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Research Article

Minimum Acceptable Diet and its Associated Factors among Children Aged 6–23 Months in Indonesia

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ABSTRACT

This study aimed to assess the fulfillment of the Minimum Dietary Diversity for children (MDD), the Minimum Meal Frequency (MMF), and the Minimum Acceptable Diet (MAD) and analyze the correlation between individual, socioeconomic, and demographic characteristics and the MAD in children between the ages of 6 and 23 months in Indonesia. This study used a cross-sectional study design. The subjects were 798 children between the ages of 6 and 23 months in Indonesia from a National Total Diet Study. The data collection on the MDD, the MMF, and the MAD used twenty-four-hour dietary recall. The chi-square and multiple logistic regression models were applied in this study with a p-value<0.05 considered significant predictors of outcome variables. The MDD, MMF, and MAD were met by 63.9%, 91.3%, and 61.8% of children, respectively. Significant positive relationships of child's age, mother's educational status, and area of residence (p<0.001) to the MAD. The determinants factors of MAD were the child's age (p<0.05; OR=7.06; 95% CI:3.46–14.38) and area of residence (p<0.05; OR=1.61; 95% CI:1.19–2.15). In conclusion, it is still necessary to improve the fulfillment of the MAD (a combined indicator of the MDD and the MMF). The government's role is to provide balanced nutritional child feeding programs based on local food, strengthen behavior change communication to meet nutritionally balanced complementary foods for children, and improve child nutrition services at *posyandu.*

INTRODUCTION

The age of 0–23 months, or a child's first 1,000 days of life, is a crucial time in their development when they must fulfill exclusive breastfeeding and complementary nutritious, adequate, safe feeding (WHO 2020). It is chiefly true with children ranging from 6 until 23 months of age who begin to require more nutrients other than breast milk and need additional complementary foods to meet the energy gap. Providing complementary food to meet nutritional needs indirectly affect changes in child's maturity process. According to the Indonesia Nutritional Status Study (Ministry of Health Republic of Indonesia (MoH RI) 2021), low proportions of children who were exclusively breastfed, began supplementary feeding at 6 months old and consumed a variety of foods (52%, 44.7%, and 52.5%, respectively). Non-fulfillment of complementary feeding will impact children's nutritional status, health status, and cognitive development into adulthood (Hasanah *et al.* 2020; Zhu *et al.* 2020).

Some of the indicators for assessing Infant and Young Children Feeding (IYCF) are simple, valid, and reliable for assessing, collecting, tabulating, and interpreting complementary feeding practices. The indicators are the Minimum Dietary Diversity for children (MDD), the Minimum Meal Frequency (MMF), and the Minimum Acceptable Diet (MAD). These three indicators evaluate complementary feeding techniques as easier and simpler (WHO & UNICEF 2021).

Research in Indonesia based on the Indonesia Demographic and Health Survey of 2012 and 2017 showed that the MDD among

provinces was met at around 39.3%, with West Sulawesi (3.67 types of food) and Yogyakarta (5.28 types of food) being the lowest in dietary diversity for children.

Other findings in Aceh showed that approximately 39% of children who received exclusive breastfeeding met the MMF at about 74%, the MDD at about 50%, and the MAD at about 40% (of 392 children aged 6 until 23 months) (Ahmad *et al.* 2019). Previously in 2018, only 28.6% of children met the MDD, 33.1% did the MMF, and around 23.4% did the MAD (of 154 children) in Aceh (Ahmad *et al.* 2018). These figures were still relatively low. It has been proven that the MDD, the MMF, and the MAD were still not evenly met. In addition, research on the factors that influence the MDD, the MMF, and the MAD in Indonesian children aged 6 until 23 months is still limited. Research should not be restricted to the rural or urban level. There is a need to conduct research assessing the MDD, the MMF, and the MAD, along with their influencing factors, at the state level.

This research is the first extensive study covering all regions in Indonesia using the Total Diet Study (TDS) and Individual Meal Consumption Survey (IFCS) data with a twenty-four-hour dietary recall. Collection of child consumption data with MDD, MMF, and MAD indicators can be determined using twenty-four-hour dietary recall (WHO 2010). In addition, this study analyzed the factors that could affect the MAD. Based on the description above, this study's objective was to determine the quality of the MAD (a combined indicator of the MDD and the MMF) and analyze the relationship of individual as well as socioeconomic and demographic characteristics to the MAD in children between the ages of 6 and 23 months.

METHODS

Design, location, and time

The research used a cross-sectional study design at one time and secondary data from the Total Diet Study (TDS) of 2014. The study was conducted in Indonesia, including 33 provinces, representing households with children in the ages range of 6 until 23 months. The subjects were 789 children between the ages of 6 and 23 months. This study used the total diet study data related to the individual twenty-four-hour dietary recall. This research had obtained ethical clearance from the Ethics Committee of the Health Research and Development Agency with a letter numbered LB.02.01/5.2/KE.189/2014. The ethical clearance was used to obtain qualification for research involvi ng humans and permission from the Ministry of Health of the Republic of Indonesia.

Sampling

Overall, the subjects totaling 817 children between the ages 6 and 23 months from the total diet study were grouped into two age groups, 6 until 11 months and 12 until 23 months. When performing a calculation of the minimum number of subjects (Lemeshow *et al.* 1997), the presumption was that 37% of children under the age of five previously met the MAD (including the MDD and the MMF) (IDHS 2012), with a confidence coefficient of 99% ($Z=2.58$ for $\alpha=0.05$) and a sampling error of 5% (0.05). Hence, the sample size needed was 354 children plus an estimated dropout of 10%, or 364 children. Meanwhile, this study used the whole subjects selected to meet the criteria, namely, about 798 of 817 children. The inclusion criteria in this study were children between the ages of 6 and 23 months whose food consumption was recorded with an individual twenty-four-hour dietary recall and children whose body weights (for age) were measured. The exclusion criteria in this study were children with incomplete individual twenty-four-hour dietary recall data and children whose biological status was ill during the twenty-four-hour dietary recall. Sampling method, inclusion, and exclusion criteria can be seen in Figure 1.

Data collection

The data collected in this study were individual characteristic variables, including the child's age, gender, birth order, and nutritional status, and socioeconomic and demographic

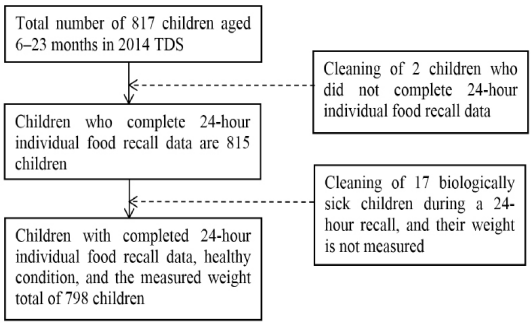

Figure 1. Sampling method, inclusion, and exclusion criteria

characteristic variables, including the mother's age, the mother's educational status, the mother's employment status, area of residence, and family size. The MDD variable was said to be fulfilled if breastfed children aged 6 until 23 months consumed foods of at least 5 of 8 food groups (with the eight MDD food groups for breastfed children being (1) breast milk; (2) grains and tubers; (3) legumes and beans; (4) dairy products; (5) meat foods (beef, fish, poultry, and liver/ organ); (6) eggs; (7) fruits and vegetables rich in vitamin A; and (8) other fruits and vegetables) and if non-breastfed children consumed foods of at least 4 of 7 food groups (excluding breast milk).

The MMF variable fulfillment was considered in the following way. The MMF was considered fulfilled if the meal frequency was 2 times (scored 1) and unfulfilled if the meal frequency was <2 times (scored 0) in breastfed children the age range of 6 until 8 months who should consume soft, semi-solid, or solid foods. The MMF was considered to be fulfilled if the meal frequency was 3 times (scored 1) and unfulfilled if the meal frequency was <3 times (scored 0) in breastfed children the age range of 9 until 23 months. The MMF was considered to be fulfilled if the consumption frequency was 4 times (scored 1) and unfulfilled if the consumption frequency was <4 times (scored 0) in non-breastfed children the age range of 6 until 23 months. .

The MAD variable was said to be fulfilled if breastfed children met the MDD and MMF or if non-breastfed children had a meal containing foods of at least four MDD food groups, met the MMF, and had a history of consuming breast milk at least 2 times.

Quality control of the data was carried out by checking the completeness of the data, selecting the subjects strictly, ensuring that the data represented the subjects being measured (representativeness), and selecting the data according to appropriate inclusion and exclusion criteria to minimize bias. In addition, we controlled for confounding variables through multivariate analysis.

Data analysis

Data processing included verification, coding, entry, cleaning, analysis, and interpretation. Bivariate analysis was conducted using chi-square for nominal data. Multivariate analysis used multiple logistic regression with SPSS version 22. Multivariate analysis was performed on the relationship between the MAD and individual, socioeconomic, and demographic characteristics. The correlation was considered significant if $p<0.05$. The odds ratio and 95% confidence interval were included.

RESULTS AND DISCUSSION

Individual, socioeconomic, and demographic characteristics. Individual characteristics were observed from the child's age, gender, birth order, and nutritional status, whereas socioeconomic and demographic characteristics were observed from the mother's age, the mother's educational status, the mother's employment status, area of residence, and family size. The distribution of data based on individual, socioeconomic, and demographic characteristics is provided in Table 1.

The data on individual characteristics showed that most children were between the ages of 12 and 23 months (93.7%), and the minority were aged 6–11 months (6.3%). Most of the children were male (54.4%), and some were female (45.6%). In terms of birth order, 36.2% of the children were second-born. Most of the children had a normal nutritional status (76.9%), but some children were found to be with an overweight nutritional status (11.7%) and an underweight nutritional status (8.9%).

The data on socioeconomic and demographic characteristics showed that most of the mothers were 20–30 years old (73.6%). The fact that most of the mothers (55.5%) had low education level means that they did not attend school, had not completed primary school, or completed education until primary and secondary school levels. In addition, most of the mothers were unemployed (61.6%), most of the children resided in urban environments (53.3%), and most of the families (52.8%) were of medium size (consisting of 5–7 people).

Minimum dietary diversity, minimum meal frequency, and minimum acceptable diet in children aged 6–23 months. Giving complementary foods gradually according to age was useful for identifying and evaluating nutrient intake during childhood development. The distribution of subjects according to the MDD, the MMF, and the MAD among breastfed and non-breastfed children is provided in Table 2.

This study found that 63.9% of children met the MDD median score 4. This rate is higher than

Table 1. Individual characteristics, socioeconomic, and demographic characteristics

Individual characteristics, socioeconomic, and demographic characteristics	Frequency (n)	Percentage (%)
Child's age		
6–11 months	50	6.3
12–23 months	748	93.7
Gender		
Male	434	54.4
Female	364	45.6
Birth order		
First	179	22.4
Second	289	36.2
Third	181	22.7
Fourth and so on	149	18.7
Nutritional status (weight for age)		
Severely underweight (<-3 SD)	20	2.5
Moderately underweight (-3 to<-2 SD)	71	8.9
Normal (-2 to+2 SD)	614	76.9
Overweight (≥+2 SD)	93	11.7
Mother's age[1]		
(<20 years old)	14	1.7
(20–35 years old)	587	73.6
(>35 years old)	197	24.7
Mother's educational status		
Low (No school, not completed primary school, or completed primary/secondary school)	443	55.5
High (High school graduate and college)	355	44.5
Mother's employment status		
Doesn't work	490	61.6
Work	308	38.6
Area of residence		
Rural	373	46.7
Urban	425	53.3
Family size		
≤4 people	300	37.6
5–7 people	421	52.8
≥8 people	77	9.6

SD: Standard Deviation

the rates found in studies conducted in Ethiopia, e.g., 18.8% in Arsi Negele Districts and 59.9% in Addis Ababa City (Beyene *et al.* 2015; Solomon *et al.* 2017). The MDD scores of children aged 6 until 11 months who were breastfed and not breastfed were around 12.5% (median score 3) and 38.8% (median score 3), respectively. Meanwhile, the MDD scores of children aged 12 until 23 months who were breastfed and not breastfed were 65.9% (median score 5) and 66.9% (median score 4), respectively. The scores of the latter were higher than those of the former. Breastfed children consumed a diet consisting of at least five food types on average, while non-breastfed children did a diet consisting of at least four food types. Children between the ages of 12 and 23 months were five times greater chance to fulfilling the MDD than children between the ages of 6 and 11 months (Sekartaji *et al.* 2021). The minimum dietary diversity fulfillment increased as children grew older and shifted to family diets (Keno *et al.* 2021). Non-breastfed children had higher MDD fulfillment than breastfed children. Non-breastfed children tended to be introduced

Table 2. Minimum dietary diversity, minimum meal frequency, and minimum acceptable diet in breastfed children and not breastfed children

Variable		n=798								Total	
		Breastfed children				Not breastfed Children					
		6–11		12–23		6–11		12–23			
		n	%	n	%	n	%	n	%	n	%
MDD											
	Unmeet	28	87.5	64	34.1	11	61	185	33	288	36.1
	Meet	4	12.5	124	65.9	7	38.8	375	66.9	510	63.9
MMF											
	Unmeet	3	9.4	4	2.1	4	22.2	58	10.4	69	8.6
	Meet	29	90.6	184	97.8	14	77.8	502	89.6	729	91.3
MAD											
	Unmeet	28	87.5	63	33.5	12	66.6	202	36.1	305	38.2
	Meet	4	12.5	125	66.5	6	33.3	358	63.9	493	61.8

MDD: Minimum Dietary Diversity; MMF: Minimum Meal Frequency; MAD: Minimum Acceptable Diet

to complementary and more varied foods to meet their nutritional needs. More varied feeding of children, earlier introduction to complementary foods and addition of formula milk could improve children's nutrition. Children in the ages range of 6 until 23 months who achieved the MDD were three or four times greater chance to adhere to the MMF than children who did not achieve the MDD (Mulaw *et al.* 2020).

Breastfed and non-breastfed children met the minimum meal frequency collectively at 91.3% (median score 6). This result is higher than the rates obtained by studies conducted in Ethiopia (11.9%) and Gambia (15%) (DHS 2021). Children in the ages range of 6 until 11 months who were breastfed and not breastfed met the MMF at 90.6% (median score 4) and 77.8% (median score 5), respectively, while children in the ages range of 12 until 23 months who were breastfed and not breastfed did at 97.8% (median score 6) and 89.6% (median score 7), respectively. This means that the latter outscored the former. On average, breastfed children had a meal frequency of 5 times, while non-breastfed children did 6 times. Children aged 12 up to 23 months were offered a wider food variety at an increased meal frequency in proportion to their nutritional needs based on their age of continued development. Children who consumed breast milk were seven or eight times greater chance to fulfill the MMF than those who did not (Wagris *et al.* 2019).

Meanwhile, the collective MAD fulfillment of breastfed and non-breastfed children was at 61.8%. This finding is higher than the rates obtained in Africa, e.g., 10.70% in Zimbabwe and 12.30% in Zambia (Gizaw & Tesfaye 2019; WHO 2020). The MAD adherence rate in breastfed children between the ages of 6 and 11 months was 12.5%, and it was 63% in non-breastfeeding children. Meanwhile, the MAD in children between the ages of 12 and 23 months who were breastfed and not breastfed was achieved at around 66.5% and 63.9%, respectively. On average, both breastfed and non-breastfed children met the MAD, with the MDD and MMF scores complying with recommendations. Non-breastfed children had higher MAD fulfillment than breastfed children. According to WHO recommendations, the difference was that non-breastfed children should consume milk (other than breast milk) at least twice a day. As a result, compliance with MAD scores had become more stringent (Khor *et al.* 2016). In this study, it is still considered necessary to improve the fulfillment of the MAD (a combined indicator of the MDD and the MMF). Although the child's meal frequency was relatively high, the minimum dietary diversity achievement was still low.

Correlation of individual, socioeconomic, and demographic characteristics with the MAD in children aged 6–23 months. In developing countries, the MAD has been used as one of the main indicators to evaluate the quality and adequacy of complementary feeding practices. The association between the MAD and individual, socioeconomic, and demographic characteristics is provided in Table 3.

Table 3. The association of individual characteristics, socioeconomic, and demographic characteristics with minimum acceptable diet

Individual characteristics, socioeconomic, and demographic characteristics	MAD						*p*
	Unmeet		Meet		Total		
	n	%	n	%	n	%	
Child's age							
6–11 months	40	80	10	20	50	6.3	0.000*
12–23 months	265	35.4	483	64.6	748	93.7	
Gender							
Male	163	37.6	271	62.4	434	54.4	0.674
Female	142	39	222	61	364	45.6	
Birth order							
First	66	36.9	113	63.1	179	22.4	0.105
Second	102	35.3	187	64.7	289	36.2	
Third	67	37	114	63	181	22.7	
Fourth and so on	70	47	79	53	149	18.7	
Nutritional status (weight for age)							
Severely underweight (<-3 SD)	8	40	12	60	20	2.5	0.801
Moderately underweight (-3 to<-2 SD)	29	40.8	42	59.2	71	8.9	
Normal (-2 to+1 SD)	229	37.3	385	62.7	614	76.9	
Overweight (≥+1 SD)	39	41.9	54	58.1	93	11.7	
Mother's age							
(<20 years old)	5	35.7	9	64.3	14	1.8	0.904
(20–35 years old)	227	38.7	360	61.3	587	73.6	
(>35 years old)	73	37.1	124	62.9	197	24.7	
Mother's educational status							
Low	186	42	257	58	443	55.5	0.014*
High	119	33.5	236	66.5	355	44.5	
Mother's employment status							
Doesn't work	178	36,3	312	63.7	490	61.4	0.165
Work	127	41.2	181	58.8	308	38.6	
Area of residence							
Rural	166	44.5	207	55.5	373	46.7	0.000*
Urban	139	32.7	286	67.3	425	53.3	
Family size							
≤4 people	110	36.7	190	63.3	300	37.6	0.241
5–7 people	159	37.8	262	62.2	421	52.8	
≥8 people	36	46.8	41	53.2	77	9.6	

MAD: Minimum Acceptable Diet; SD: Standard Deviation; *p<0.05 is consider significantly associated (chi-square test)

Results demonstrated a significant association between the child's age (p=0.000) and the MAD, meaning that the greater the child's age, the greater the fulfillment of the MAD. Children between the ages of 12 and 17 months had twice as high a chance, and those between the ages of 18 and 23 months had thrice, of achieving the MAD (Acharya *et al.* 2021). The mother's educational status and the MAD were positively associated in this study (p=0.014), meaning that the higher the mother's educational status, the higher the minimum diet acceptable to the child. Children whose parents had formal high school and college education were more probably to

have the MAD fulfilled than children with parents without formal education (Mulat *et al.* 2019).

It is also indicated that there was a highly significant link between area of residence (p=0.000) and the MAD. Children living in urban areas (67.3%) were higher in MAD fulfillment than those living in rural areas (55.5%). In other words, compared to children living in urban environments, children in rural environments were more susceptible to MAD non-fulfillment. Easier access to foods in urban areas and the availability of more diverse types of foods were attributable to such MAD fulfillment rate in urban areas (Ng *et al.* 2012).

On the other hand, birth order and the MAD had no significant correlation (p=0.105). Acharya *et al.* (2021) and Ali *et al.* (2021) revealed that children born in the second order had a higher probability of having the MAD fulfilled than children born in the first order. Nutritional status (p=0.801) and the MAD had an insignificant negative correlation. The food index may not be sensitive to chronic malnutrition because it is judged from twenty-four-hour dietary recall, which may not give a picture of a child's typical food intake, which could partly explain why the association is so low (Saaka *et al.* 2016). Family size and the MAD had an insignificant negative correlation too (p=0.241). Children with more than five family members had a lower chance of meeting the MAD (Guirindola *et al.* 2018).

There were non-significant correlations between gender (p=0.674) and the mother's employment status (p=0.165) and the MAD. Children with mothers who did not work (63.7%) were higher in MAD fulfillment than children with mothers who worked (58.8%), meaning that the proportion of minimum diet for children with working mothers was lower than children with mothers who did not work. Children whose mothers did not have a workload had a higher likelihood of receiving proper complementary eating, and thus better MAD fulfillment, than children whose mothers did (Yisak *et al.* 2020).

Determinant factors associated with the MAD. Factors that affected the MAD were encountered in children ranging from 6 until 23 months. Multiple logistic regression analysis is an approach for modeling the relationship between more than one independent variable and one dependent variable. If the result of multiple logistic regression analysis between the dependent and independent variables is lower than 0.05 ($p<0.05$), then the independent variable is significantly related to the dependent variable. Usually, a variable is selected for multivariate analysis if it has $p<0.25$. Thus, in this case, gender, nutritional status, and maternal age should not be selected. The selected independent variables were the child's age, the child's birth order, the mother's educational status, the mother's employment status, area of residence, and family size. Based on the final results of multiple logistic regression, the child's age and area of residence ($p<0.05$) were found to be the determinant of MAD.

Table 4 shows that one determinant factor for MAD was the child's age ($p<0.05$; OR=7.06; 95% CI:3.46–14.38). Children between the ages of 12 and 23 months were seven times greater chance than younger children to meet the MAD (6 to 11 months). As children grew older, the fulfillment of the MAD also increased. Toddler mothers' perceptions of the digestive condition of children who aren't ready to be given complementary foods with a solid or semi-solid textured are the cause of sub-optimal MAD fulfillment in younger children (Molla *et al.* 2021). This finding is consistent with that of

Table 4. Determinant factors associated with minimum acceptable diet

Variable	Minimum acceptable diet		OR (95% CI)	*p*
	Unmeet	Meet		
Child's age (months)				
6–11	40 (80)	10 (20)	1.00	
12–23	265 (35.4)	483 (64.6)	7.06 (3.46–14.38)	0.000*
Area of residence				
Rural	166 (44.5)	207 (55.5)	1.00	
Urban	139 (32.7)	286 (67.3)	1.61 (1.19–2.15)	0.002*

*p<0.05 as analyzed with multiple logistic regression; OR: Odds Ratio; CI: Confidence Interval

Tassew *et al.* (2019), who revealed that children between the ages of 18 and 23 months were 4 times higher likely to meet the MAD than younger children (6–8 months).

Another factor determining fulfillment of the MAD was area of residence ($p<0.05$; OR=1.61; 95% CI:1.19–2.15). Children living in urban areas had a one- or two-fold chance of meeting the MAD than children living in rural areas. Mothers living in urban areas found it easier to obtain information, available healthcare facilities, internet, television, newspapers, and other media exposures to increase their knowledge to practice good eating patterns (Teshome & Tadele 2022). Living in urban areas made it easier for mothers to access various foodstuffs in places such as markets, vegetable shops, and malls or find ready-to-eat foods in places such as restaurants, cafes, food stalls, bakeries, and urban food courts (Woldegebriel *et al.* 2020). This finding is consistent with those of Worku *et al.* (2022) and Birie *et al.* (2021), who stated that compared to children whose mothers resided in rural environments, children whose mothers resided in urban environments were five times higher likelihood of having the MAD fulfilled. Another finding is that rural children were more prone to experiencing low food diversity scores. Better equitable access is needed to reach food producers, utilize various types of locally available foods, use vegetable gardens, and increase mothers' knowledge in managing foods (dela Luna *et al.* 2020).

Strengths and limitations. This study has several limitations, one of which is twenty-four-hour recall data collection being only carried out for one meal. A twenty-four-hour recall based on the mother's memory had the potential for response bias, such as errors in remembering. The twenty-four-hour recall data collection time should be extended to two days or more to allow for accurate, precise description of the amount of food consumed by children. The use of secondary data was limited, leading to the use of what variables available. However, this study has an advantage in the use of large-scale data of representative subjects throughout Indonesia. This study provides an overview of information to the public, especially parents with children between the ages of 6 and 23 months, to increase awareness about giving complementary foods in greater diversity, frequency, and minimum adequacy of diet for children.

CONCLUSION

The research subjects were mainly children aged 12–23 months, male, second-born, and of average weight nutritional status. The majority of mothers were in the age range between 20 and 35 years, of low educational status, unemployed, resided in urban environments, and with medium family size (5–7 people). The percentages of children that met the MDD, the MMF, and the MAD were 63.9%, 91.3%, and about 61.8%, respectively. Several factors of individual and socioeconomic characteristics could affect the fulfillment of the minimum acceptable diet, namely, the child's age and area of residence ($p<0.05$). It is suggested for further research to use a more balanced proportion of sample units between children in the age range of 6 until 11 months and 12 until 23 months to evaluate the fulfillment of the MAD. The government's role is to provide balanced nutritional child feeding programs based on local food, strengthen behavior change communication to meet nutritionally balanced complementary foods for children, and improve child nutrition services at *posyandu.*

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DECLARATION OF CONFLICT OF INTERESTS

The authors assert to have no conflicts of interest.

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