# Analysis of the Effect of Potassium of Young Coconut Water Consumed by Pregnant Women in the Third Trimester on the Levels of Potassium Saliva of Mothers and the Newborn as well as Meconium Levels of Amniotic Fluid as an Indicator of Meconium Staining of Amniotic Fluid

**Tri Ratna Ariestini[1], Merryana Adriani[2], Windhu Purnomo[2], Shrimarti Rukmini Devy[2]**

*[1]Doctoral Program of Public health, Airlangga University, Department of Nursing, Health Polytechnic of Palangka Raya, [2]Faculty of Public Health, Airlangga University, Indonesia*

## Abstract

**Background:** Meconium staining of amniotic fluid harms newborns. Pregnant women in Palangka Raya City have the habit of consuming young coconut water to prevent the meconium staining of amniotic fluid. Young coconut water contains the highest mineral potassium. Potassium can affect the intestinal peristaltic.

**Objective:** Analyzing the effect of potassium of young coconut water consumed by pregnant women in the third trimester on the levels of potassium saliva of mothers and the newborn and meconium levels of amniotic fluid.

**Methods:** This study was a prospective cohort study of third-trimester pregnant women. The study sample was taken randomly, 24 pregnant women who consumed young coconut water and 24 who did not consume young coconut water.

**Results**: Potassium levels of young coconut water had a positive correlation with levels of maternal salivary potassium (b = 0,414, p = 0,000). Maternal salivary potassium levels had a negative correlation with meconium levels of amniotic fluid (b = -0,603, p = 0,000). Maternal salivary potassium levels through infant salivary potassium levels had a negative correlation with meconium levels of amniotic fluid (b= -0,205, p = 0,000).

**Conclusion**: Young coconut water consumed by pregnant women during the third trimester can prevent the meconium staining of amniotic fluid

***Keywords:*** *Potassium, young coconut water, pregnant women, meconium*

## Introduction

Meconium levels of amniotic fluid are an indicator of meconium staining of amniotic fluid (MSAF). The incidence of the MSAF base on ethnicity in the world is around 14% -29%[1]. The MSAF harms newborns[2]. Meconium aspiration syndrome causes the mortality rate of newborns to increase by 35%[3]. Babies accompanied by the MSAF are admitted to the neonatal intensive care unit (NICU) by 98.4% -100%[4].

Pregnant women in Palangka Raya City have the habit of consuming young coconut water (YCW) to prevent the MSAF. The YCW contains the main mineral the highest is potassium, amounting to 7300 mg per liter[5]. Potassium intake is necessary because the body

**Corresponding author:**
**Tri Ratna Ariestini**
Doctoral Program of Public health, Faculty of Public Health, Airlangga University, Mulyorejo, Surabaya, Indonesia.
E-mail: tri.ratna.ariestini-2017@fkm.unair.ac.id

cannot produce and store it[6]. It is necessary to prove the effect of young coconut water potassium on the potassium levels of the mother and baby as well as the meconium levels of amniotic fluid that is an indicator of the MSAF.

## Methods

This study was a cohort prospective study observational. The study locations were 10 health centers, namely Pahandut, Panarung, Bukit Hindu, Menteng, Kalampangan, Kereng Bangkirai, Kayon, Jekan Raya, Marina Permai and Tangkiling, in Palangka Raya City, Central Kalimantan, Indonesia. The population consisted of 40 third trimester pregnant women who consumed YCW and 38 pregnant women who did not consume YCW. The study sample was taken randomly, 24 from pregnant women who consumed YCW (YCW group) and 24 from mothers who did not drink YCW (control group). Data collection from 28 weeks of gestation until delivery or the third trimester (November 2019 to February 2020). The inclusion criteria were pregnant women who entered the third-trimester of pregnancy (28 weeks), the age of the pregnant women was 20-35 years. The exclusion criteria were Gemelli, intrauterine growth retardation (IUGR). The drop-out criteria were premature, intrauterine fetal death, placental insufficiency, malpresentation, prolonged labor, position abnormalities, premature rupture of membranes.

The potassium content of young coconut water was measured using the atomic absorption spectrophotometer method at the Uanir Pharmacy Laboratory. Daily intake of potassium levels was measured using the estimated food records method[7], photos of food sizes[8], NutriSurvey software. Maternal salivary potassium levels and newborn salivary potassium levels were measured using a cardy potassium meter[9]. The meconium level of amniotic fluid was measured using the meconium-crit method in the Biomedical Laboratory[10]. The statistical test of the data used path analysis with the help of multiple regressions.

## Results

**Table 1. Characteristics of respondents based on the YCW group and the control group**

| Variable | YCW Group | Control Group | p |
|---|---|---|---|
| YCW potassium levels consumed by pregnant women (mg/day) | 646, 79 ± 230,09 | - | |
| The potassium levels of daily intake of pregnant women (mg/day) | 1807,34 ± 434,80 | 1733,01 ± 423,46 | 0,551 |
| Potassium saliva levels of pregnant women (mmol/l) | 41,00 ± 6,78 | 27,50 ± 6,08 | 0,000* |
| the newborn salivary potassium levels (mmol/l) | 22,82 ± 5,03 | 15,14 ± 6,32 | 0,000* |
| Maternal amniotic fluid meconium level (%) | 3,75 ± 1,89 | 11,67 ± 6,03 | 0,000* |

The average YCW potassium level consumed by pregnant women in the third-trimester of the YCW group was about 1/3 of the daily intake potassium level. Daily intake of potassium levels in the two groups did not differ p> 0.05. The potassium level in the YCW group was 13.50 mmol/l higher than the control group. The potassium saliva level of the newborn in the YCW group was 7.68 mmol/l higher than the control group. As much as 29% of the potassium level in the control group was hypokalemia. The amniotic meconium level in the YCW group was 7.92% lower than the control group.

**Table 2. Effect of YCW Potassium Levels on Potassium Saliva Levels of Pregnant Women**

| Variable | b | p |
|---|---|---|
| YCW potassium levels | 0,699 | 0,000* |
| The potassium levels of daily intake | 0,360 | 0,000* |

YCW potassium levels after controlled for daily potassium levels had a positive correlation on salivary potassium levels in pregnant women ($p < 0.05$)

**Table 3. Effect of Potassium Saliva Levels of Pregnant Women on Potassium saliva levels of the newborn**

| Variable | b | p |
|---|---|---|
| Potassium Saliva Levels of Pregnant Women | 0,470 | 0,001 |

**Table 4. Effect of Potassium Saliva Levels of Pregnant Women through the newborn salivary potassium levels**

| Variabel | b | p |
|---|---|---|
| Potassium Saliva Levels of Pregnant Women | -0,603 | 0,000* |
| the newborn salivary potassium levels | -0,435 | 0,000* |

The direct effect of salivary potassium levels of pregnant women on meconium levels of amniotic fluid was -0.603. The indirect influence of salivary potassium levels of pregnant women through the newborn salivary potassium levels on meconium levels of amniotic fluid was the multiplication result of 0.470 x (-0.435) = (-0.205). The percentage of the contribution of the influence of the maternal salivary potassium and the newborn simultaneously on the amniotic fluid meconium levels was from the R Square value of 79.9%. Figure of the path analysis results was as follows.

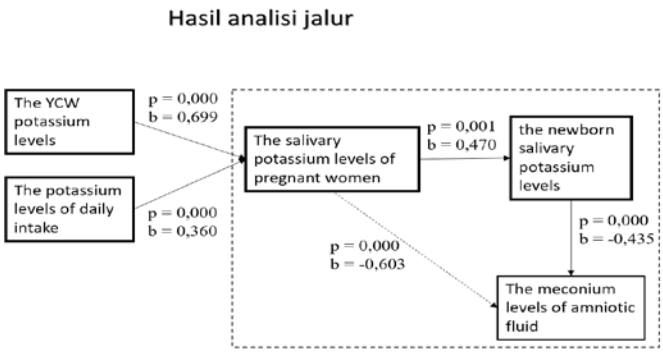


**Figure 1. The results of the path analysis**

YCW potassium levels after controlled for potassium levels of daily intake through the variable between mother and newborn salivary potassium levels had an effect on the meconium levels of amniotic fluid

## Discussion

After controlled for potassium levels of daily intake, YCM potassium increased maternal salivary potassium levels. The YCM was more easily and quickly absorbed by the body. The ease and speed of the YCW was absorbed by the body because of the factor composition, specific gravity, osmolarity, and homeostasis. The compound of YCW electrolytes was similar to electrolytes for body fluids. The major cation or electrolyte positive charge YCW and body fluids consist of potassium (K), calcium (Ca), magnesium (Mg), and

sodium (Na). The major anion or electrolyte negative charge of YCW and body fluids, namely chloride (Cl) and phosphate (PO4). Apart from the composition that caused YCW to be easily and quickly absorbed was its specific gravity. The YCW specific gravity was the same as the specific gravity of blood plasma, which was 1.020[11]. YCW had an osmolarity that corresponds to the osmolarity of blood. The YCW osmolarity was around 300 mOsm / kg, and the blood osmolarity is 280-330 mOsm/kg[12, 13]. Based on the homeostasis test YCW did not cause coagulation initiation even if half of the plasma was replaced with YCW fluid[14]. Evidence of young coconut water was easier and faster absorption in the body seen from several speed indicators such as the following study results. Young coconut water had the highest and fastest recovery rehydration index compared to drinking supplement[15], plain water[16], pocari sweat[17], watermelon and lemon juice[18]. Young coconut water was more able to maintain plasma volume than the drinking of supplement[19]. Young coconut water accelerates the recovery of the pulse better after exercise compared to mineral water and drinking of isotonic[20]

Maternal salivary potassium levels had the effect of increasing salivary potassium levels in newborns. Maternal potassium levels play a significant role as a relaxant and vasodilator of blood vessels, it facilitate the flow of uteroplacental blood to the fetus[21]. Every 30 peq/100 g per minute potassium release from the muscle causes a 5x increase in blood flow, this does not occur in hypokalemia[22]. In the third-trimester of pregnancy, the number of potassium channels increased in the smooth muscle of the uterus so increasing fetal oxygenation[23,24]. Infants born with hypoxia had the flow of potassium in the pulmonary artery smooth muscle was very little. Infants born with normoxia had a dramatic increase in pulmonary artery potassium channels[25].

Levels of potassium saliva for pregnant women through the newborn salivary potassium levels had the effect of reducing meconium levels of amniotic fluid. Potassium acts as a stabilizing force in the physiology of gastrointestinal movements[26]. The fetal gastrointestinal function began to approach normal in the third-trimester of pregnancy but was still inactive[6]. The results of study on 60 fetuses found that progressive potassium addition was highest in the pregnancy third trimester[27]. The current density of potassium in fetal colonic smooth muscle was very high inactivation was more persistent. The phenomenon inhibits the action potential and thereby delaying the activation of bowel movements[28]. The results of this study were 29.3% of newborns in the hypokalemia control group. Hypokalemia caused an incomplete repolarization process resulting in reentry, overloads of intracellular Ca2 +, causes colonic arrhythmias[29]. Hypokalemia also caused circulatory disorders, caused vasoconstriction, and increased intraluminal pressure from 10 to 60 to 100 mmHg[24]. Vascular vasoconstriction impedes the smooth flow of blood, leading to intestinal smooth muscle ischemia and gastrointestinal arrhythmias[30,31]. Colonic arrhythmias either caused by reentry events or intestinal smooth muscle ischemia due to potassium deficiency could lead to excretion of meconium in the amniotic fluid.

There was a direct effect of salivary potassium levels of pregnant women on meconium levels of amniotic fluid. The meconium content of amniotic fluid was the percentage of meconium (solute) deposits in the amniotic fluid (as a solvent)[10]. Maternal salivary potassium could affect the volume of amniotic fluid so affecting osmolarity. If osmolarity decreased (dilute solution) could reduce the meconium level of amniotic fluid. The amniotic fluid volume was strongly influenced by the movement in-out the amniotic space through the intramembrane[32]. Maternal hydration increased the volume of amniotic fluid, not because of increased fetal urine production but because of intramembranous fluid shifting[33,11]. Maternal salivary potassium promoted blood circulation, increased intramembranous flow, and affected the volume of amniotic fluid[21].

The levels of potassium saliva for pregnant women, both directly and indirectly, reduced the meconium level of amniotic fluid, which means that it prevented cloudy amniotic fluid. The influence of the mother and newborn saliva potassium on the amniotic fluid meconium level was 79.9%, meaning that there were other variables in addition to the variables examined in this study. Potassium from the electrolyte content of amniotic fluid needed to be considered in subsequent studies where in this study it had not been taken into account.

## Conclusion

Young coconut water consumed by pregnant women during the third trimester can prevent the meconium staining of amniotic fluid

**Ethical Clearance:** This study received a certificate of passing an ethical review (Ethical Approval) from the Faculty of Nursing Unair Number 1755-KEPK on August 14, 2019

**Conflict of Interest:** This study had no conflict of interest

**Source of Funding:** This study was conducted with individual funding.

## Reference

1. Balchin, I., Whittaker, J.C., Lamont, R.F., Steer, P.J. Maternal and Fetal Characteristics Associated with Meconium-Stained Amniotic Fluid. Obstetrics & Gynecology. 2011;117(4): 828-835.
2. Hutton, E.K, Thrope, J. (2014) Consequences of Meconium Stained Amniotic Fluid: What Does The Evidence Tell Us? Early Human Development. 2014;90(1):333–339.
3. Shaikh, E.M., Mehmood, S., Shaikh, M.A. Neonatal Outcome in Meconium Stained Amniotic Fluid-One Year Experience. J Pak Med Assoc. 2010;60(9):711-714.
4. Jeena, S., Singh., A., Arya, A. Perinatal Outcomes Associated with Meconium Stained Non Vigoroius Babies in A Tertiary Centre of Uttarakhand (India). Journal of Biomedical and Pharmaceutical Research. 2014;3(1):81-87.
5. Berlina, R. Potensi Buah Kelapa Muda Untuk Kesehatan dan Pengolahannya. J. Perfektif. 2004;3(2):46-60
6. Hall, J.E. Guyton & Hall; Texbook of Medical Physiology; Thirteenth Editon. International Edition; ISBN: 978-1-4557-7016-8; Copyright by Elsevier, Inc. All rights reserved. 2016
7. Supariasa, I.D.N., Bakri, I., Fajar, I. Penilaian Status Gizi. EGC. Jakarta.2012
8. Kementerian Kesehatan RI. Buku Foto Makanan Survei Konsumsi Makanan Individu. Badan Penelitian dan Pengembangan Kesehatan. 2014
9. Gangaiah, C., Ahmad, A.A., Nguyen, H.V., Radovich, T.J.K. (2016) A Correlation of Rapid Cardy Meter Sap Test and ICP Spectrometry of Dry Tissue for Measuring Potassium (K+) Concentrations in Pak Choi (Brassica Rapa Chinensis Group). Communications in Soil Science and Plant Analysis, 2016;47(17):2046–2052
10. Mokra, D., Calkovska, A., Drgova, A., Javorka, K. Surfactant Lung Lavage Using Asymmetric High-Frequency Jet Ventilation Followed By Conventional Ventilation in Rabbits With Meconium Aspiration. Britisl Lek Listy. 2005;106(12):412-415.
11. Flack, N.J., MD, Sepulveda, W., Bower, S., Fisk, N.M. Acute maternal hydration in third-trimester oligohydramnios: Effects on amniotic fluid volume, uteroplacental perfusion, and fetal blood flow and urine output. Am J Obstet Gynecol. 1995;173(4):1187-1191.
12. Prades, A. Coconut Water Use, Compositionband Properties: a review, Fruit J. 2012; 67:87-107.
13. Hatta, M., Susanto, H., Rahfilludin, M.Z. Perbandingan pemberian air kelapa muda (cocos nucifera l) dengan isotonik terhadap denyut nadi dan VO2maks atlet remaja. Jurnal Gizi Indonesia. 2016;4(2):71-81.
14. Pummer, S., Heil, P., Maleck, W., Petroianu, G. Influence of Coconut Water on Hemostasis. American Journal of Emergency Medicie. 2001;19(4):287 – 289.
15. Susilo, E.A. Pengaruh Konsumsi Air Kelapa Muda Terhadap Waktu Reaksi Setelah Melakukan Interval Training. Jurnal Kesehatan Olahraga. 2015;03(03):94-8.
16. Bahri, S., Sigit J.I., Apriantono, T., Sapriani, R., Dwita, L.P., Octaviar, Y.H., Penanganan Rehidrasi Setelah Olah Raga dengan Air kepala Muda, Air Kelapa Muda ditambah Gula Putih, Minuman Suplemen dan Air Putih. Jurnal matematika dan Sain. 2012;17(1):22-26.
17. Putra, A.D. Perbandingan Air Kelapa dan Pocari Sweat untuk Penanganan Rehidrasi Atlet Cabang Atletik Kabupaten Pangkep Setelah Latihan. Skripsi, Fakultas Ilmu Keolahragaan Universitas Negeri Makasar. 2019:1-15.
18. Zhaffran, I.F dan Pramono, B.A. Perbandingan Pengaruh Pemberian Air Kelapa, Jus Semangka dan Air Lemon Terhadap Tingkat Dehidrasi. Skripsi, Fakultas Ilmu Olah Raga. Universitas Negeri Surabaya. 2019;
19. Dwita, L.P., Amalia, l., Iwo, M.I., Bahri, S. Pengaruh Rehidrasi Menggunakan Air KelapaTerhadap

Stamina Atlit Dayung. Farmasain. 2015;2(5):229-233.

20. Nasution, A.P., Pengaruh Pemberian Air Kelapa Terhadap Denyut Nadi Pemulihan Paska Berolahraga. Jurnal Olahraga Prestasi. 2020;16(1):1-6.
21. Nakade, U.P., Sharma, A., Kumari, P., Bhatia, S., Nair., S.P., Karikaran, K.N., Sharma, V., Choudhury, S., Garg, S.T. Functional and Molecular Characterization of Endothelium-Dependent and Endothelium-Independent Relaxant Pathways in Uterine Artery of Non-Pregnant Buffaloes. Naunyn-Schmiedeberg's Archives of Pharmacology. 2020;399:225-241.
22. Knochel, J.P. Neuromuscular Manifestations of Electrolyte Disorders. The American Journal of Medicine. 1982;72(1):521-535.
23. Rosenfeld, C.R., Roy, T., DeSpain, K., Cox, B.E. Large-Conductance $Ca^{2+}$-Dependent $K^{+}$ Chanels Regulate Basar Uteroplacental Blood Flow in Ovine Pregnancy. J. Soc Gynecol Investing. 2005;12(6):402-408.
24. Corcoran, J., et al., 2008
25. Hong, Z., Weir, E.K., Varghese, A., Olschewski, A. Effect of Normoxia and Hypoxia on K Current and Resting Membrane Potential of Fetal Rabbit Pulmonary Artery Smooth Muscle. Physiol. Res. 2005; 54(1):175-184.
26. Heithmann, D., Warth, R. Physiology and Pathophysiology of Potassium Channels in Gastrointstinal Epithelia. Physiol Rev The American Physiological Society. 2008;88:119-1182
27. Bresson, J.L., Burlingame, B., Dean, T., Tait, S.F., Heinonen, M., Ernst, K.I.H., Mangelsdorf, I., McArdle, H., Naska, A. Berthold, M.N., Nowicka, G., Pentieva, K., Sanz, Y., Siani, Y., Sjödin, A., Stern, M., Tomé, D., Turck, D., Loveren, H.V., Vinceti, M., Willatts, W. Dietary Reference Values for potassium EFSA Panel on Dietetic Products, Nutrition and Allergies (NDA). EFSA Journal. 2016;14(10):1-59.
28. Xiong, Z., Sperelakis, N., Noffsinger, A., Preiser, C.F. Potassium Currents in Rat Colonic Smooth Muscle Cell and Changes During Development and Aging. Eur J Physiol.1995;430:563-572.
29. Lammers, W.J.E., Stephen, B., Karam, S.M. Functional Reentry and Circus Movement Arrhythmias in The Small Intestine Of Normal and Diabetic Rats. Am J Physiol Gastrointest Liver Physio. 2012;302:G684–G689.
30. Telezhkin, V., Goecks, T., Bonev, A.D., Osol, G., Gokina, N.I. Decreased Function of Voltage-Gated Potassium Channels Contributes to Augmented Myogenic Tone of Uterine Arteries in Late Pregnancy. Am J Physiol Heart Circ Physiol. 2008;294:272-284.
31. Irimia, A., Wikswo, J.P. Gastrointestinal Arrhythmias Are Associated With Statistically Significant Fluctuations in Systemic Information Dimension. Physiological Measurement. 2008;29:N33-N40.
32. Moore, T.R. Amniotic Fluid Dynamics Reflect Fetal and Maternal Health and Disease. Obstetrics & Gynecology. 2010;116(3):759-765.
33. Gizzo , S., Noventa , M., Vitagliano, A., Asta , A.D., Antona , D., Aldrich, C.J., Quaranta , M., Frusca , T., Patrelli, T.S. An Update on Maternal Hydration Strategies for Amniotic Fluid Improvement in Isolated Oligohydramnios and Normohydramnios: Evidence from a Systematic Review of Literature and Meta-Analysis. Plos one Journal. 2015;10(12):1-16.