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TABLE OF CONTENTS

RESEARCH ARTICLES

Effect of Physical Activity and Vitamin D Status on Geriatrics Obesity Rivan Virlando Suryadinata, Amelia Lorensia, Elisabeth Carolina Tangkilisan	1
The Effect of Mixed-Fruit Juice on Uterine Contractions and Cervical Dilatation During the First Stage of Delivery Bellia Loranthifolia Martasari, Wisnu Cahyadi, Gaga Irawan Nugraha, Farid Husin, Hadi Susiarno, Yudi Mulyana Hidayat, Mieke Hemiawati Satari	7
Community Knowledge and Behavior in the Utilization of Medicinal Plants in Cikoneng Village Bandung District Santun Bhukti Rahimah, Yuktiana Kharisma, Eka Nurhayati, Yuniarti, Shenny Dianathasari Santoso, Muhammad Faridza	15
Effectiveness of Various Mosquito Repellent Solutions Effectiveness to Control Mosquito Population Lia Faridah, Christian Albert, Nisa Fauziah	21
The Effect of <i>Kerokan</i> to Liver Function of Hepatitis B Patients Nur Adiba Hanum, Ismalayani, Rahmad Aswin Juliansyah, Syokumawena, Marta Pastari, Hanna Sari Widya Kusuma, Yukko Arinta	27
The Use Reproductive Health Game (KEPO Game) on Female Adolescent's Five Dimensions Satisfaction Sri Susilawati, Farid Husin, Firman Fuad Wirakusumah, Meita Damayanti, Herry Herman, Ruswana Anwar, Nanan Sekarwana	32
Prescription Writing Errors in Clinical Clerkship among Medical Students Raden Anita Indriyanti, Fajar Awalia Yulianto, Yuke Andriane	40
Effects of Metformin, Avocado Seed, and Diabetic Ingredients Infusion to Weight and Fasting Blood Glucose on Sucrose Diet Rats Diana Krisanti Jasaputra, Teresa Liliana Wargasetia, Elizabeth	46
Reproductive Health Problems in Adolescents in Banten Province Ismiyati, Udin Sabarudin, Tuti Wahmurti, Farid Husin, Susi Susanah, Deni Kurniadi Sunjaya	52
Primary Hippocampal Cell Culture and Its Application in Medical Researches Nur Atik, Alfya Nandika, Erda Avriyanti, Tryando Bhatara, Raden Angga Kartiwa	59
<i>Soygurt</i> Supernatant on the Cytotoxic Effect on Mouse Embryonic Fibroblast (MEF) Uci Ary Lantika, Astrid Feinisa Khairani	64
Validation of Patient Perception Instruments for Junior Doctor Performance: a Factor Analysis Mia Kusmiati, Rafidah Bahari, Noor Aini Abdul Hamid, Suhaila Sanip, Ova Emilia	71

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The result is the core of scientific writing. This section presents data and information that will be used as

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Discussion of the article reveals, explains, and discusses the results of the study with an analysis by the research design, interpretation, and explanation of its synthesis. Also, the results obtained are compared with the results of previous research of others.

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The conclusion is submitted by the results obtained by the researcher and written briefly and clearly in two or three sentences.

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All authors must make a formal statement at the time of submission indicating any potential conflict of interest that might constitute an embarrassment to any of the authors if it were not to be declared and were to emerge after publication. Such conflicts might include, but are not limited to, shareholding in or receipt of a grant or consultancy fee from a company whose product features in the submitted manuscript or which manufactures a competing product.

Acknowledgement

Acknowledgments should be provided to research contributors without writing a degree.

References

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A, Theodoridou MN, Roka V, Rachiotis G, et al. Association of treatment for bacterial meningitis with the development of sequelae. *Intern J Infect Dis*. 2013;17(9):e707–13.

Zhang B, Kunde D, Tristram S. Haemophilus haemolyticus is infrequently misidentified as Haemophilus influenzae in diagnostic specimens in Australia. *Diagn Microbiol Infect Dis*. 2014;80(4):272–3.

Books and Other Monographs

Editor as Author

Nriagu J, editor. *Encyclopedia of environmental health*. Michigan: Elsevier BV; 2011.

Organization as Author

World Health Organization (WHO). *Guideline: neonatal vitamin A supplementation*. Geneva: WHO Press; 2011.

Chapter in Book

Miller LG. Community-associated methicillin resistant *Staphylococcus aureus*. In: Weber JT, editor. *Antimicrobial resistance. Beyond the breakpoint*. Basel: Karger; 2010. p. 1–20.

Conference Proceeding

Nicholai T. Homeopathy. *Proceedings of the Workshop Alternative Medicines*; 2011 November 30; Brussels Belgium. Belgium: ENVI; 2011.

Journal Article from Internet

King P. Haemophilus influenzae and the lung (Haemophilus and the lung). *Clin Transl Med*. 2012;1:10 [cited 2015 August 15]. Available from: <https://clintransmed.springeropen.com/articles/10.1186/2001-1326-1-10>.

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RESEARCH ARTICLE

Effect of Physical Activity and Vitamin D Status on Geriatrics Obesity**Rivan Virlando Suryadinata,¹ Amelia Lorensia,² Elisabeth Carolina Tangkilisan²**¹Department of Public Health, Faculty of Medicine, ²Faculty of Pharmacy,
Universitas Surabaya, Surabaya, Indonesia**Abstract**

Vitamin D levels in the body are decreased in tropical countries. This may be due to a decrease in physical activity, age and obesity to be a risk factor for decreased vitamin D levels. This study aims to determine differences in the level of physical activity in geriatrics obesity and non-obesity to vitamin D. This research method is observational with case-control study design. The study was conducted at Public Health Center Taman, Sidoarjo district, East Java in March–July 2017. Geriatric were grouped into 2 groups of obese and non-obese by using body mass index (BMI) calculations. Respondents were given a questionnaire to assess the level of physical activity and vitamin D status. Furthermore, an assessment of physical activity and vitamin D status were performed on each respondent. The first questionnaire was given to 30 people for the validity test ($r > 0.361$) and reliability test (Cronbach alpha = 0.731). The results showed no significant differences in physical activity levels between the two groups (chi-square, $p = 0.883$). The assessment of vitamin D status can be seen as a significant difference (chi-square, $p = 0.042$). In conclusion, geriatrics with obesity and non-obesity had similar levels of physical activity, but vitamin D status in obesity tended to be lower than non-obese.

Key words: Geriatrics, obesity, physical activity, vitamin D**Pengaruh Aktivitas Fisik dan Status Vitamin D terhadap Obesitas Geriatri****Abstrak**

Kadar vitamin D dalam tubuh semakin menurun di negara yang beriklim tropis. Hal ini dapat disebabkan oleh penurunan aktivitas fisik, usia, dan obesitas menjadi faktor risiko penurunan kadar vitamin D. Penelitian ini bertujuan mengetahui perbedaan tingkat aktivitas fisik pada geriatri obesitas dan nonobesitas terhadap status vitamin D. Metode penelitian ini adalah observasional dengan desain penelitian kasus kontrol. Penelitian dilakukan di Puskesmas Taman, Kabupaten Sidoarjo, Jawa Timur pada bulan Maret–Juli 2017. Responden geriatri dilakukan penimbangan berat badan dan pengukuran tinggi badan untuk dikelompokkan menjadi 2 kelompok, yaitu kelompok obesitas dan nonobesitas dengan menggunakan perhitungan indeks massa tubuh (IMT). Responden diberikan kuesioner untuk menilai tingkat aktivitas fisik dan status vitamin D. Selanjutnya, dilakukan penilaian aktivitas fisik dan status vitamin D pada tiap-tiap responden. Kuesioner telah diberikan kepada 30 orang untuk dilakukan uji validitas ($r > 0,361$) dan uji reliabilitas (Cronbach alfa = 0,731). Hasil penelitian memperlihatkan tidak terdapat perbedaan tingkat aktivitas fisik yang signifikan antara kedua kelompok (chi-kuadrat, $p = 0,883$). Pada penilaian status vitamin D dapat terlihat perbedaan yang signifikan (chi-kuadrat, $p = 0,042$). Simpulan, geriatri dengan obesitas dan nonobesitas memiliki tingkat aktivitas fisik yang sama, sedangkan kadar vitamin D pada obesitas cenderung lebih rendah dibanding dengan nonobesitas.

Kata kunci: Aktivitas fisik, geriatri, obesitas, vitamin D

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Introduction

The decrease of vitamin D levels in society is increasing and is almost spread worldwide regardless of age, gender, origin, location, and food. The increasing rate of declining vitamin D levels not only occurs in developing countries but also in developed countries. Several developed countries in America, Europe, Australia, Africa, the Middle East, and South Asia are also affected. The highest number of vitamin D deficiency is mostly found in China, South America, India and the Middle East with a prevalence that varies from 30% to 100%.¹ The decreasing of vitamin D levels to below 20 µg/mL reaches 90.5% in the Malay ethnics while in the Chinese ethnics, it only reaches 55%.²

Various kinds of risks can be caused by vitamin D deficiency because the body's system does not work optimally, so that it will trigger various diseases. Vitamin D can also be categorized as an antioxidant, so free radicals that enter the body can be neutralized.³ Free radicals and antioxidant imbalances in the body can also increase the incidence of disease.⁴ Many diseases can result from vitamin D deficiency such as cardiovascular disease, diabetes, chronic kidney failure, and asthma.⁵⁻⁷

The cause of the decrease in vitamin D levels in the body is less sun exposure caused by various factors, namely obesity, age, and decreased physical activity.⁸⁻¹⁰ Weight gain may be associated with a decrease in vitamin D levels. It is probably because of the relation of vitamin D gene receptor (VDR) polymorphism which gives a difference in VDR expression so that it can inhibit adiposity differentiation and increase adipose mass. In addition, increased adiposity may lead to increasing levels of parathyroid hormone and changes calcium to adipocytes, which increases lipogenesis.¹¹ Another triggering factor is a decrease in the leptin hormone in obese patients because vitamin D is an important factor in producing leptin. Inhibition of leptin synthesis will result in increased appetite and obesity.⁸

Age factors can trigger a decrease in vitamin D levels. Physically, geriatrics are less mobile and have poor nutritional status. In addition, there are physiological processes that aggravate the decline in vitamin D levels in the body such as a decrease in vitamin D production in the skin after the exposure to sunlight caused by skin atrophy, eating foods that are low in vitamin

D, gastrointestinal absorption disorders, and a decrease in production 1,25(OH)₂D in kidney.⁹

Physical activity is also associated with a decrease in vitamin D levels. This is because the previous risk factors, namely age, and obsession, can directly affect the level of physical activity. Increased physical activity is related to the 25OHD increase caused by muscle movements during exercise. Physical activities carried out in the daily activities allow sufficient amounts of sunlight exposure to produce vitamin D.¹² This study aims to compare vitamin D status and physical activity using questionnaire so that it can predict the risk of vitamin D deficiency in obese geriatrics.

Methods

This research was an observational study with a case-control design. The study was conducted in the geriatric age group at Public Health Center Taman, Sidoarjo, East Java (No.: 070/5099/209.4/2017). The selection process was carried out according to the inclusion criteria in the elderly age group such as disability, kidney failure, consumption of anti-seizure drugs and visual impairments, while the exclusion criteria if the respondent resigns as a study sample.¹³

Geriatric respondents who have been interviewed will be divided into 2 groups: 52 obese people and 60 non-obese people by weighing and height measurement, to be assessed by calculating the body mass index (BMI). Sampling used was non-random sampling with purposive sampling technique with a significance level of 5% and a test strength of 95%. Then the two groups were given a question regarding physical activity and vitamin D status.

The physical activity questionnaire that will be used in this study is the International Physical Activity Questionnaire (IPAQ)¹⁴ and vitamin D status.¹⁵⁻¹⁷ The questionnaire has been tested for validity and reliability test on 30 homogeneous respondents with research respondents. Validity test is done based on the calculated r value (Corrected Item–Total Correlation) > r table. The r table is obtained from the product moment table with a significant level of 5%, if the r value > 0.361 so the question is declared valid. While the reliability test uses the Cronbach alpha correlation. Cronbach alpha value is said to be reliable if the questionnaire reliability test value is equal to or more than 0.6.

Physical activity categories divided into 3 groups, namely light physical activities (cleaning the house, shopping, doing yoga), moderate physical activities or physical activities which can only increase heart work (dancing, gardening, doing light exercise), and heavy physical activities or physical activities that can make breathing faster and increase the work of the heart (running, fast cycling, climbing, doing competitive sport).¹²

Data on physical activity and vitamin D status analyzed by using the chi-square test to see differences in physical activity and vitamin D status in the obese and non-obese geriatric groups.

Results

Characteristics of respondents in both groups were present in Table 1. It was seeing more women respondents than men in groups. 112 respondents were found 19 men (17%) and 93 women (83%), while 47 people aged 45–59 years (42%) found age, 50 people aged 60–66 years (45%), and 15 people aged > 70 years (13%).

The results of the value distribution of questionnaires about physical activity in both groups are present in Table 2. Level low of physical activity in the obesity group was 47

respondents (90%), and the non-obese group also shows a low level of physical activity that was equal to 54 respondents (92%).

The distribution results of the vitamin D status category are present in Table 3. Vitamin D status in the obese and non-obese groups was mostly in the deficiency category. The obesity group was 42 respondents (81%), while in the non-obese group there were 38 respondents (63%).

The results of data analysis by chi-square test in both groups on the level of physical activity are in Table 4 and vitamin D status in Table 5. Based on the results of data analysis with chi-square test showed the p value at the level of physical activity (Table 4) was 0.883 (p>0.05), while the value of vitamin D status (Table 5) showed p value=0.042 (p<0.05).

Discussion

Geriatrics is a natural aging process that is sure to happen to everyone. The aging process is accompanied by a decrease in physical activity, organ function and immune system and changes in diet. This results in geriatric susceptibility to disease.

Vitamin D is often called prohormones, which have 2 active forms of vitamin D2 (ergocalciferol)

Table 1 Distribution of Respondents Based on Gender and Age

Characteristics		Groups			
		Obesity (n=52)		Non-obesity (n=60)	
		Frequency	Percentage	Frequency	Percentage
Gender	Man	8	15	11	18
	Woman	44	85	49	82
Age (year)	45–59	21	40	26	43
	60–69	25	48	25	42
	>70	6	12	9	15

Table 2 Distribution of Levels of Physical Activity in Both Groups

Physical Activity	Groups			
	Obesity (n=52)		Non-obesity (n=60)	
	Frequency	Percentage	Frequency	Percentage
Low	47	90	54	92
Medium	4	8	4	5
High	1	2	2	3
Total	52	100	60	100

Table 3 Distribution of Vitamin D Status

Vitamin D Status	Groups			
	Obesity (n=52)		Non-obesity (n=60)	
	Frequency	Percentage	Frequency	Percentage
Deficiency	42	81	38	63
Non-deficiency	10	19	22	37
Total	52	100	60	100

Table 4 Chi-square Test Results of Physical Activity Level

Groups	Physical Activity			Total	Chi-square Test
	Low	Medium	High		
Obesity	47 (90%)	4 (8%)	1 (2%)	52 (100%)	p value=0.883 (p>0.05)
Non-obesity	54 (92%)	4 (5%)	2 (3%)	60 (100%)	
Total	101	8	3	112	

p<0.05=significant

Table 5 Chi-square Test Results of of Vitamin D Status

Groups	Vitamin D Status		Total	Chi-square Test
	Deficiency	Non-deficiency		
Obesity	42 (81%)	10 (19%)	52 (100%)	p value=0.042 (p<0.05)
Non-obesity	38 (63%)	22 (37%)	60 (100%)	
Total	80	32	112	

p<0.05=significant

and vitamin D₃ (cholecalciferol). Ergocalciferol comes from vegetable sources, while cholecalciferol is derived from animal sources, which is formed by ultraviolet B radiation at 7-dehydrocholesterol. Furthermore, vitamin D is converted into an active hormone so it can be used in mineral metabolism and physiological functions of the body. Vitamin D₂ and vitamin D₃ have the same potential.⁷

Vitamin D in humans serves to maintain serum calcium concentration and increase phosphorus absorption, but does not regulate phosphorus concentration in the blood but depends on renal excretion. Vitamin D in the form of 1,25(OH)₂D also works with parathyroid and calcitonin hormones to maintain calcium concentration in plasma within the normal range. This is done by adjusting the efficiency of the small intestine to absorb calcium from the diet, mobilizing calcium from the bones and tubular reabsorption of

calcium in the kidneys. Parathyroid hormones and 1,25(OH)₂D together stimulate osteoblasts to induce pre-osteoclast maturation into osteoclasts, thereby increasing bone resorption.^{7,18}

The physical activity is a body movement that results in greater energy expenditure than at rest. The physical activity carried out in the outside environment, with sun exposure, will provide an increase in vitamin D in the body.¹⁹

Vitamin D is one of the important vitamins in geriatrics because it has the ability to increase endurance. The main source of vitamin D is easy to obtain, which is through exposure to sunlight. However, several factors can inhibit the formation of vitamin D such as less physical activity and obesity.^{20,21}

The results show no difference between the level of physical activity in geriatric obesity and non-obesity. However, there were similarities between the two groups, most of which have a

low level of activity. Whereas in vitamin D status, there was a significant difference between the geriatric obesity group and the non-obesity, although most of the vitamin D status in both groups is in deficiency status.

Conclusion

Geriatrics with obesity and non-obesity had similar levels of physical activity, but vitamin D status in obesity tended to be lower than non-obese.

Conflict of Interest

The authors declare no conflict of interest.

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21. Fernandes MR, Barreto WDR Junior. Association between physical activity and vitamin D: a narrative literature review. *Rev Assoc Med Bras.* 2017;63(6):550–6.

Authors Index

A		Muhammad Faridza	15
Alfya Nandika	59		
Amelia Lorensia	1	N	
Astrid Feinisa Khairani	64	Nanan Sekarwana	32
		Nisa Fauziah	21
B		Noor Aini Abdul Hamid	71
Bellia Loranthifolia Martasari	7	Nur Adiba Hanum	27
		Nur Atik	59
C		O	
Christian Albert	21	Ova Emilia	71
D		R	
Deni Kurniadi Sunjaya	52	Raden Angga Kartiwa	59
Diana Krisanti Jasaputra	46	Raden Anita Indriyanti	40
E		Rafidah Bahari	71
Eka Nurhayati	15	Rahmad Aswin Juliansyah	27
Elisabeth Carolina Tangkilisan	1	Rivan Virlando Suryadinata	1
Elizabeth	46	Ruswana Anwar	32
Erda Avriyanti	59	S	
F		Santun Bhukti Rahimah	15
Fajar Awalia Yulianto	40	Shenny Dianathasari Santoso	15
Farid Husin	7, 32, 52	Sri Susilawati	32
Firman Fuad Wirakusumah	32	Suhaila Sanip	71
G		Susi Susanah	52
Gaga Irawan Nugraha	7	Syokumawena	27
H		T	
Hadi Susiarno	7	Teresa Liliana Wargasetia	46
Hanna Sari Widya Kusuma	27	Tryando Bhatara	59
Herry Herman	32	Tuti Wahmurti	52
I		U	
Ismalayani	27	Uci Ary Lantika	64
Ismiyati	52	Udin Sabarudin	52
L		W	
Lia Faridah	21	Wisnu Cahyadi	7
M		Y	
Marta Pastari	27	Yudi Mulyana Hidayat	7
Meita Damayanti	32	Yuke Andriane	40
Mia Kusmiati	71	Yukko Arinta	27
Mieke Hemiawati Satari	7	Yuktiana Kharisma	15
		Yuniarti	15

Subjects Index

A		M	
Adolescent	52–57	MEF cell	64–66, 68, 69
Avocado seed	46, 47, 50	Metformin	46–48, 50
B		Mixed-fruit juice	7–13
Behavioral	16, 17, 19	Mosquito population	21, 22
C		Mosquito repellent solution	21
Cell viability	64–66, 68, 69	N	
Cervical dilatation	7–13	Neuron	59–62
Cikoneng village	15–17, 19	O	
Clerkship	40–44	Obesity	1–5
Community	15–17, 19	P	
Construct	71, 72, 74, 76–78	Patient	71, 72, 74, 77, 78
D		Perception	15–17, 19
Diabetic ingredient	46, 47, 50	Performance	71, 72, 74, 77, 78
E		Physical activity	1–5
Effectiveness	21, 22, 25	Prescription	40–44
Error	40–44	Primary cell culture	60
Evaluation	71, 72, 74, 76–78	Psychometric	72
F		R	
Fasting blood glucose	46, 50	Reproductive health	52, 53, 55–57
G		S	
Geriatrics	1–5	Satisfaction	32, 33, 35–38
H		Sexuality	52, 54–56
Hepatitis B	27–30	SGOT	27–30
Herbal medicine	16, 17, 19	SGPT	27–30
Hippocampus	59, 60, 62	Soyghurt supernatant	64–66, 68, 69
K		U	
KEPO game	32, 35–38	Uterine contractions	7–10, 12, 13
<i>Kerokan</i>	27–30	V	
Knowledge	15–17, 19	Vitamin D	1–5
L		W	
Learning media	33, 35, 38	Weight	46–48, 50

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TABLE OF CONTENTS

RESEARCH ARTICLES

Effect of Physical Activity and Vitamin D Status on Geriatrics Obesity Rivan Virlando Suryadinata, Amelia Lorensia, Elisabeth Carolina Tangkilisan	1
The Effect of Mixed-Fruit Juice on Uterine Contractions and Cervical Dilatation During the First Stage of Delivery Bellia Loranthifolia Martasari, Wisnu Cahyadi, Gaga Irawan Nugraha, Farid Husin, Hadi Susiarno, Yudi Mulyana Hidayat, Mieke Hemiawati Satari	7
Community Knowledge and Behavior in the Utilization of Medicinal Plants in Cikoneng Village Bandung District Santun Bhekti Rahimah, Yuktiana Kharisma, Eka Nurhayati, Yuniarti, Shenny Dianathasari Santoso, Muhammad Faridza	15
Effectiveness of Various Mosquito Repellent Solutions Effectiveness to Control Mosquito Population Lia Faridah, Christian Albert, Nisa Fauziah	21
The Effect of <i>Kerokan</i> to Liver Function of Hepatitis B Patients Nur Adiba Hanum, Ismalayani, Rahmad Aswin Juliansyah, Syokumawena, Marta Pastari, Hanna Sari Widya Kusuma, Yukko Arinta	27
The Use Reproductive Health Game (KEPO Game) on Female Adolescent's Five Dimensions Satisfaction Sri Susilawati, Farid Husin, Firman Fuad Wirakusumah, Meita Damayanti, Herry Herman, Ruswana Anwar, Nanan Sekarwana	32
Prescription Writing Errors in Clinical Clerkship among Medical Students Raden Anita Indriyanti, Fajar Awalia Yulianto, Yuke Andriane	40
Effects of Metformin, Avocado Seed, and Diabetic Ingredients Infusion to Weight and Fasting Blood Glucose on Sucrose Diet Rats Diana Krisanti Jasaputra, Teresa Liliana Wargasetia, Elizabeth	46
Reproductive Health Problems in Adolescents in Banten Province Ismiyati, Udin Sabarudin, Tuti Wahmurti, Farid Husin, Susi Susanah, Deni Kurniadi Sunjaya	52
Primary Hippocampal Cell Culture and Its Application in Medical Researches Nur Atik, Alfya Nandika, Erda Avriyanti, Tryando Bhatara, Raden Angga Kartiwa	59
<i>Soygurt</i> Supernatant on the Cytotoxic Effect on Mouse Embryonic Fibroblast (MEF) Uci Ary Lantika, Astrid Feinisa Khairani	64
Validation of Patient Perception Instruments for Junior Doctor Performance: a Factor Analysis Mia Kusmiati, Rafidah Bahari, Noor Aini Abdul Hamid, Suhaila Sanip, Ova Emilia	71

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