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Original article

Willingness to change diet and exercise behavior is associated with better lifestyle in dialysis patients close to a kidney transplant

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SUMMARY

Background & aims: Evidence suggests that multiple-behavior interventions (with a specialist) have a greater impact on public health than single-behavior interventions, particularly in a chronic patient. However, there is little understanding of some very basic principles concerning multiple health behavior change, especially in situations such as kidney transplantation, which requires a great willingness to change negative lifestyle behaviors to achieve intermediate and long-term success. We compared healthy lifestyles and nutritional status according to the willingness to change dietary and exercise behavior in dialysis patients from a living donor kidney transplant program.

Methods: 400 dialysis patients had a dietetic, anthropometric, protein-energy wasting [subjective global assessment (SGA)] and biochemical evaluation. Lifestyle was evaluated with an adapted instrument to measure lifestyle in chronic disease. Willingness to change behaviors was evaluated by the trans-theoretical model; 2 groups were formed: willingness to change dietary and exercise behaviors and unwillingness to change.

Results: Willingness to change dietary behavior was 50% and exercise 25%. Patients with willingness to change dietary and exercise behaviors had better healthy lifestyle scores, and higher frequency of healthy food consumption. Healthy lifestyle score ($R^2 = 0.37$, $p < 0.0001$) was predicted by older age, higher educational degree, shorter time on dialysis, and the highest willingness to change dietary and exercise behaviors.

Conclusions: Willingness to change dietary and exercise behaviors was associated with healthy lifestyle, as well as with higher frequency of healthy food consumption and with lower frequency of unhealthy food consumption.

1. Introduction

Kidney transplantation is the preferred renal replacement therapy for end-stage renal disease (ESRD) patients because it offers the best quality of life and is economically advantageous compared to dialysis [1]. Patients with chronic dialysis close to kidney transplantation are subjected to a comprehensive medical, psychological and nutritional evaluation, in order to select the best candidates and decrease risks for morbidity and mortality, reduce medical costs and improve quality of life [2]. However, nutritional and metabolic complications [protein energy wasting (PEW), obesity, dyslipidemia, diabetes, hypertension] are frequent after transplantation, and represent some of the main concerns in long-term care, as they have implications on patient's outcomes. Therefore, modification of lifestyle is usually required in order to improve the perioperative and long-term outcomes of

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transplantation [3]. Unhealthy lifestyle habits reduce the treatment efficacy and may increase the risk of medical complications in dialysis and transplant patients. It has been repeatedly reported that dialysis patients had very poor adherence to dietetic recommendations [4] and exercise practice [5]; moreover, in the maintenance phase after transplantation, only 17% and 39% of patients adheres to salt and protein recommendations, respectively [6]. Therefore, dietary and exercise behaviors are considered as key components of healthy lifestyle.

There is an increasing need to ensure acceptance of personal responsibility or patient lifestyle, to attain empowerment to make the necessary changes, and to enable patients to maintain healthy behaviors once achieved. However, if the patient has not accepted his/her condition and does not have the will to change lifestyle, any progress made will not be kept in the long-term. The transtheoretical model (TTM) evaluates the individual's willingness to act on newer healthier behavior and offers change strategies or processes to guide the person through the stages of change to action and maintenance [7]. In general population, people who have no intention to engage in healthy behaviors are less likely to engage in desirable healthy lifestyles, such as a healthy diet or regular exercise, and applies the same to ESRD patients [8]. To our knowledge there are no studies evaluating the association between willingness to change and lifestyle in dialysis or transplant patients. Therefore, our objective was to compare healthy lifestyles according to the willingness to change dietary and exercise behavior in dialysis patients from a living donor kidney transplant program.

2. Methods

This is a cross-sectional study on ESRD patients of a Tertiary Care Teaching Hospital of the Mexican Institute of Social Security (IMSS) in the city of Guadalajara, Mexico. All patients were in the living donor kidney transplant program, and were included if they were on dialysis at least 6 months, >18 years old, with any cause of kidney disease and granted their verbal informed consent. Patients with a previous transplant were excluded. This study adheres to the Declaration of Helsinki and was approved by the Local Committee of Research and Ethics (No. R-2016-1301-95). Socio-demographical and clinical variables were obtained from interview and clinical files. Healthy lifestyles were evaluated by the self-administered Instrument to Measure Diabetic Lifestyles (IMEVID) questionnaire [9], which is made up of 25 items to evaluate seven domains: nutrition, physical activity, tobacco consumption, alcohol consumption, emotion management, disease knowledge, and therapeutic adherence. Each item has three possible response options (individualized for each domain), with ratings of 0, 2 and 4 points; total score is 0–100, the higher the score, the healthier the lifestyle. IMEVID questionnaire was first developed for diabetes mellitus patients; thus, the disease knowledge, emotion and adherence domains were modified to consider kidney disease instead of diabetes.

All patients had a nutritional evaluation, consisted on: subjective global assessment (SGA), dietary intake, anthropometric and biochemical measurements. Quantitative SGA evaluates weight loss, dietary intake, gastrointestinal symptoms, functional capacity, comorbidity, muscle and fat wasting; results are expressed in a score of 7–35 points, the higher the score, the worse the nutritional status [10]. Energy and nutrient intake were estimated by means of 3-day 24-h questionnaires (two days in the midweek and one weekend day), and was processed manually using reference charts from the Mexican Equivalent Food System [11]. Percentage of consumed calories and proteins was calculated and compared to the usual recommendations for hemodialysis and peritoneal dialysis patients [12]. Additionally, a food frequency questionnaire was performed in order to evaluate the intake of specific groups of foods; frequency intake answers were classified in a 6-points ordinal scale from 0 = never to 5 = daily; the higher the scale the more frequent the ingestion of the food group. Dry weight and height were measured to calculate body mass index (BMI). Biochemical parameters were measured in the Central Laboratory of Specialty Hospital, Western National Medical Center, Mexican Institute of Social Security, and included the following serum determinations measured by habitual techniques in a VITROS 950/950AT Chemistry System (Johnson & Johnson, Langhorne, PA, USA): creatinine, total cholesterol, triglycerides, glucose, electrolytes and hemoglobin. Serum albumin was determined by the green bromocresol method, and C-reactive protein (CRP) was measured using high-sensitivity kits (Dade Behring, Marburg, Germany) in a Nephelometer Analyzer II (Dade Behring).

Self-reported willingness to change was determined by selecting a TTM staging inventory that includes five statements reflecting the five stages of change [7]. TTM proposes that persons are at varying points of willingness (or readiness) to adopt a specified health-related practice and move about a sequence of stages along a continuum of behavioral change [13]. Participants select the statement that best describes their current behaviors on diet and exercise, from the following 5-points ordinal scale options: 1 = "I have not think about it" (precontemplation), 2 = "I am thinking about it" (contemplation), 3 = "I am planning to star on the next six months" (preparation), 4 = "I have started since six months ago" (action) and 5 = "I do it in a regular way on my life" (maintenance); the higher the score, the better willingness to change. For comparison purposes and considering that patients in precontemplation, contemplation and preparation are not taking action, all of them were classified as unwillingness to change dietary and exercise behavior, whereas patients in action and maintenance were grouped as willingness to change, similar as previously reported [14].

Statistical analysis. Data are shown as mean ± SD or median (25th to 75th percentiles) when dimensional variables had parametric or nonparametric distribution, respectively, or as percentage in the case of nominal variables. Comparisons between groups (willingness *vs* unwillingness to change) were performed by means of Student *t* test or Mann–Whitney U test for dimensional variables, as appropriate. In case of nominal variables, comparison analysis was done by means of χ^2 or Fisher exact tests, as appropriate. A correlation analysis was performed by means of Spearman test to analyze food frequency consumption and willingness to change dietary and exercise behavior. Cronbach's alpha was calculated to assure internal consistency of the modified lifestyle questionnaire (IMEVID), a value above 0.7 was considered as adequate. Finally, a linear multiple regression was used to predict healthy lifestyle score. A p value < 0.05 was accepted as significant.

3. Results

Four hundred ESRD patients on chronic dialysis were studied. In the whole sample, mean age was 28 ± 10 years, 280 (70%) were male, and 76% had an unknown cause of kidney disease. IMEVID lifestyle questionnaire had a Cronbach's alpha of 0.78, which confirmed internal consistency.

Distribution of stages of change according to TTM to modify dietary and exercise behaviors is shown in Fig. 1. Half the patients (n 202) were willing to change (in action and maintenance) dietary behavior, whereas only 20% (n 80) was willing to change exercise behavior.

Patients were classified according to the willingness to change dietary and exercise behaviors, and demographic, biochemical and nutritional factors were compared (Table 1). Although most of the

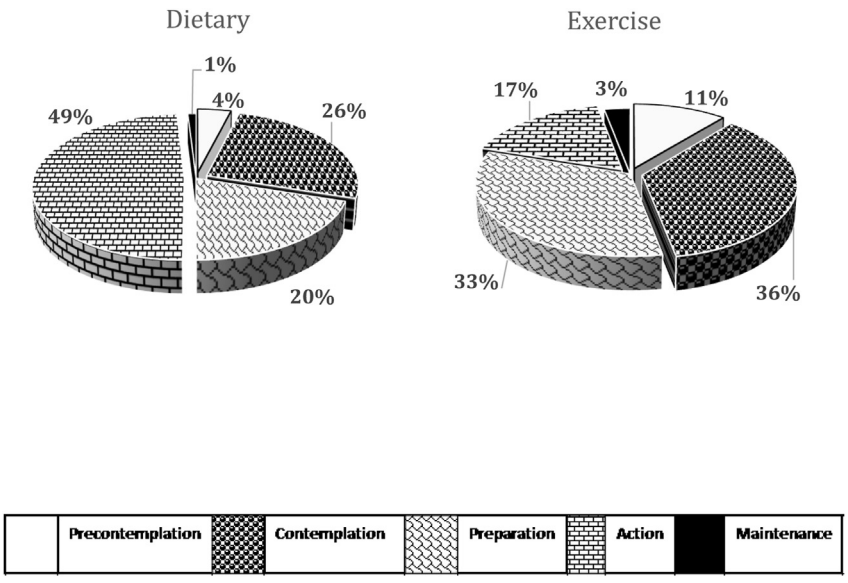

Fig. 1. Distribution of stage of change to modify dietary and exercise behaviors.

sample were men, percentage of women in the willingness to change dietary behavior group was higher compared to the unwillingness group, whereas the percentage of male sex was lower in the latter (77% willingness to change *vs* 63% unwillingness, $p = 0.003$). Patients willing to change dietary behavior were older, had lower levels of serum potassium and phosphorus, and lower score of SGA compared with those unwilling to change; additionally, they had higher levels of hemoglobin. Regarding exercise behavior, patients with willingness to change had higher levels of hemoglobin, and lower SGA score and serum potassium than those without willingness of change.

It was observed that patients willing to change their dietary behavior had higher score in almost all dimensions (diet, tobacco, alcohol, knowledge of disease, emotions, adherence), and consequently in the total score, compared to patients unwilling to change. On the other hand, patients willing to change their exercise behavior had a higher score in diet, physical activity, knowledge of the disease, and adherence dimensions, as well as in total evaluation, in comparison with patients unwilling to change (Table 2).

A correlation analysis was performed between the frequency of selected food consumption and the stage of change in diet and exercise behavior (Table 3). Frequency of healthy food consumption as vegetables and meats (chicken and fish) positively correlated with better diet behaviors (willingness to change). Pork and chicken consumption frequency was positively correlated with healthier exercise behavior.

Finally, in the linear multiple regression analysis (Table 4), a higher SGA score (PEW) was predicted by longer dialysis vintage,

Table 1
Comparison of demographic, biochemical and nutritional variables according to the group of willingness to change dietary and exercise behavior.

Variable	Dietary behavior		Exercise behavior	
	Unwillingness to change	Willingness to change	Unwillingness to change	Willingness to change
	N = 198	N = 202	N = 320	N = 80
Demographic data				
Age, years	26 ± 8	30 ± 11*	28 ± 10	30 ± 11
Female sex, n (%)	45 (23)	74 (37)*	90 (28)	29 (36)
Dialysis vintage, mo	31 ± 16	30 ± 18	30 ± 18	30 ± 17
Biochemical data				
Triglycerides, mg/dL	147 ± 71	151 ± 64	153 ± 71	133 ± 52
Cholesterol, mg/dL	171 ± 38	175 ± 35	174 ± 35	173 ± 42
Creatinine, mg/dL	11.3 ± 5	11.0 ± 4.2	11.4 ± 4.8	10.3 ± 3.8
Glucose, mg/dL	85 ± 11	84 ± 10	85.3 ± 10.5	84 ± 10
Hemoglobin, g/dL	10.3 ± 2.3	10.9 ± 2.1*	10.4 ± 2.3	11 ± 2.1*
Albumin, g/dL	3.8 ± 0.5	3.8 ± 0.5	3.9 ± 0.6	3.8 ± 0.6
CRP, mg/dL	3 (3–5.4)	3 (3–5.6)	3 (3–5.0)	3.4 (3–9.2)
Phosphorus, mg/dL	5.3 ± 1.8	4.8 ± 1.5*	5.0 ± 1.7	5.3 ± 1.4
Potassium, mEq/L	5.1 ± 0.8	4.8 ± 0.8*	5.0 ± 0.8	4.7 ± 0.8*
Nutritional status data				
Energy intake, n (%)[a]	104 (52)	117 (58)	182 (57)	39 (49)
Protein intake, n (%)[a]	124 (63)	134 (66)	214 (67)	44 (55)
BMI, kg/m^2	22.9 ± 4	23.1 ± 4.2	22.9 ± 4.2	23 ± 3.5
SGA score	15.6 ± 2.7	14.9 ± 2.8*	15.4 ± 2.6	14.2 ± 3.0*

HD, hemodialysis; CRP, C-reactive protein; BMI, body mass index; SGA, subjective global assessment; mo, months.
*$p < 0.05$ (Unwillingness to change vs willingness to change).
[a] Percentage of patients eating daily recommendation.

Table 2
Comparison of healthy lifestyle domains according to the dietary and exercise willingness of change.

IMEVID dimension	Max. score	Dietary behavior		Exercise behavior	
		Unwillingness to change	Willingness to change	Unwillingness to change	Willingness to change
		N = 198	N = 202	N = 320	N = 80
Diet	36	23.9 ± 5.1	27.8 ± 4.4*	25.5 ± 5.2	27.2 ± 4.8*
Physical activity	12	6.6 ± 3.3	6.4 ± 3.3	5.6 ± 3.0	10.0 ± 1.8*
Tobacco	8	7.6 ± 1.2	7.9 ± 0.5*	7.8 ± 0.8	7.6 ± 1.2
Alcohol	8	7.7 ± 0.9	7.9 ± 0.4*	7.8 ± 0.7	7.8 ± 0.7
Disease knowledge	8	5.9 ± 2.4	6.6 ± 1.8*	6.1 ± 2.2	6.9 ± 1.9*
Emotions	12	7.0 ± 3.8	7.8 ± 3.8*	7.3 ± 3.8	8 ± 3.9
Adherence	16	12.8 ± 2.9	15.5 ± 1.0*	14.0 ± 2.7	14.8 ± 1.8*
Total score	100	71.7 ± 10.4	80.1 ± 8.6*	74.3 ± 10.2	82.4 ± 9.0*

*$p < 0.05$ (Unwillingness to change vs willingness to change).

Table 3
Correlation between food consumption frequency[a] and willingness to change dietary and exercise lifestyles[b].

Dietary behavior			Exercise behavior		
Variable	r	*p*	Variable	r	*p*
Vegetables	0.32	<0.0001	Pork meat	0.21	0.001
Chicken	0.30	<0.0001	Chicken	0.32	<0.0001
Fish	0.23	<0.0001			
Legumes	−0.25	<0.0001			

[a] Food frequency was codified in a 6-points ordinal scale from 0 = never to 5 = daily; the higher the scale the more frequent the ingestion.
[b] Willingness of change was codified as 1 = precontemplation to 5 = maintenance, the higher the score the better behavior.

higher serum creatinine concentrations and worse dietary behavior. On the other hand, a healthier lifestyle score was predicted by older age, shorter dialysis vintage, and better exercise and dietary behavior.

4. Discussion

The willingness to change dietary behavior was associated with better nutritional status, (lower SGA scores) and healthy lifestyle behaviors (higher IMEVID scores) in dialysis patients close to kidney transplantation. PEW is very common in dialysis patients [15], and patients with pre-transplant PEW have a significant increased risk of anemia, graft loss, and cardiovascular and all-cause mortality after transplantation [16–18]. On the other hand, after transplantation, the well-being sensation, the improvements in dietary intake and the addition of the immunosuppressive drug effects, may increase the presence of obesity and metabolic disorders [19]. Obesity and metabolic syndrome, in turn, are associated with an increased risk for new onset diabetes [20], graft loss, cardiovascular and all-cause mortality [18,21,22]; additionally, obesity increases the risk of delayed graft function, acute rejection and surgical complications [22]. Therefore, nutritional status and healthy lifestyle in dialysis patients should be addressed in order to decrease the risk of post-transplant disorders. To the best of our knowledge this is the first study in dialysis patients close to kidney transplant that assessed readiness to change in dietary and exercise behaviors, and its association with nutritional and lifestyle data.

4.1. Lifestyle

As expected, patients willing to change diet behavior showed better scores of diet lifestyle subscale of IMEVID questionnaire in comparison with those unwilling to change (except the exercise domain). Regarding exercise, patients willing to change showed higher scores in diet, knowledge of disease, and adherence to treatment subscales, in comparison with patients unwilling to change. The latter findings could be explained because once patients changed or improved one lifestyle behavior, they may

Table 4
Linear multiple regression model predicting healthy lifestyle score and SGA.

Variable	Univariable analysis B (95% CI)	β	*p*	Multivariable analysis B (95% CI)	β	*p*
Wasting score (SGA)[a]						
Dialysis vintage (mo)	0.07 (0.05–0.08)	0.42	<0.0001	0.05 (0.03–0.08)	0.36	<0.0001
Dietary behavior	−0.34 (−0.61 to −0.08)	−0.13	0.01	−0.45 (−0.83 to −0.06)	−0.17	0.023
Serum creatinine (mg/dL)	0.11 (0.04–0.18)	0.19	0.002	0.12 (0.03–0.21)	0.20	0.01
Healthy lifestyle score (IMEVID)[b]						
Age (years)	0.24 (0.13–0.34)	0.22	<0.0001	0.25 (0.14–0.36)	0.24	<0.0001
Educational level (≥high school)	4.91 (2.9–6.9)	0.26	<0.0001	4.72 (2.77–6.66)	0.25	<0.0001
Dialysis vintage (mo)	−0.04 (−0.10 to 0.01)	−0.07	0.14	−0.07 (−0.13 to −0.01)	−0.12	0.02
Exercise behavior	3.55 (2.5–4.6)	0.31	<0.0001	2.50 (1.55–3.91)	0.22	<0.0001
Dietary behavior	3.85 (2.9–4.7)	0.39	<0.0001	2.88 (1.36–3.64)	0.29	<0.0001

Dietary and exercise willingness of change was codified as 1 = precontemplation to 5 = maintenance, the higher the score the better behavior.
[a] Multivariable model: $R^2 = 0.231$, $p < 0.0001$; Variables included: Age, sex, dialysis vintage, dialysis type, serum albumin, serum creatinine, CRP, body mass index, healthy lifestyle score, exercise and dietary behavior stage of change.
[b] Multivariable model: $R^2 = 0.370$, $p < 0.0001$; Variables included: Age, sex, educational level, dialysis vintage, dialysis type, CRP, subjective global assessment, exercise and dietary willingness of change.

increase confidence in their ability to overcome barriers and achieve healthy lifestyle, increasing the probability to change other unhealthy behavior [13]. Patients with high self-efficacy and confidence that they can perform healthy lifestyle activities and solve problems on their own, probably have more appropriate self-care behaviors [23].

Even though none of the groups reached the maximum score in lifestyle dimensions, those subjects with willingness to change dietary and exercise behaviors had a mean total score above 80, considered as adequate in previous studies using IMEVID in our setting [24]. On the other hand, in spite of healthcare team promotion of healthy dietary patterns, diet interventions in dialysis patients are very complex, and frequently require multiple dietary restrictions that should be individualized, making more difficult patients' understanding and adherence [25]. Probably, each dietary modification requires different approaches for effective modification. The low proportion of patients willing to change their exercise behavior may be related to the fact that exercise is not part of the standard clinical care, and it is associated with multiple barriers, such as lack of motivation, inadequate exercise equipment and training, fatigue, presence of multiple comorbidities and risks for complications and side effects, among others [26,27]. Probably, members of the healthcare team should have a more active role recommending physical activity.

4.2. Willingness to change

Patients willing to change their dietary behavior were older and more frequently women than those unwilling to change. It has been repeatedly shown in other studies, that women had better self-care behaviors than men, as well as people of older age [28]. Women role and responsibilities in housework (food selection and cooking), and care of family members have a positive influence in controlling their diet. We included patients on a protocol for living donor transplantation, the latter could explain the young age of patients; it would be valuable to evaluate willingness to change in an older dialysis population.

The willingness to change in dietary and exercise behaviors was associated with more frequently intake of healthy (vegetables) and rich-protein foods (pork, chicken, fish); additionally, those patients willing to change had better phosphorus and potassium control, which probably reflected a better food selection. A patient's willingness to take action for the control of their medical condition is a crucial component for successful self-management; it has been shown that patients with diabetes and the better readiness to change in dietary behavior had higher self-management practices, dietary problem-solving skills, diabetes knowledge and self-efficacy, and lower dietary barriers, than those who do not had willingness to change [29].

The linear multiple regression confirms that the better dietary behavior in these patients was associated with better nutritional status and lifestyle, which could be related to a better motivation and adherence to dietitian advice. Consistent with previous studies, nutritional status worsens as dialysis vintage was longer [30], but contradictory results were observed in creatinine as predictor of wasting; in the present study, inadequate protein source and/or adequacy of dialysis could not be ruled out.

On the other hand, the willing to change both behaviors (dietary and exercise) strongly predicted better lifestyle. This could be explained because, as previously mentioned, empowered patients with high self-efficacy could be more likely to change and improve several self-care activities once one of them was achieved [23]. Additionally, regression analysis showed that older age and shorter time on dialysis were associated with a better lifestyle score. The latter finding may be explained because patients starting dialysis might be more motivated to self-care and feel their selves next to kidney transplant, whereas those with a longer dialysis vintage could be more frequently disappointed with renal replacement treatment, and with a long time waiting a kidney transplant [31]. The finding of higher educational level predicting lifestyle score is concordant with previous studies showing that literacy related to understand basic information on health promotes behavior changes [32].

A patient's willingness to take action for the treatment of their health conditions is a crucial component for successful self-management. Assessment of the willingness to make changes is useful, first to understand why patients do not attend preventive or educative programs regarding behavior modification as diet and exercise, and second it helps to tailor messages, strategies and programs to individual needs, in order to effectively help patients to progress and reach goals in their own lifestyle [7] (i.e., patients unwillingness of change will be benefit of educational programs about risks of their current behavior and should be encouraged to do so through an action plan, and those who are already having a healthy lifestyle will benefit from positive feedback).

5. Conclusion

In conclusion, willingness to change diet and exercise behaviors was associated with better nutritional status and healthy lifestyle, as well as with higher frequency of healthy foods consumption and less intake of unhealthy ones. Willingness to change evaluation is important to recognize the healthy lifestyles non-adherence risk, and to design tailored strategies to increase motivation and enhance changes of negative lifestyle, in order to improve clinical outcomes and decrease complications during dialysis and after kidney transplantation.

5.1. Practice implications

It is necessary to evaluate whether a “stage-matched” individualized intervention according to the readiness to change can modify lifestyle behaviors over time, particularly in patients next to kidney transplant that will need to engage with multiple lifestyle changes and improve nutritional status to preserve kidney graft.

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Author contribution

Claudia N. Orozco-González, Contribution: Perform the idea, clinical examination, writing the paper, data analysis.

Laura Cortés-Sanabria, Contribution: Perform the idea, clinical examination, writing the paper, data analysis.

Roxana M. Marquez-Herrera, Contribution: Perform the idea, clinical examination, writing the paper, data analysis.

Fabiola Martín-del-Campo, Contribution: Perform the idea, clinical examination, writing the paper.

Erika F. Gómez-García, Contribution: Perform the idea, clinical examination, writing the paper.

Enrique Rojas-Campos, Contribution: Perform the idea, clinical examination, writing the paper.

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Declaration of competing interest

All the authors declare no conflict of interests.

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