredding is a form of processed food product in Indonesia, usually formulated from animal meat, typical of the fiber component, along with other raw materials, including more meat and fish. These foods have the advantage of a long shelf life, and *Pilsbryoconche exilis* clams from the Morowali district were used to create floss products in this study. *Pilsbryoconcha exilis* is a freshwater mussel species from Southeast Asia that serves as a significant source of high-quality protein (Bolotov et al., 2023). This freshwater mussel can be found in Indonesia, especially in the Cikaniki River, West Java, (Sata Yoshida & Prihatini, 2019) and in the Tompira River, North Morowali, and Central Sulawesi. The yield is expected to fulfill the protein and amino acid Recommended Dietary Allowances (RDA) and possibly serve as a solution to prevent stunting in Central Sulawesi and Indonesia, in general. Based on this literature review, there has been an upsurge in interest in calculating the potential intake of protein and amino acids in clam floss *(Pilsbryoconche exilis)* as an alternative to prevent stunting in pregnant women.

METHODS

This quantitative descriptive study was conducted to calculate the potential intake of proteins and amino acids in clam floss *(Pilsbryoconche exilis)*. In addition, the research design uses true experiments for analysis of protein and amino acid. The sample includes *pilsbryoconcha exilis* clams obtained in the Tompira river, North Morowali, Central Sulawesi, using the Acceptable Quality Level (AQL) sampling method (specimen), with an acceptable percentage (not damaged) of 95% (SNI 2326: 2010). The data collection method was carried out after obtaining ethical permission from the Ethics Committee of the Palu Ministry of Health.

The production of clam floss (*Pilsbryoconche exilis)* was manufactured using a developed recipe previously tested for favorite levels in pregnant women, with a 95% preference outcome.

Procedural analysis of protein (AOAC, 1990) consists of three stages: destruction, distillation, titration and analysis of amino acids using HPLC (AOAC, 1990)(Otter, 2012).The variables in this study included the potential of protein and

amino acids in *Pilsbryoconche exilis* clam floss obtained at Morowali, Central Sulawesi, and used as an alternative dish by pregnant women to prevent stunting. Measurement method of protein analysis. Measurement of the result is the clam floss weight (gr) to fulfill the protein and amino acids needs of pregnant women based on the Recommended Daily Allowance (RDA) Standards.

RESULTS

The potential of proteins and amino acids in clam floss *(Pilsbryoconche exilis)* is as follows. The potential of protein in grams per day required to meet the protein Recommended Dietary Allowances (RDA) according to the gestational age is shown in Table 1.

Table 1 Potential of clam floss based on protein Recommended Daily Allowance (RDA) for pregnant women

Trimester (weeks)	Floss protein content (gr)	RDA Protein (gr)	Recommended floss needs (gr/Day)
I (0-12)	26	58	223.07
II (13-24)	26	68	261.54
III (25-36)	26	88	338.46

The average potential intake of clam floss is 274.36 gr/Hr

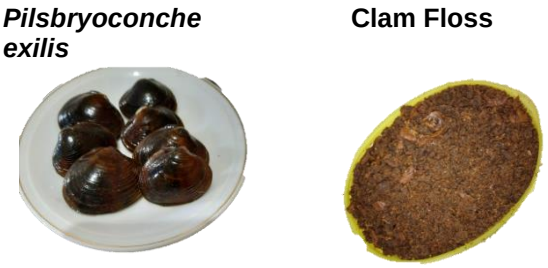

Figure 1. *Pilsbryoconche exilis* and Clam Floss

The potential of amino acids in clam floss, showed arginine and leucine as the largest essential amino acids, whereas glutamic acid and aspartic acid were determined to be non essential. Furthermore, the average essential and non-essential amino acid contents were 0.7206 and 0.9236 g, respectively, as shown in Table 2.

Table 2. The essential amino acid content of clam floss (*Pilsbryoconche exilis)*

Amino Acid	Amino acid content in floss (g/100g)
Essensial	
Phenylalanine	0.703 ± 0.042
Isoleucine	0.691 ± 0.014
Valine	0.805 ± 0.01
Arginine	1.361 ± 0.014
Lysine	1.069 ± 0.003
Methionine	0.259 ± 0.052
Histidine	0.329 ± 0.023
Threonin	0.740 ± 0.007
Leucine	1.110 ± 0.003
Triptopan	0.139± 0.016

Amino Acid	Amino acid content in floss (g/100g)
Non Essensial	2.146 ± 0.014
Glutamic Acid	0.748 ± 0.017
Glycine	0.919 ± 0.004
Alanin	1.359 ± 0.02
Aspartic Acid	0.038 ± 0.01
Cystine	0.713 ± 0.01
Proline	0.494 ± 0.025
Tyrosine	0.972 ± 0.016
Serin	

Table 3 shows the potential amino acids based on the consumed clam floss weight sufficient to fulfill the Recommended Dietary Allowances (RDA) of essential and non essential amino acids.

Table 3 Potential of clam floss *(Pilsbryoconche exilis)* based on the Recommended Dietary Allowances of essential and non-essential amino acids required by pregnant women

Amino Acid	Amino Acid RDA (gr/kg BW)	Recommended floss needs (gr/kg BW per Day)
Histidine	0.018	5.47
Isoleucine	0.025	3.62
Leucine	0.056	5.04
Lysine	0.051	4.8
Methionine + cystine	0.025	9.65
Phenylalanine + tyrosine	0.044	3.67
Treonin	0.026	3.51
Tryptophan	0.070	50.3
Valine	0.031	3.85

The potential of amino acids in clam floss on average is 9.98 g/kg BW per day

DISCUSSION

1. Potential of protein in clam floss

Freshwater mussels are a type of mollusk that is abundant in Asia and has reliable protein content. Research shows that these freshwater mussels contain approximately 20.53% protein along with essential amino acids such as glutamic acid (Bolotov et al., 2023). Clam floss (*Pilsbryoconche exilis)* has good prospects as an alternative dish because of its high protein content 14.6gr in 100g, compared to beef floss (Ministry of Health, 2018). In addition, 40% of the total protein content is assumed to play an important role in the formation of the fetus, placenta, and amniotic fluid, whereas 60% is implicated in the development of uterine, breast, and adipose tissues, along with increased blood volume and extracellular fluid. According to Elango and Ball (2016), deficiency is implicated in unpleasant pregnancy risks. Switkowski et al., (2016) reported the possibility of stunted fetal growth and the tendency to produce short-born or stunted children. This is consistent with a research by Uauy et al., (2016), where the lack of protein was associated with amino acid deficiency and consequently implicated in stunting. based on the research results, the intake of mussel floss to support the fulfillment of daily needs of pregnant women is 274.36 gr/Hr, or equivalent to 18

tablespoons. This mussel floss is suitable for consumption with rice as a source of carbohydrates or mixed with bread.

2. Potential amino acids in clam floss

The protein quality is determined by the type and abundance of amino acids in food. In addition, floss from *Pilsbryoconche exilis* clams has demonstrated good potential as alternative dishes because of the composition of 18 essential and non essential amino acid types. This is in accordance with the research by Nurjanah et al., (2020) in Situ Gede estimated the presence of these 18 types.

Inadequate amino acid intake has devastating effects on human metabolism. Due to the inability of bodies to synthesize essential amino acids, fulfillment is solely achieved through food intake. Methionine is highly important because it is a precursor for the formation of non-essential amino acids, such as cysteine, as well as the main methyl donor in polyamine synthesis (Wu, 2009). Methionine supplementation from food during pregnancy can increase fetal growth by increasing protein synthesis (Scherbinsky et al., 2024). In addition, Tryptophan is essential for maternal and fetal health, facilitating processes such as protein synthesis, fetal development, and immune regulation (Badawy, 2015), It's a precursor for serotonin formation in intestinal cells, while Lysine is needed for collagen structure modification. lysine requirements determined in healthy pregnant women during early and late stages of gestation were 36.6 and 50.3 mg · kg−1 · d−1 (Payne et al., 2018). Also, Threonine plays an important role in protective mucus formation at the intestinal lining, while Histidine is implicated in protein methylation, as well as structure hemoglobin, and Phenylalanine serves as a precursor for tyrosine and ketoalamin synthesis (Wu, 2009).

Therefore, deficiency in the intake of essential amino acids inhibits the synthesis of non essential amino acids. This finding is congruent with that of Wu (2009), in which glycine was reported to play an important role in the synthesis of protein and bile acid purines. This compound also serves as a neurotransmitter in the central nervous system. Therefore, poor amino acid consumption leads to the birth of children with slow brain development. This outcome was also reported by Semba *et al* (2016) and was associated with stunting caused by amino acid deficiency.

The limitation of this study is the absence of an in vivo evaluation of the potential of proteins and amino acids. Therefore, the suggestion is restricted only to the recommended intake of clam floss *(Pilsbryoconche exilis),* based on the determined Recommended Dietary Allowances (RDA).

CONCLUSION

Based on the results and discussion, the potential of protein and amino acid in clam floss *(Pilsbryoconche exilis)* for pregnant women is expected to be an average of 274.36 gr/day and 9.98 gr/kg BW per day.

This research significantly contributes to the knowledge on the intake required to prevent stunting, and further research is encouraged to consider in-vivo evaluations.

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REFERENCES

AOAC, A. of official A. C. (1990). Honey. In K. HELRICH (Ed.), *Official Methods Of Analysis* (Fifteenth, Vol. 15, p. 1230). AOAC Association of Official Analytcal Chemist Inc. https://law.resource.org/pub/us/cfr/ibr/002/aoac.methods.1.1990.pdf

Badawy, A. A. B. (2015). Tryptophan metabolism, disposition and utilization in pregnancy. *Bioscience Reports*, *35*(5), 1–16. https://doi.org/10.1042/BSR20150197

Bolotov, I. N., Konopleva, E. S., Vikhrev, I. V., Gofarov, M. Y., Kondakov, A. V., Lyubas, A. A., Soboleva, A. A., Chan, N., Lunn, Z., Win, T., & Inkhavilay, K. (2023). Integrative Taxonomic Reappraisal and Evolutionary Biogeography of the Most Diverse Freshwater Mussel Clade from Southeast Asia (Pseudodontini). *Water (Switzerland)*, *15*(17), 1–39. https://doi.org/10.3390/w15173117

Elango, R., & Ball, R. O. (2016). Protein and Amino Acid Requirements during Pregnancy. *Nutrition*, *7*(2), 839–844. https://pubmed.ncbi.nlm.nih.gov/27422521/

Huey, S. L., & Mehta, S. (2016). Stunting : The Need for Application of Advances in Technology to Understand a Complex Health Problem. *EBioMedicine*, *6*, 26–27. https://doi.org/10.1016/j.ebiom.2016.03.013

Kemenkes. (2019). *Angka Kecukupan Gizi yang Dianjurkan Untuk Masyarakat Indonesia* (pp. 1–23). https://stunting.go.id/kemenkes-permenkes-no-28-tahun-2019-angka-kecukupan-gizi-yang-dianjurkan/

Kemenkes, R. (2018). *Tabel komposisi*. https://repository.stikespersadanabire.ac.id/assets/upload/files/docs_1634523137.pdf

Litbangkes. (2018). *Riset Kesehatan Dasar tahun 2018*. Kementrian Kesehatan. https://layanandata.kemkes.go.id/katalog-data/riskesdas/ketersediaan-data/riskesdas-2018

Nurjanah, N., Jacoeb, A. M., & Hidayat, T. (2020). Perubahan Komposisi Kimia Kijing Lokal (Pilsbryoconcha exilis) Segar Dan Kukus. *Marinade*, *3*(02), 148–159. https://doi.org/10.31629/marinade.v3i02.3403

Otter, D. E. (2012). Standardised methods for amino acid analysis of food. *British Journal of Nutrition*, *108*(SUPPL. 2). https://doi.org/10.1017/S0007114512002486

Payne, M., Stephens, T., Lim, K., Ball, R. O., Pencharz, P. B., & Elango, R. (2018). Lysine requirements of healthy pregnant women are higher during late stages of gestation compared to early gestation. *Journal of Nutrition*, *148*(1), 94–99. https://doi.org/10.1093/jn/nxx034

Prendergast, A. J., & Humphrey, J. H. (2014). The stunting syndrome in developing countries. *Peadiatrics and International Child Health*, *35*, 250–265. https://doi.org/10.1179/2046905514Y.0000000158

Sata Yoshida, & Prihatini, S. R. (2019). Characterization of metallothionein protein from hepatopancreas organ of Pilsbryoconcha exilis collected from Cikaniki River, Western Java, Indonesia. *Nusantara Bioscience*, *12*(1), 1–5. https://doi.org/10.13057/nusbiosci/n120101

Scherbinsky, K., Rasmussen, B. F., Li, B., Kong, D., Ball, R. O., Pencharz, P. B., Courtney-Martin, G., & Elango, R. (2024). Total sulfur amino acid requirements are higher during late gestation compared with early gestation in healthy Canadian pregnancies in a repeated-measures trial. *American Journal of Clinical Nutrition*, *120*(4), 973–983. https://doi.org/10.1016/j.ajcnut.2024.07.034

Semba, R. D., Shardell, M., Sakr, F. A., Moaddel, R., Trehan, I., Maleta, K. M., Ordiz, M. I., Kraemer, K., Khadeer, M. A., Ferrucci, L., & Manary, M. J. (2016). Child Stunting is Associated with Low Circulating Essential Amino Acids. *EBioMedicine*, *6*, 246–252. https://doi.org/10.1016/j.ebiom.2016.02.030

Stobaugh, H. C., Ryan, K. N., Kennedy, J. A., Grise, J. B., Crocker, A. H., Thakwalakwa, C., Litkowski, P. E., Maleta, K. M., Manary, M. J., & Trehan, I. (2016). Including whey protein and whey permeate in ready-to-use supplementary food improves recovery rates in children with moderate acute malnutrition : a randomized , double-blind clinical trial. *AJCN*, *C*, 1–8. https://doi.org/10.3945/ajcn.115.124636.

Switkowski, K. M., Jacques, P. F., Must, A., Kleinman, K. P., Gillman, M. W., & Oken, E. (2016). Maternal protein intake during pregnancy and linear growth in the offspring. *Am J Clin Nutr*, *104*(11), 1128–1136. https://doi.org/10.3945/ajcn.115.128421.1128

Uauy, R., Suri, D. J., Ghosh, S., Kurpad, A., & Rosenberg, I. H. (2016). Low Circulating Amino Acids and Protein Quality : An Interesting Piece in the Puzzle of Early Childhood Stunting. *Ebiomedicine*, *8*, 28–30. https://doi.org/10.1016/j.ebiom.2016.05.026

UNICEF, WHO, & WORLD BANK. (2023). Level and trend in child malnutrition. *World Health Organization*, 4. https://www.who.int/publications/i/item/9789240073791

Wu, G. (2016). Dietery Protein Intake and Human Health. *Food Fungtion*, *7*, 1251–1265. https://doi.org/10.1039/c5fo01530h