International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 11 November 2023
DOI: 10.47191/ijcsrr/V6-i11-43, Impact Factor: 6.789
IJCSRR @ 2023

Use of Chicken Eggshell Powder to Improve Calcium Content in Egg-Milk Pudding as a Food to Prevent Stunting and its Sensory Acceptability

Suci Apsari Pebrianti[1*], Yusrima Syamsina Wardani[2], Mufti Ghaffar[2], Leny Yuliyani[1]
[1]Faculty of Agriculture, Universitas Siliwangi, Indonesia
[2]Faculty of Health Science, Universitas Siliwangi, Indonesia

ABSTRACT: Chicken eggshell powder has a high calcium content. Eggshells, which were formerly thought of as waste food, can be added to egg-milk pudding and produce a nutritious food high in calcium to prevent stunting. This research aims to determine the proper amount of chicken eggshell powder in addition to the characteristics of egg-milk pudding and determine its sensory acceptability. This research used a completely randomized design with one factor, the concentration of eggshell powder addition. There were four levels of concentration (F0 = 0% (control), F1 = 2.5%, F2 = 5%, F3 = 7.5%). The parameters observed were sensory acceptability (hedonic ranking test), analysis of ash, protein, fat, calcium content, and calculation of Recommended Dietary Allowances (RDA) for protein, fat, and calcium. The results showed that the addition of eggshell powder significantly increased the levels of ash, protein, fat, and calcium compared to the control and significantly affected the sensory acceptance parameters of taste, aroma, and texture. However, it does not affect the color parameters of the pudding. The two most preferable formulations, F1 and F2, had hedonic scores of 2.46 and 2.48 respectively, which did not differ significantly. The highest calcium content was obtained from formulation F3, followed by F2, F1, and F0 formulations each at 563.92 mg/100 g, 500.14 mg/100 g, 436.32 mg/100 g, and 32.81 mg/100 g. Based on sensory evaluation and % RDA value, the F2 formulation is better than other formulas with an RDA of 38% for pregnant and nursing mothers. Consuming egg-milk pudding with eggshell powder can be a nutritious source of calcium and may aid in supplying the daily requirements of calcium to prevent stunting.

KEYWORDS: Calcium, Eggshell powder, Egg milk, Pudding, Stunting.

1. INTRODUCTION

Based on United Nations Children's Fund (UNICEF) data in 2020, Indonesia is in the 5th place as the country with the highest incidence of stunting in the world in children under 5 years old [1]. The results of the Indonesian nutritional status survey (SSGI) in 2022 show that Indonesia's stunting prevalence is 21.6%, which is still far above the government's target of reducing stunting to 14% [2]. The urgency of handling and preventing stunting is related to forming qualified human resource candidates. Stunting will harm physical growth, cognitive abilities, and mental health, carrying over into productive age [3]. The domino effect that can occur in society is the availability of human resources with low work capacity and productivity [4].

Stunting is related to inadequate food intake, both in quantity and quality of nutrition, as well as imbalances and deficiencies in the information of certain nutrients that meet the needs. Quality nutritional intake is fulfilled primarily by consuming healthy food to prevent stunting from an early age. Cow's milk and eggs are agricultural food products with high availability on the market, so they are easy to obtain. Besides being an energy source with high protein content, cow's milk is also rich in calcium to stimulate tissue development and bone formation. Consuming cow's milk can also stimulate the synthesis of growth hormone, namely Insulin-like Growth Factor (IGF-1), essential for linear growth [5]. Consuming 150 ml of Ultra High-Temperature cow's milk and 1 egg for 90 days can increase the Length-for-Age Z score (LAZ) and linear growth in children under 2 years of age [6].

On the other hand, research results show that consuming 1 egg per day for 6 months in babies aged 6-9 months can reduce the prevalence of stunting by up to 47% [7]. Children who consume eggs 1-3 times a week have a lower risk of stunting than those who consume eggs <1 time a week [8]. Eggs contain high protein and good biological value with a complete composition of essential amino acids for muscle and bone development. Consuming 10 eggs per week positively affects children's growth parameters [9] supported by the availability of iron, choline, and essential fatty acids in eggs, which are necessary for brain function growth and formation [9] [10].

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 11 November 2023
DOI: 10.47191/ijcsrr/V6-i11-43, Impact Factor: 6.789
IJCSRR @ 2023

The high consumption of eggs in society will reach 1.9 kg per capita per week in 2022 [11] which will be linear with the amount of shell waste produced. If left unchecked, eggshell waste can cause food safety problems and become a growing medium for pathogens, animals and disease-carrying organisms. Eggshell waste can be utilized by processing powder that is rich in calcium, reaching >95% in calcium carbonate and calcium phosphate [12]. Calcium is vital in linear growth and bone formation, so attention must be paid to its intake to prevent stunting. Stunted children are reported to have lower calcium intake than normal or non-stunted children [13] [14] [15] [16]. The child's linear growth will be disrupted and potentially pose a risk of stunting if potassium intake is deficient and the calcium content in the bones is less than 50% of standard requirements. Children with low calcium intake have a stunting prevalence of 3.6 times greater than children with adequate calcium intake [13]. It was reported that consumption of eggshell powder (500 mg Ca) was able to reduce the prevalence of stunting while increasing the Length-for-Age Z score (LAZ) and Weightfor-Age Z score (WAZ) [17].

Even with naturally rich sources of calcium, such as milk and eggshell powder, fortified foods are a constructive way to support those who cannot get enough calcium from their diet. These must meet the Recommended Dietary Allowance (RDA) values the government recommends, mainly to prevent stunting. Fortification of eggshell powder as a source of calcium has been carried out in several products, including jelly [18] and candy jelly [18] and candy jelly [19], cookies [20], and biscuits [21]. In this research, milk and eggs will be processed into pudding with a sweet taste and soft texture that is relatively popular and readily accepted by all groups, especially stunting subjects, including children, teenage girls and pregnant or nursing mothers. Apart from adding the eggshell powder to egg-milk pudding, this research aims to create a diet that can help overcome the problem of calcium deficiency and meet the appropriate calcium needs to prevent stunting.

2. MATERIALS AND METHODS

The ingredients used were purebred chicken eggs, purebred chicken eggshells, lime, granulated sugar, UHT liquid cow's milk, and vanillin. The equipment used was analytical scales, blenders, sieves, drying ovens and trays, refrigerators, equipment for proximate analysis based on Indonesian National Standards 01-2891:1992 [22], spectrophotometers, pans, stirrers, basins, 60 ml plastic cups, sets stationery, and questionnaire forms.

This research was an observational laboratory with a Completely Randomized Design (CRD) for one factor: the concentration of eggshell powder added to the egg-milk pudding. There were four levels of addition of eggshell powder, namely 0% (control), 2.5%, 5%, and 7.5% of the total ingredients used. The Friedman test analyzed Data from organoleptic tests and continued with further tests using the Wilcoxon Matched Sign Rank Test to see which pudding formulation was most preferred. Data on proximate content, % RDA values, and calcium content were analyzed using parametric statistical methods, namely Analysis of Variance (ANOVA), and continued with the Duncan Multiple Range Test (DMRT) for differences between formulations. Data were analyzed using SPSS software - version 26 for Windows.

2.1. Preparation of chicken eggshell powder

Processing eggshell powder began with washing, boiling for 30 minutes, and soaking in 0.5% lime solution for 3 hours. Next, drained and dried using an oven at 60°C for 3 hours. The dried eggshell powder was ground using a blender and sieved using an 80 mesh size. Next, the eggshell powder was subjected to a proximate test and stored in an airtight container at room temperature until ready to use [23].

2.2. Preparation of egg-milk pudding with the addition of chicken eggshell powder

Pudding processing began with mixing the ingredients, namely eggs (1.5%), milk (2.5%), sugar (0.35%), and vanillin (0.02%). Eggshell powder was added at three different concentration levels, namely 0% (F0=control), 2.5% (F1), 5% (F2), and 7.5% (F3). Next, the ingredients were poured into a 60 ml plastic cup with a net value of 14 grams and steamed over medium heat for 15 minutes. After cooking was complete, the pudding was drained and stored in the refrigerator before serving [24].

2.3. Nutrient content analysis

Nutrient content testing was carried out through proximate testing referring to Indonesian National Standards 01-2891:1992 [22], which included water content, ash content, fat and protein, carried out on eggshell powder and pudding for all formulations. Apart from that, calcium content was also tested using the Atomic Absorption Spectrophotometry (AAS) method.

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 11 November 2023
DOI: 10.47191/ijcsrr/V6-i11-43, Impact Factor: 6.789
IJCSRR @ 2023

2.4. Determination of RDA value

Determination of the % RDA was carried out based on proximate calculations concerning Recommended Dietary Allowances (RDA) and Nutrition Label Reference (NLR), each of which was stated in the Regulation of the Minister of Health of the Republic of Indonesia No. 28 of 2019 and Regulation of the Head of the Food and Drug Supervisory Agency of the Republic of Indonesia No. 9 of 2016. The % RDA value showed the percentage contribution of nutrients in one serving or serving size of pudding compared to the amount needed for these nutrients in a day.

2.5. Hedonic ranking test

The hedonic ranking test was carried out by 35 untrained panelists consisting of young women and housewives concerning Indonesian National Standards 01-2346-2006 [25]. Testing was carried out 1-2 hours after lunch, with the product served cold (after refrigerator storage). The hedonic rating test was used to measure the level of liking with four ordinal scales, namely immensely dislike (1), dislike (2), like (3), and very like (4).

3. RESULTS AND DISCUSSION

3.1. Eggshell Powder

The average consumption of purebred chicken eggs in Indonesia in 2022 will reach 2.336 kilograms (kg) per capita per week [11]. The high consumption of eggs would align with the amount of eggshell waste produced by households, food traders, the food industry, and even the tourism sector, such as hotels. The position of eggshells, previously only considered waste, had begun to shift with various efforts to utilize eggshells, one of which was processing them into powder. Processing eggshell waste into eggshell powder in this research had a yield value of 82.67%. The proximate test results for eggshell powder can be seen in Table I.

Table I. Proximate analysis of eggshell powder.

Parameter	Content (% w/b)
Water	0.81 ± 0.02
Ash	82.08 ± 0.01
Protein	4.14 ± 0.03
Fat	0.07 ± 0.01

The test results showed that the content of eggshell powder was dominated by ash content of 83.08%, which represented the availability of minerals in it. More than 95% of the mineral content in eggshell powder came from calcium, which was available in the form of calcium carbonate ($CaCO_3$) and calcium phosphate ($Ca(PO_4)_2$) [12]. The second largest part of eggshell powder was carbohydrates which were also known to contain a small portion of fiber (1.74%) [23]. Eggshell powder also contained protein, although the amount was not too high. On the other hand, the fat content in eggshell powder was relatively very low, namely only 0.07%. The proximate results of eggshell powder in this research were in accordance with the research results of Wijinindyah et al. [23] which stated that purebred chicken eggshell powder contained 82.92% ash, 3.53% protein, and 0.06% fat.

3.2. Nutrient Contents of Egg-Milk Pudding

Based on the statistical analysis results, the addition of eggshell powder significantly increased the nutritional content of pudding in all treatments with the concentration of eggshell powder added when compared with the control (0%). As listed in Table II, the nutrients that significantly increased were ash and calcium contents. If you looked at the proximate data for eggshell powder in Table I, the increase in ash and calcium content in egg-milk pudding with the addition of eggshell powder resulted from additional nutrients originating from eggshell powder. In this research, eggshell powder had a high ash content (82.08%). So, the more eggshell powder added, the higher the ash content in the pudding produced.

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 11 November 2023
DOI: 10.47191/ijcsrr/V6-i11-43, Impact Factor: 6.789
IJCSRR @ 2023

Table II. Nutritional content of egg-milk pudding.

Parameter	Formulations			
	F0 (0=control)	F1 (2.5%)	F2 (5%)	F3 (7.5%)
Calcium (mg/100 gr)	32.81 ± 0.00^{d}	436.32 ± 0.01^{c}	500.14 ± 0.00^{b}	563.92 ± 0.00^{a}
Ash content (% w/b)	0.70 ± 0.01^{d}	2.30 ± 0.02^{c}	2.58 ± 0.02^{b}	6.90 ± 0.03^{a}
Protein content (% w/b)	6.23 ± 0.03^{d}	6.50 ± 0.03^{c}	6.58 ± 0.02^{b}	7.55 ± 0.05^{a}
Fat content (% w/b)	3.14 ± 0.01^{c}	3.98 ± 0.02^{b}	4.19 ± 0.01^{a}	4.18 ± 0.02^{a}

Note: the same letter indicates that it is not significantly different based on the DMRT test with α=5%.

These results were in accordance with research by Novelina et al. [18], Younas et al. [19], and Merta [26], respectively found that the ash content in candy jelly, jelly, and chicken nuggets increased significantly as the concentration of eggshell powder was added. The ash content of a food indicated whether the minerals contained therein were low or high. The ash content in the F0 pudding formulation was only 0.70% and then increased as the concentration of eggshell powder was added.

The ash content from highest to lowest was produced respectively from pudding formulations F3, F2, F1, and F0. The pudding's ash level rose in direct proportion to the amount of eggshell powder used. This was because the amount of minerals contained in eggshell powder increased in line with the increase in the concentration or mass of added powder that contained minerals. The highest nutritional content in eggshell powder was the ash content which was dominated by calcium. This caused the calcium content in the pudding to increase as the concentration of eggshell powder was added, as listed in Table II. The highest calcium content was found in F3 pudding formulation, with a calcium content reaching 563.92 mg/100 gr. The results of this research were in accordance with data from other studies, which stated that the more eggshell powder was added, the higher the calcium contained in the final product produced [18] [19] [26].

3.3. RDA Value of Egg-Milk Pudding

Calcium plays a vital role to create muscles and bones, mineralize bone, and avoid osteoblast dysfunction which is required for bone remodelling or the creation of new bone components. Thus, monitoring calcium intake was essential for treating stunting. It has been found that toddlers with inadequate calcium intake are 3.6 times more likely to experience stunting than toddlers with enough calcium intake, which may cause problems for children's linear growth [13]. If one's calcium consumption was less than 77% of the Recommended Dietary Allowance (RDA), it was considered low. Because calcium intake is linked to getting ready for a future pregnancy, it should be taken into account for adolescent and adult women as well.

Among the other groups, the highest calcium consumption was needed by expectant moms and nursing mothers. According to Regulation of the Head of the Food and Drug Supervisory Agency of the Republic of Indonesia No. 9 of 2016 [27], the required daily intake of calcium for each age group was 200 mg for infants and young children, 250 mg for adults and adolescents, 650 mg for children and young adults, 1100 mg for teenagers and adults, and 1300 mg for nursing and pregnant women. Table III shows the results of the % RDA computation. For each 100 g of pudding, the best and lowest calcium RDA values were successively derived from pudding formulas F3, F2, F1, and F0. This result is consistent with the calcium analysis results in Table II, which indicated that the pudding formulations F3, F2, and F1 had the highest calcium contents in that order, and F0 had the lowest.

Table III. Calculation of RDA value of egg-milk pudding.

Formulations	RDA Value (%)											
	Age 7-11 months			*Age 1-3 years*			*General*			*Pregnant & nursing mothers*		
	Ca	Protein	Fat	Ca	Protein	Fat	Ca	Protein	Fat	Ca	Protein	Fat
F0 (control)	13	35	9	5	34	7	3	10	4	3	8	4
F1 (2.5%)	174	36	11	67	25	9	40	11	5	34	9	5
F2 (5%)	200	36	12	77	25	10	45	11	6	38	9	5
F3 (7.5)	225	42	12	87	29	10	51	13	6	43	10	5

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 11 November 2023
DOI: 10.47191/ijcsrr/V6-i11-43, Impact Factor: 6.789
IJCSRR @ 2023

According to the RDA, consuming egg-milk pudding with the addition of eggshell powder could assist all age groups in meeting their daily calcium requirements. The calcium content in this pudding did not exceed the daily calcium intake limit of 2500 mg, so it is still safe for consumption [24]. It is important to take into account the requirement for nutrients other than calcium because stunting was not caused by a single nutritional shortfall. From six months of age to adulthood, the daily needs for protein and fat are 18–76 g of protein and 36–87 g of fat [27]. Egg-milk pudding with the addition of eggshell powder contained a relatively small number of calories and % RDA of fat and protein. However, based on the suggested nutritional adequacy estimates, it might be able to fulfill a modest percentage of daily requirements for protein and fat.

3.4. Sensory Acceptability of Egg-Milk Pudding

Some panelists had infants or toddlers or were nursing mothers in this test, but there were no panelists who were pregnant. The pudding's degree of preference was assessed using the hedonic ranking test to ascertain which concentration of additional eggshell powder the panelists preferred. The amount of panelists' liking for pudding diminishes as eggshell powder is added, according to the data in Table IV. F0, F1, and F2 were the most favored pudding formulations, and they did not differ statistically from one another. F3 was the least desired recipe.

The explanation for this variation in the degree of like is provided by going over each sensory feature. The pudding's taste tended to becoming less sweet as the concentration of added eggshell powder increased during processing since granulated sugar was not added in tandem with the increasing eggshell powder addition. The panelists' preference for the F3 pudding formulation most likely decreased as a result of this. According to statistics, there was no statistically significant difference in the level of preference for the aroma between the F1 and F2 pudding formulations and the control (F0). It differed significantly from the F3 pudding recipe, though. The panelists found that the F1 and F2 pudding formulations' aroma was more tolerable due to the fishy scent of the eggs and eggshell powder.

Table IV. Hedonic ranking test results of egg-milk pudding.

Formulations	*Test results*				
	Flavor	**Aroma**	**Texture**	**Colour**	**Total**
F0 (control)	2.85 ^{a}	2.29 ^{a}	3.29 ^{a}	3.09 ^{a}	2.88 ^{a}
F1 (2.5%)	2.41 ^{bc}	2.09 ^{ab}	2.50 ^{b}	2.82 ^{a}	2.46 ^{b}
F2 (5%)	2.59 ^{ab}	2.15 ^{a}	2.38 ^{b}	2.82 ^{a}	2.48 ^{b}
F3 (7.5%)	2.29 ^{c}	1.74 ^{b}	2.38 ^{b}	2.79^{a}	1.97^{c}

Note: The same letter indicates that it is not significantly different based on the Wilcoxon Matched Sign Rank Test with α=5%. The scale shows very dislike (1-1.45), dislike (1.46-2.45), like (2.46-3.45), and very like (3.46-4.00)

The pudding's texture became tougher once the eggshell powder was added, deviating from the soft pudding's well-known nature. When compared to the control, this decreased the panelists' preference for the pudding texture in all pudding formulations with eggshell powder. This outcome was consistent with study by Rahmawati & Fitri [28], which found that panellists' preferences for the texture of cookies decreased when additional chicken eggshell powder was added. Nevertheless, statistical analysis revealed no variation in the degree of consistency preference across all pudding compositions when eggshell powder was included. The panelists believed that the F3 pudding formulation was their least favorite among the three, since it had the roughest and sandiest texture. Panelists chose the F1 and F2 pudding formulations above the F3 pudding formulation because they had a little softer texture.

There was no variation in the panelists' level of preference for pudding color as shown in Table III above because the addition of eggshell powder had no discernible impact on the panelists' color choice. Overall, all of the formulas generated pudding that was pale yellow in color. These outcomes were consistent with studies conducted by Rahmawati & Fitri [28], Safitri et al. [29], and Ardin et al. [30], which found that the organoleptic color quality of cookies, soy milk, and karasi cake was not significantly affected by the addition of eggshell powder.

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 11 November 2023
DOI: 10.47191/ijcsrr/V6-i11-43, Impact Factor: 6.789
IJCSRR @ 2023

4. CONCLUSION

When preparing egg-milk pudding, eggshell powder can be added to greatly boost the nutritional value of the finished product, particularly the calcium content. The most favored formulation was pudding containing 2.5% and 5% eggshell powder, while the least favored formulation was pudding containing 7.5% eggshell powder. Based on calcium content, pudding containing 5% eggshell powder has a higher calcium content than pudding containing 2.5% eggshell powder. This pudding's calcium content may help to reach the recommended daily calcium requirements. These results classify egg-milk pudding with eggshell powder as a nutrientdense food source of calcium that may be utilized to treat stunting. This fortified food was made for human consumption to meet their daily requirements for calcium. Further research is needed to analyze the absorption of calcium from this pudding product in vivo.

ACKNOWLEDGMENT

This research was funded by the Beginner Lecturer Research scheme - Institute of Research and Community Services, Siliwangi University in 2023.

REFERENCES

1. UNICEF, “The State of Children in Indonesia Trends, Opportunities and Challenges for Realizing Children’s Rights,” 2020. https://www.unicef.org/Indonesia/Reports/State-of-Children-in-Indonesia-2020
2. S. L. Munira, “Hasil Survei Status Gizi Indonesia (SSGI) 2022,” *Ministry of Health of the Republic of Indonesia*, 2023. https://ayosehat.kemkes.go.id/pub/files/files46531._MATERI_KABKPK_SOS_S SGI.pdf
3. A. Soliman *et al.*, “Early and long-term consequences of nutritional stunting: From childhood to adulthood,” *Acta Biomed.*, vol. 92, no. 1, pp. 1–12, 2021, [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7975963/
4. H. Alderman *et al.*, “Evidence of Impact of Interventions on Growth and Development during Early and Middle Childhood,” in *Child and Adolescent Health and Development*, Washington (DC): National Library of Medicine, 2017. doi: 10.1596/9781-4648-0423-6_ch7.
5. B. Grenov and K. F. Michaelsen, “Growth Components of Cow’s Milk: Emphasis on Effects in Undernourished Children,” *Food Nutr. Bull.*, vol. 39, no. 2S, pp. S45-S53., 2018.
6. M. Mahfuz, M. A. Alam, S. Das, and S. M. Fahim, “Daily Supplementation With Egg, Cow Milk, and Multiple Micronutrients Increases Linear Growth of Young Children with Short Stature,” *J. Nutr.*, pp. 394–403, 2019, doi:
7. 10.1093/jn/nxz253.
8. L. L. Iannotti, C. K. Lutter, C. P. Stewart, C. A. G. Riofrío, and C. Malo, “Eggs in Early Complementary Feeding and Child Growth: A Randomized Controlled Trial,” *Pediatrics*, vol. 140, no. 1, 2017, doi: 10.1542/peds.2016-3459.
9. S. M. Nachvak, O. Sadeghi, S. Moradi, A. Esmailzadeh, and R. Mostafai, “Food groups intake in relation to stunting among exceptional children,” *BMC Pediatr.*, vol. 20, no. 1, pp. 1 – 8, 2020, [Online]. Available: https://bmcpediatr.biomedcentral.com/articles/10.1186/s12887-020-02291-7
10. J. I. Baum, J. D. Miller, and B. L. Gaines, “The effect of egg supplementation on growth parameters in children participating in a school feeding program in rural Uganda: a pilot study,” *Food Nutr. Res.*, vol. 61, no. 1, 2017, doi: 10.1080/16546628.2017.1330097.
11. R. D. Semba *et al.*, “The association of serum choline with linear growth failure in young children from rural Malawi,” *Am. J. Clin. Nutr.*, vol. 104, no. 1, pp. 191 – 7, 2016, doi: 10.3945/ajcn.115.129684.
12. Badan Pusat Statistik, “Rata-rata Konsumsi Perkapita Seminggu Menurut Kelompok Telur dan Susu Per Kabupaten/kota (Satuan Komoditas),” *Badan Pusat Statistik*, 2022. https://www.bps.go.id/indicator/5/2099/1/rata-rata-konsumsiperkapitaseminggumenurut-kelompok-telur-dan-susu-per-kabupaten-kota.html
13. L. R. Brun, M. Lupo, D. A. Delorenzi, V. E. Di Loreto, and A. Rigalli, “Chicken eggshell as suitable calcium source at home,” *Int. J. Food Sci. Nutr.*, vol. 64, no. 6, pp. 740 – 743, 2013, doi: 10.3109/09637486.2013.787399.
14. E. M. Sari, M. Juffrie, N. Nurani, and M. N. Sitaresmi, “Asupan protein, kalsium dan fosfor pada anak stunting dan tidak stunting usia 24-59 bulan,” *J. Gizi Klin. Indones.*, vol. 2, no. 4, pp. 152–160, 2016, doi: 10.22146/ijcn.23111.
15. R. Ismawati, I. Romadhoni, and R. D. Soeyono, “Nutrition intake and causative factor of stunting among children aged under-5 years in Lamongan city,” *Enferm. Clin.*, vol. 30, no. S4, pp. 71–74, 2020, doi: 10.1016/j.enfcli.2019.10.043.

International Journal of Current Science Research and Review
ISSN: 2581-8341
Volume 06 Issue 11 November 2023
DOI: 10.47191/ijcsrr/V6-i11-43, Impact Factor: 6.789
IJCSRR @ 2023

16. A. T. Ramadhani, W. Fatmaningrum, and R. Irawan, "Correlation between protein, calcium and zinc intake with stunting in children age 3-5 years old in Gubeng, Mojo, Surabaya," *Heal. Nations*, vol. 3, no. 2, pp. 480–485, 2019.
17. D. D. K. Jayusman, E. Y. Aritonang, and Z. Lubis, "Comparison of Calcium and Iron Intake of Stunting and Non-Stunting Toddlers in Langkat Regency," *Int. J. Res. Rev.*, vol. 8, no. 1, pp. 2454–2237, 2021.
18. A. Omer, D. Mulualem, H. Classen, S. J. Whiting, and H. Vatanparast, "Promotion of Egg and Eggshell Powder Consumption on the Nutritional Status of Young Children in Ethiopia," *Int. J. Food Sci. Nutr. Res.*, vol. 1, no. 1, pp. 1–11, 2019.
19. N. Younas, A. I. Durrani, S. Rubab, A. Munawar, M. Batool, and A. Sheikh, "Formulation and Characterization of CalciumFortified Jelly and Its Proximate Composition and Sensory Analysis," *J. Oleo Sci.*, vol. 70, no. 6, pp. 849–854, 2021, doi: 10.5650/jos.ess21051.
20. N. Novelina, T. Anggraini, and L. N. Putri, "Characteristics of Jelly Candy made from Soybean Milk and Addition of Eggshell Powder," *AJARCDE (Asian J. Appl. Res. Community Dev. Empower.*, vol. 4, no. 1, pp. 41–47, 2020, doi: 10.29165/ajarcde.v4i1.37.
21. E. Zerek and N. Ersoy, "Determination of some nutritional and quality properties of eggshell powder added cookies: Properties of eggshell powder added cookies," J. Food Meas. Charact., vol. 16, no. 9, 2022, doi: 10.1007/s11694-02201419-w.
22. Shahnila, S. Arif, I. Pasha, H. Iftikhar, F. Mehak, and R. Sultana, "Effects of eggshell powder supplementation on nutritional and sensory attributes of biscuits," *Czech J. Food Sci.*, vol. 40., no. 1, pp. 26–32, 2020, doi: 10.17221/309/2020-CJFS.
23. Badan Standardisasi Nasional, "Standar Nasional Indonesia (SNI) 01-2891:1992 Cara uji makanan dan minuman.," 1992. A. Wijinindyah, J. Selvia, H. Chotimah, and S. E. Lumbangaol, "Potensi dan Karakteristik Bubuk Cangkang Telur yang Dibuat dengan Perendaman Asam Alami," *J. Peternak. Indones.*, vol. 25, no. 1, pp. 57 – 69, 2023.
24. T. D. Adfar, Y. Yensasnidar, and M. Murnawelis, "Pengaruh penambahan yogurt, telur, dan tepung kacang hijau (Phaseolus
25. Radiatus) terhadap uji organoleptik, kadar protein, kalsium dalam silky pudding sebagai makanan tambahan pada balita, *Darussalam Nutr. J.*, vol. 6, no. 2, pp. 63 – 71,2022, [Online]. Available: https://garuda.kemdikbud.go.id/documents/detail/3146703
26. "Standar Nasional Indonesia (SNI) 01-2346-2006 Petunjuk pengujian organoleptik dan atau sensori.," 2006. [Online]. Available:https://www.academia.edu/42337013/Standar_Nasional_Indonesia_Petunjuk_pengujian_organoleptik_dan_atau_sensori_ 67_240_Badan_Standardisasi_Nasional
27. M. G. W. Merta, N. M. Wartini, and I. M. Sugitha, "Karakteristik Nugget yang Difortifikasi Kalsium Tepung Cangkang Telur Ayam Ras," *Sci. J. Food Technol.*, vol. 7, no. 1, pp. 39–50, 2020, [Online]. Available: file:///C:/Users/laptop 5/Downloads/62590-1321-163431-1-10-20200730 (2).pdf
28. BPOM, *Peraturan Kepala Badan Pengawas Obat dan Makanan Republik Indonesia No 9 Tahun 2016 Tentang Acuan Label Gizi*. Indonesia, 2016. [Online]. Available: https://tabelgizi.pom.go.id/regulasi/4_Peraturan_Kepala_BPOM_Nomor_9_Tahun_2016_tentang_Acuan_Label_Gizi.pdf
29. W. A. Rahmawati and F. C. Nisa, "Fortifikasi Kalsium Cangkang Telur pada Pembuatan Cookies (Kajian Konsentrasi Tepung Cangkang Telur dan Baking Powder)," *J. Pangan dan Agroindustri*, vol. 3, no. 3, pp. 1050–1061, 2015.
30. A. I. Safitri, N. Muslihah, and S. Winarsih, "Kajian Penambahan Tepung Cangkang Telur Ayam Ras Terhadap Kadar Kalsium, Viskositas, dan Mutu Organoleptik Susu Kedelai," *Maj. Kesehat. FKUB*, vol. 1, no. 3, pp. 149–158, 2014, [Online]. Available: https://majalahfk.ub.ac.id/index.php/mkfkub/article/view/36
31. L. Ardin, L. Karimuna, and A. Pagala, "Fromulasi tepung cangkang telur dan tepung beras merah terhadap nilai kalsium dan organoleptik kue karasi," *J. Sains dan Teknol. Pangan*, vol. 4, no. 1, pp. 1892–1904, 2019, doi: http://dx.doi.org/10.33772/jstp.v4i1.5623.