

Polish Adaptation of the TOS Scale in the Adult Population and Comparison with the ORTO-15 Scale

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Abstract

Background

Orthorexia nervosa (ON) is a concept introduced in 1997. It is defined as excessive concentration on healthy eating. Orthorexia can lead to health loss and disrupt the psychosocial functioning of a person.

A significant and current research problem on nervous orthorexia is the lack of appropriate diagnostic tools. One of the promising tools for studying orthorexia behavior is the Teruel Orthorexia Scale (TOS). This scale allows distinguishing pathological orthorexia (*Ne*) from healthy orthorexia (*He*), defined as an interest in healthy eating free from psychopathology.

There are still no tools to measure orthorexia-related behavior with good psychometric properties. Therefore, this study aimed to adapt and validate Teruel Orthorexia Scale (TOS) in Poland.

Methods

The research involved the evaluation of 680 questionnaires collected in a group of adult Poles (18-68 years old). The research was conducted in the period from June 2019 to March 2020. The diagnostic survey method was used to collect the data. The study used the TOS scale translated into Polish and the Polish adaptation of the ORTO-15 scale. The obtained results were statistically analyzed. The validation procedure included three primary methods: assessment of the discriminant power, reliability, and validity of the tool compared to the ORTO-15 scale.

Results

Almost all items of the validated scale achieved a satisfactory value of discriminant power >0.3 . The individual TOS subscales were characterized by high reliability (TOS *He* = 0.87; TOS *Ne* = 0.78). The validity analysis of the validated tool consisting in correlating the obtained results with the results of the ORTO-15 questionnaire showed a significant correlation between the scales (healthy orthorexia $r = -0.36$; pathological orthorexia $r = -0.19$).

Conclusions

The Polish version of the TOS scale is a reliable and valuable tool for measuring orthorexia-related behavior in the Polish adult population.

Background

Global nutritional trends have changed significantly lately. Increasingly, people are reaching for food that has a beneficial effect on their health. Especially, more affluent people decide to choose products that are generally considered healthy [1]. Although these changes seem to be positive for public health, they may be associated with the risk of excessive concentration on healthy eating, referred to as orthorexia (ON) [2].

Orthorexia is most often defined as too much attention to choices related to eating restrictive avoidance of foods that are subjectively considered unhealthy. A person with ON can pay attention to the quality and origin of food and the form of storage and preparation of dishes, the way of eating meals, and even the type of food packaging materials. This excessive concentration on the nutritional process negatively affects the patient's functioning in society [3–5]. In extreme cases, orthorexia can lead to significant health loss and even threaten the patient's life [6].

Research into orthorexia has been going on for over 20 years. The number of publications on orthorexia is systematically increasing. Researchers most frequently use the ORTO-15 test to estimate the degree of orthorexia. However, more and more studies accuse it of over-diagnosing orthorexia and low psychometric value [7–11]. The ORTO-15 scale has also been criticized for insufficient internal consistency and fluctuations in the alpha-Cronbach value [12, 13]. In 2018, two Spanish researchers, Barrada and Roncero, developed the TOS (Teruel Orthorexia Scale) [14]. According to the authors' assumptions, this questionnaire allows distinguishing pathological orthorexia (unhealthy orthorexia) from healthy orthorexia, defined as an interest in healthy eating free from psychopathology. Moreover, it allows assessing the relationship with other psychological constructs and disorders theoretically related to orthorexia, such as eating disorder symptoms, obsessive-compulsive disorders, negative affect, and perfectionism [14–16]. The TOS tool consists of 17 items that can be answered on a 4-point scale (from "I do not agree at all" to "I entirely agree"). Despite the promising properties of this questionnaire, future research confirming its psychometric usefulness is needed [16]. Currently, the TOS questionnaire has been translated into German (Strahler et al., 2020), Portuguese [18], Arabic [19], and English [20]. To the best of the authors' knowledge, there was no Polish version of the TOS at the time of writing this article.

Methods

Participants and procedure

The research was conducted from June 2019 to March 2020 in a group of adult Poles. The research was approved by the Bioethics Committee of the Medical University of Lublin (consent number KE-0254/223/2019). The tests were carried out in accordance with the relevant guidelines / regulations. The diagnostic survey method was used to collect the data. The questionnaire was anonymous, and the respondents filled it in independently. The respondents agreed to participate in the research.

Seven hundred thirteen people participated in the study. After verification, 680 questionnaires were qualified for further analysis.

Research Tools

The TOS (Teruel Orthorexia Scale) was used for the research, which, with the consent of the authors, was translated into Polish by a translator, and then another translator performed a back-translation. After consulting a psychologist, the final version was established after comparing both versions. The

questionnaire was validated using the guidelines included in the document describing the translation and adaptation of WHO instruments [21]. The Polish adaptation of the TOS scale consisted of 17 statements. Individual questions in the TOS scale can be answered on a 5-point scale: where 1 means the statement "does not concern you at all," 5 – the statement "completely affects you," and 3 means a neutral attitude. The original version includes a 4-point response scale [14]. By adapting the scale to Polish, it was decided to expand the scale of responses by the so-called midpoint (neutral answer). Using a 4-point scale is to force the respondents to make an unambiguous declaration. Some researchers criticize the 4-point scale and recommend using a 5-point scale, which increases the reliability of the measurement [22, 23]. The English and Polish versions of the TOS scale are presented in Table 1.

The validated scale was divided into two subscales, written as TOS He (nine items) – healthy orthorexia, without a pathological carrier, and TOS Ne (eight items) – pathological orthorexia. The higher the score on both scales meant the higher the intensity of a given form of orthorexia. On the TOS Ne scale, position 10 was inverted. This result was re-coded for the needs of analyses. Due to the theoretical discrepancy between the two subscales, the overall score was calculated separately for TOS He and TOS Ne. The lowest possible result for TOS He is nine, and for TOS Ne – eight. The highest possible result in the TOS He subscale is 45, in the TOS Ne – 40.

Another tool used for the research was the ORTO-15 questionnaire in the Polish adaptation [24]. It consists of 15 questions. They can be answered on a 4-point scale: always, often, rarely, never. The responses indicating the risk of orthorexia behavior receive 1 point, and the answers corresponding to the correct attitude to food – 4. To diagnose the risk of orthorexia, a cut-off point of more than 35 points was adopted [7, 25–27]. In the original version of the ORTO-15 questionnaire, a cut-off point of 40 was suggested, but the latest studies show that the cut-off point of 35 allows limiting the possibility of overestimating the incidence of orthorexia [27, 28].

To assess the correct weight of the respondents, the BMI index was estimated.

Table 1
English and Polish versions of the TOS scale.

TOS' Items
<p>1. I feel good when I eat healthy food. Czuje się w zgodzie ze sobą, kiedy odżywiam się zdrowo.</p>
<p>2. I spend a lot of time buying, planning and/or preparing food so my diet will be as healthy as possible. Spędzam wiele czasu kupując, planując i/lub przygotowując jedzenie by moja dieta była tak zdrowa jak to możliwe.</p>
<p>3. I believe that the way I eat is healthier than that of most people. Wierzę, że jadam zdrowiej niż większość ludzi.</p>
<p>4. I feel guilty when I eat food that I do not consider healthy. Obwiniam się gdy jem rzeczy postrzegane jako niezdrowe.</p>
<p>5. My social relations have been negatively affected by my concern about eating healthy food. Moje przekonania dotyczące zdrowego jedzenia negatywnie wpłynęły na moje relacje z innymi.</p>
<p>6. My interest in healthy food is an important part of the way I am, of how I understand the world. Moje zainteresowanie zdrową żywnością jest ważną częścią tego kim jestem i jak rozumiem świat.</p>
<p>7. I'd rather eat a healthy food that is not very tasty than a good tasting food that isn't Healthy. Preferuję bardziej zjedzenie zdrowego posiłku, który nie jest bardzo smaczny, niż smacznego posiłku, który jest niezdrowy.</p>
<p>8. I mainly eat foods that I consider to be healthy. Głównie jem żywność, którą postrzegam za zdrową.</p>
<p>9. My concern with healthy eating takes up a lot of my time. Poświęcam wiele czasu na szukanie informacji o zdrowej żywności.</p>
<p>10. I am concerned about the possibility of eating unhealthy foods. Martwi mnie możliwość jedzenia niezdrowych rzeczy.</p>
<p>11. I don't mind spending more money on food if I think it is healthier. Nie przeszkadza mi wydawanie dużej ilości pieniędzy na produkty, które postrzegam za bardziej zdrowe od innych.</p>
<p>12. I feel overwhelmed or sad if I eat food that I consider unhealthy. Czuje się przygnębiony i smutny, jeśli zjem coś niezdrowego.</p>

TOS' Items
13. I prefer to eat a small quantity of healthy food rather than a lot of food that may not be healthy. Wolę raczej zjeść małą porcję zdrowego posiłku niż dużą porcję posiłku, który może być niezdrowy.
14. I avoid eating with people who do not share my ideas about healthy eating. Unikam jedzenie z osobami, które żywią się niezdrowo.
15. I try to convince people from my environment to follow my healthy eating habits. Staram się przekonać osoby w moim otoczeniu do podążania za moimi nawykami żywieniowymi.
16. If, at some point, I eat something that I consider unhealthy, I punish myself for it. Obwiniam siebie, gdy zjem coś, co postrzegam jako niezdrowe.
17. Thoughts about healthy eating do not let me concentrate on other tasks. Ciągłe myślenie o zdrowym jedzeniu nie pozwala mi skoncentrować się na wykonywaniu innych zadań.
TOS He = 1 + 2 + 3 + 6 + 7 + 8 + 11 + 13 + 15 TOS Ne = 4 + 5 + 9 + 10 + 12 + 14 + 16 + 17

Statistical analysis

The obtained data were statistically analyzed using IBM SPSS Statistics. The significance level of $\alpha = 0.05$ was adopted in the analyses. To assess the normality of distributions, analyses were carried out using the Shapiro-Wilk test, and the values of skewness, kurtosis, and standardized values were analyzed.

To adapt and validate the TOS questionnaire, the distribution of scores on both scales (TOS He and TOS Ne) and individual items' psychometric values were analyzed, and the external validity was verified. The discriminant power of each item was checked using the Pearson correlation coefficient r . The reliability of the questionnaires was assessed using Cronbach's alpha coefficient (α). Central tendency measures were determined for the TOS subscales. To assess the accuracy of the tools, they were correlated with another measure that tested a similar (assumed) construct – the ORTO-15 questionnaire. Depending on the normality of the distribution of variables, the Pearson r coefficient or the Kendall $tau-b$ coefficient was used.

Determination Of The Cut-off Point For The Tos Subscales

To determine the cut-off point for both subscales of TOS, the percentile distribution of the results was analyzed. The cut-off point in both cases was considered to be the 95th percentile [29, 30].

Results

The study group consisted of 680 people (80.3% were women). Most of the surveyed people were between 18 and 30 years of age (72.2%). The mean age in the group was $M = 28.01$ ($SD = 9.76$). The youngest person surveyed was 18 years old, and the oldest was 68. The most significant part of the group were people with higher education (43%) and, in turn, people undergoing studies (39%). The demographic data of the respondents are presented in Table 2.

The research estimated how the correct bodyweight of the respondents was shaped using the BMI index. Most of the examined people had an average body weight (65.7%), 18.1% were overweight. The percentage of underweight people was 11.2%.

Table 2. Characteristics of the research group.

Variable	Number of responses	N%
Women	546	80,3%
Male	134	19,7%
Age (year)		
18-30	491	72,2%
31-40	106	15,6%
41-50	47	6,9%
51-60	29	4,3%
>61	7	1,0%
Educational level		
College graduation	290	42,6%
During studies	262	38,5%
High school graduation	103	14,1%
Professional (vocational) school graduation	25	3,8%

Table 3. Characteristics of the studied group in terms of BMI.

Variable	Number of responses	N%
BMI		
Underweight	76	11,2%
Norm	447	65,7%
Overweight	123	18,1%
Obesity	34	5,0%

Scale validation results

The discriminant power of each item was verified relating to specific TOS subscales. Almost all items achieved a satisfactory value of discriminant power >0.3 (Table 4). Item 10 had too low discriminatory power, but it was decided not to remove it from further analyses.

Table 4. Correlation of each test item with the overall score of a given subscale - estimate of the discriminant power.

Item	Discriminating power	Item	Discriminating power	Item	Discriminating power
TOS He					
1	0,59	2	0,61	3	0,67
6	0,72	7	0,57	8	0,71
11	0,45	13	0,62	15	0,55
TOS Ne					
4	0,61	5	0,48	9	0,36
10*	0,05	12	0,64	14	0,54
16	0,64	17	0,57		

Annotation. The "*" symbol indicates items with a discriminatory power not higher than 0.3.

The subsequent step in the analysis was to test the reliability of both subscales and to detect any items that underestimated this reliability (Table 5). The TOS He scale obtained the reliability equal to 0.87 (high reliability), and the TOS Ne – 0.77 (good reliability). In the TOS He scale, no item lowered the reliability of the entire scale. In TOS Ne, the only test item lowering the full scale was item 10. In further research, it is worth considering removing or correcting the content of item 10.

Table 5. Reliability analysis of both subscales and subscales after removing each item.

Item	α after deleting an item	Item	α after deleting an item	Item	α after deleting an item
TOS He					
α for the entire subscale = 0.87					
1	0.86	2	0.86	3	0.85
6	0.85	7	0.86	8	0.85
11	0.87	13	0.86	15	0.86
TOS Ne					
α for the entire subscale = 0.78					
4	0.73	5	0.75	9	0.76
10*	0.82	12	0.72	14	0.74
16	0.72	17	0.74		

Annotation. Items that underestimated the reliability of the scale were marked with the symbol "*". α - Cronbach's alpha value.

It was also verified which test items in both subscales obtained the highest and the lowest mean responses. The results are shown in Table 6. The lowest mean response was observed in the TOS He scale for item 15. ("I am trying to convince people around me to follow my eating habits.") – 2.27. It means that the respondents somewhat disagreed with this statement. The test item on the TOS He scale with the highest average response was the first item ("I feel at peace with myself when I eat healthily.") – 3.91. The respondents claimed that this statement applied to them instead. The item with the lowest mean on the TOS Ne scale was item 17. ("Constantly thinking about healthy eating prevents me from concentrating on other tasks.") – 1.61. On average, the respondents disagreed with this statement. The highest average on the TOS Ne scale was achieved by position 10 ("I am worried about the possibility of eating unhealthy things.") – 2.73. It was a result located almost in the middle of the scale of answers, which means that, on average, the respondents neither disagreed nor agreed with this statement.

Table 6. Mean response to each statement in both TOS subscales.

Item	Average	Item	Average	Item	Average
TOS He					
1	3.91	2	2.73	3	3.08
6	2.77	7	2.82	8	3.46
11	2.90	13	3.16	15	2.27
TOS Ne					
4	2.46	5	1.63	9	2.58
10	2.73	12	2.17	14	1.95
16	2.17	17	1.61		

The distributions of the results of both TOS subscales were analyzed (Table 7). Due to the significant result of the Shapiro-Wilk test and the standardized kurtosis values for He and skewness for Ne greater than two ($z_{k1} = 2.42$ and $z_{s1} = 7.55$), it was decided to consider the distributions of both variables inconsistent with the normal ones. The mean response for He was 27.09 and for Ne 17.29. The minimum TOS He score was 9.00, and the maximum was 44.00. In TOS Ne, the minimum score was 8.00, and the maximum score was 40.00.

Table 7. Characteristics of each of the TOS subscales.

Subscale	<i>M</i> [CI]	<i>SD</i>	Min	Max	<i>S</i>	<i>K</i>	<i>W</i>	<i>p</i>
He	27.09 [26.50; 27.67]	7.77	9.00	44.00	-0.042	-0.453	0.990	< 0.001
Ne	17.29 [16.84; 17.74]	5.97	8.00	40.00	0.710	0.229	0.995	< 0.001

Annotation. CI - confidence intervals 95% (confidence intervals), Min - minimum result obtained, Max - maximum result obtained, S - skewness; K - kurtosis, W - value of the Shapiro-Wilk test statistic.

The mean result in the group of people with healthy orthorexia was 42.81, and in the group with unhealthy orthorexia - 31.94 (Table 8). None of the distributions were normal – p was <0.001 for all variables, values of skewness or kurtosis for people with healthy and unhealthy orthorexia were greater than one, and standardized kurtosis values for the group without healthy orthorexia ($z_k = 2.57$) and standardized skewness and kurtosis for the group without unhealthy orthorexia ($z_s = 3.19$, $z_k = -4.81$) exceeded the range from -2 to 2.

Table 8. Characteristics of the distribution of results in the group of people with and without healthy orthorexia, with and without unhealthy orthorexia.

Variable	<i>M</i> [<i>CI</i>]	<i>SD</i>	<i>Me</i>	<i>S</i>	<i>K</i>	<i>W</i>	<i>p</i>
Healthy orthorexia	42.81 [42.44; 43.20]	0.85	43.00	0.377	-1.540	0.770	< 0.001
Lack of healthy orthorexia	26.56 [26.00; 27.13]	7.34	27.00	-0.169	-0.488	0.987	< 0.001
Orthorexia nervosa	31.94 [30.76; 33.11]	3.20	31.00	1.031	0.009	0.842	< 0.001
Lack of orthorexia nervosa	16.59 [16.20; 16.99]	5.12	16.00	0.306	-0.924	0.961	< 0.001

Annotation. CI - confidence intervals 95% (confidence intervals), Me - median, S - skewness, K - kurtosis, W - Shapiro-Wilk test statistic value.

The authors of the Polish version of the TOS scale decided to set a cut-off point for both subscales of the TOS (Table 9). The cut-off point in both cases was considered to be the 95th percentile. People who scored more than 41 points on the TOS He scale were qualified to people with healthy orthorexia. People who scored more than 28 points on the TOS Ne scale were qualified to the group of people with unhealthy orthorexia. Half of the people had a TOS He result no greater than 27, and TOS Ne no greater than 16.

Table 9. Percentiles in the distribution of TOS scores.

Percentiles						
5	10	25	50	75	90	95
TOS He						
13.05	16.00	22.00	27.00	32.00	37.00	41.00
TOS Ne						
9.00	10.00	13.00	16.00	21.75	25.00	28.00

The last step of the analysis was to assess the tool's accuracy by correlating the results of both subscales with the ORTO-15 scale and its factors, which was treated as the so-called *gold standard*. All correlations, except for TOS Ne and the third factor of the ORTO-15 scale, turned out to be statistically significant. These were compounds with very weak (not exceeding 0.20) or weak (<0.40) strength, inversely proportional. It is consistent with the assumptions of both scales – higher results on the ORTO scale meant a lower risk of orthorexia, higher results on the TOS scale meant higher intensity of a given type of orthorexia. The most substantial relationship was observed for the TOS He and ORTO-15 scales –

τ - b = -0.36. The higher the severity of healthy orthorexia, the higher the risk of orthorexia as measured by ORTO-15 (Table 10).

Table 10. Validity analysis - correlation of the results obtained in TOS He and TOS Ne with the results obtained in ORTO-15 and with the given factors of this scale.

Variable	ORTO-15	Factor 1	Factor 2	Factor 3
TOS He	-0.36***	-0.33***	-0.12***	-0.24***
TOS Ne	-0.19***	-0.16***	-0.25***	-0.01

Annotation. *** $p < 0.001$.

Discussion

To the best of our knowledge, the Polish adaptation of the TOS scale has not been published so far. The obtained results allow us to consider the Polish adaptation of the TOS questionnaire as a reliable tool for identifying the phenomenon of orthorexia in the adult population. The discriminant power of individual items of the scale and its subscales was calculated. All items achieved a satisfactory value of discriminant power (> 0.3) except for statement 10 ("I am worried about the possibility of eating unhealthy food"), which had too low discriminant power. However, it was decided at this stage of the research not to remove it from further analysis, as the overall discriminatory power of the tool was satisfactory. Moreover, the statistical argument for the advisability of keeping all the questions is that the alpha statistic does not exceed the value of 0.9 [25]. In the original questionnaire version, the authors used a 4-point scale of answers, thus forcing the respondents to declare a positive or negative attitude to the statement. The authors of the Polish version decided to use a 5-point scale to enable the respondents to declare a "neutral" relationship, which, as some studies indicate, increases the reliability of the obtained results [22, 23].

To establish the cut-off point for both subscales, an analysis of the distribution of results was performed, assuming the 5% limit of the results ("fifth percentile") as significant, following the statistical canon of defining the predicted value by the method of analyzing the distribution of values in the population [25, 31, 32]. The cut-off point for TOS He is > 41 , and for TOS Ne > 28 points. The authors of the original version of the scale did not set a cut-off point [14].

A significant advantage of the TOS questionnaire is the distinction between two dimensions of orthorexia: healthy orthorexia (He) and pathological orthorexia (Ne). Both distinguished factors showed good reliability. The Cronbach's alpha coefficient was 0.87 for TOS He and 0.78 for TOS Ne. The reliability of the original version of the TOS questionnaire was 0.85 for healthy orthorexia and 0.83 for pathological [33]. In turn, the Arab adaptation reliability coefficient was 0.829 for TOS He and 0.853 for TOS Ne [19].

To assess the accuracy of the TOS scale adaptation, it was correlated with the ORTO-15 scale. The results indicated a significant correlation between the scales (healthy orthorexia $r = -0.36$; pathological orthorexia $r = -0.19$). In the studies by Barrad and Rancero [14], the correlation between the TOS and ORTO-15 scales for the factors examining healthy orthorexia was $r = -0.45$ and $r = -0.41$ for pathological orthorexia. The Arabic version of the TOS scale was compared with the equally popular tool for testing orthorexia, i.e., the DOS scale (Düsseldorf Orthorexia Scale) and the ORTO-R (Lebanese adaptation of the ORTO-15 scale). Higher DOS scores were significantly correlated with higher scores on the TOS Ne subscale ($r = 0.715$; $p < 0.001$) and with higher scores on the TOS He subscale ($r = 0.754$; $p < 0.001$). The same is true for the ORTO-R score; higher ORTO-R scores were significantly associated with a lower number of TOS Ne ($r = -0.437$; $p < 0.001$) and TOS He scores ($r = -0.305$; $p < 0.001$), respectively [19]. The literature analysis shows that the degree of orthorexia diagnosis in various studies using the TOS scale are similar [14, 34].

Limitations And Advantages Of The Conducted Research

The problem in researching orthorexia is the lack of a universal diagnostic tool that could be the so-called *gold standard*. In this study, the ORTO-15 questionnaire was used to assess the validity of the validated TOS scale. ORTO-15 is a tool that can lead to the over-diagnosis of orthorexia.

The work is innovative because it is an adaptation to the Polish conditions of a new tool for diagnosing orthorexia, the psychometric values of which are high, allowing for distinguishing between healthy and nervous orthorexia.

However, further research is recommended, considering various risk groups of orthorexia, to confirm the psychometric properties of this adaptation of the TOS scale.

Conclusions

Considering the limitations of the ORTO-15 questionnaire, which is still the most frequently used tool in research on orthorexia, the TOS scale is an important alternative. This questionnaire extends the diagnosis of orthorexia by two factors: healthy orthorexia and nervous orthorexia. Thanks to this, this scale may allow for a better understanding of the psychological aspects of orthorexia. The Polish adaptation of the TOS scale is a relatively short tool characterized by internal consistency, validity, and reliability.

Abbreviations

TOS - Toruel Ortorexia Scale

TOS Ne - subscale of the TOS scale, examining the severity of orthorexia referred to as nervous (pathological)

TOS He - subscale of the TOS scale, examining the severity of orthorexia referred to as healthy (non-pathological)

He - orthorexia described as healthy (non-pathological)

Ne - orthorexia defined as nervous (pathological)

Declarations

Acknowledgments

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Ethics approval and consent to participate

The consent for the research was issued by the Bioethics Committee of the Medical University of Lublin. Consent number KE-0254/223/2019.

All procedures were followed in accordance with the Helsinki Declaration. Before data were collected, all respondents were informed of the purpose of the study and informed consent was obtained. In addition, all participants were assured that their anonymity and confidentiality would be maintained and that they were entitled to drop out of the study at any time.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request. Raw data is part of a broader research and may only be provided upon reasonable request to protect the rights of the Authors.

Competing interests

The authors have no conflicts of interest to report.

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None.

Authors' contributions

MG prepared the questionnaires and the research plan. MS corrected and approved the research plan. MG conducted the research and analyzed the data. MG and MS formulated conclusions. MS consulted the

research at every stage. MG was a major contributor in writing the manuscript. All authors read and approved the final manuscript.

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