

## PEER REVIEW HISTORY

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### ARTICLE DETAILS

<b>TITLE (PROVISIONAL)</b>	Psychological distress mediates the association between daytime sleepiness and consumption of sweetened products: Cross-sectional findings in a Catholic Middle Eastern Canadian community
<b>AUTHORS</b>	Moubarac, Jean-Claude; Cargo, Margaret; Receveur, Olivier; Daniel, Mark

### VERSION 1 - REVIEW

<b>REVIEWER</b>	Mathieu Roy, Ph.D  Stagiaire postdoctoral (boursier des fonds de recherche du Québec-Santé)  Centre de recherche sur le vieillissement de l'Université de Sherbrooke (CDRV)  Centre de santé et de services sociaux - Institut universitaire de gériatrie de Sherbrooke (CSSS-IUGS)  I have no competing interest do declare
<b>REVIEW RETURNED</b>	21-Nov-2012

<b>THE STUDY</b>	There is no supplemental documents which contain information that should be better reported. The Tables in this manuscript are quite clear (with some minor revisions described below to take in account)
<b>GENERAL COMMENTS</b>	Dear authors,  Your original research paper entitled "Psychological distress mediates the associations between daytime sleepiness and consumption of sweetened products: Cross-sectional findings in a Catholic Middle Eastern Canadian Community" is interesting, well-written, and of public health relevance. Your article is furthermore conceptually and methodologically well-sound. It contains valuable and novel information regarding the field of eating behaviors as well as regarding the field of mental health among a migrant population. The mediation models investigated in your research were not intuitive for me. It was consequently very interesting to read your literature review and discussion. Finally, I was aware of very few nutritional studies in the Canadian Middle Eastern community. So again, I was pleased to read one.  My reviewer decision is to accept your paper with minor revisions. I think that your paper should be published in BMJ Open if you decide to consider the following comments in a revised version of your manuscript. As a consequence, I invite you to consider the following comments:  My detailed comments:

-Abstract

1) Conclusion section: Please include a sentence about future studies and future works in this area of research.

2) Key words: Are these key words are Mesh keywords? If not, it is possible to include some?

-Article focus

3) Second point: Please change “verify” alternative mediating models for “test” or “examine” alternative mediating models.

-Introduction

4) First paragraph (lines 4 to 6): When you talked about obesity in other ethnic groups in Canada, you mainly talked about Asiatic populations (Chinese, Japanese, and South Asians) with the exception of White. Is it possible to give proportions of obesity (or to inform the reader) about other Canadian ethnic groups? Is it also possible to better define the “White” construct? Does it refer to Canadian natives or it refers to another construct?

5) Page 6 (2nd paragraph, line 3): When you write: This mediating effect is supported in the literature for several of Baron and Kenny’s criteria to establish mediation. There are only 4 available criteria to establish mediation according to these authors. Maybe the term “several” is a little bit too strong. Please change the term “several” in this sentence.

6) Page 6 (2nd paragraph, line 6): I think you forgot to format a reference (Gaina, 2007). Please adjust this in consequence as well as all other references in the text.

7) Page 6 (last line of the page): Please change “report on” for “establish” or “estimate” or “assess”. I think these expressions are better suited to express your idea.

-Method

8) Page 7 (Last paragraph): Physical activity was assessed by asking the question “how many times per week do you exercise enough to sweat?”. Is it a continuous measure or did you categorize possible answers?

9) Page 8 (1st paragraph): Is it possible to inform the reader about the psychometric properties of the FFQ?

10) Page 8 (2nd paragraph): The high test-retest reliability of the EES was based on a period of what time? One week? Two weeks? One month?

11) Page 8 (2nd paragraph): Please give more information about the daytime sleepiness measure. It is an important measure to understand your results and discussion. What are the eight items of this measure? Does this variable refers to the total number of hours slept in one night or it also refers also to possible nap in the afternoon?

12) Page 8 (3rd paragraph): Is it possible to inform the reader about the psychometric properties of the K10?

13) Page 9 (all 1st paragraph): The information about the categorization of your variables should be placed in the Methods section of your manuscript when you described your measures.

14) Page 9 (Last paragraph, line 307): I think the first word of the line ("and") have to be removed.

#### -Results

15) To respect APA guidelines, you have to change "n" or "N" in parentheses for "n". The abbreviation "n" should be italicized as well as in small letters. Using a capital n such as (N) refers to all Catholic Middle Eastern Canadian and not to a subsample of this population. This is why the "n" should be in small letter.

16) Please define (SD) prior using this expression for the first time as (Standard Deviation (SD)).

17) Page 12 (1st paragraph): Please change "was not significant" for "was no longer significant".

#### -Discussion and Conclusion

18) Does the association between daytime sleepiness and psychological distress could be explained by quality of sleep? If an individual does not sleep well in the night, he or she will be more likely to fall asleep in the day. If it is the case, my hypothesis will be that his quality of sleep will also be associated with psychological distress rather than daytime sleepiness. Maybe you can discuss of this possibility in your discussion?

19) Page 15 (limitations): When you write on lines 5-6 (Second, study is based on self-reported subjective measures), you forgot to mention that it was also based on self-reported objectives measures such as height and weight.

#### -Tables

20) To respect APA guidelines, you have to change "n" or "N" in parentheses for "n". The abbreviation "n" should be italicized as well as in small letters. Using a capital n such as (N) refers to all Catholic Middle Eastern Canadian and not to a subsample of this population. This is why the "n" should be in small letter.

21) In the legend under table 1, it is written (T-test performed for sex). I'm not able to see where you performed those T-test. You do not talk about t-test in the analysis section of your paper.

22) Table 2: What is the unadjusted model? If it is the association between daytime sleepiness and daily sugar intake, why the  $P = 0.04$  is different from table ( $p = 0.03$ )?

#### -Overall comment (not related to any section)

	<p>23) Throughout the entire manuscript, you are talking about a partial mediation “partially mediated. I thought that a partial mediation using Baron &amp; Kenny procedures to establish mediation was when the association between the independent and dependent variables was still significant with the inclusion of the mediator. In your case (as your Table 2 shown), this association was no longer significant when you adjust the association for psychological distress. So, according to my knowledge, I thought it was a complete mediation rather than a partial mediation.... Please verify this point and adjust your manuscript in consequence.</p>
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<b>REVIEWER</b>	<p>Alexandros N. Vgontzas, Professor of Psychiatry, Penn State, Hershey, PA, 17033, USA</p> <p>I have not competing interests</p>
<b>REVIEW RETURNED</b>	15-Dec-2012

<b>THE STUDY</b>	There is lack of objective measurements that limit the studied associations
<b>GENERAL COMMENTS</b>	<p>Mubarac et al, test the hypothesis that psychological distress mediates the association of subjective daytime sleepiness with consumption of sugary food. This study is interesting in terms of novelty and sound in terms of statistical approach of the proposed mediation model, however there are some major concerns:</p> <ol style="list-style-type: none"> <li>1. This study is limited by the small sample size and by the lack of important data known to be associated with excessive daytime sleepiness, i.e. subjective and objective sleep variables, respiratory data, objectively measured anthropometric data. Addition of these variables in the described model could have significantly altered the results and thus the reliability of the current findings is questionable.</li> <li>2. Body Mass Index (BMI) has been shown to correlate with sleepiness, psychological distress and sugar consumption but in the current study such associations were not confirmed. Is there any explanation for this discrepancy? Could it be attributed to the major limitation stated above, i.e. the absence of objectively measured data?</li> <li>3. Psychological distress was assessed using the Kessler Psychological Distress Scale (K10) and was found to be significantly associated with daytime sleepiness. <ol style="list-style-type: none"> <li>a. First, the item #1 of the questionnaire assesses tiredness/fatigue, which by definition could be expected to correlate highly with subjective sleepiness, since these terms are commonly used interchangeably. Thus in order to avoid this possible bias and make their findings more robust, we suggest that the authors repeat the analyses using the new total score of the K10 after excluding item #1 and compare and contrast the results of the two analyses.</li> <li>b. Second, the K10 Scale assesses both anxiety and depressive symptoms. Previous studies in adults have shown an association of daytime sleepiness with depression (for example Bixler et al, 2005). Thus it would also be of interest to explore which of the two, i.e. anxiety or depression correlate stronger with sleepiness in the current study as well.</li> </ol> </li> </ol> <p>Minor comments: Please replace the commas (,) with dots (.) to separate decimals in Table 1. Currently for some numbers the dot is used and for some others the comma.</p>

## VERSION 1 – AUTHOR RESPONSE

### ANSWER TO REVIEWER #1 COMMENTS

My detailed comments:

-Abstract

1) Conclusion section: Please include a sentence about future studies and future works in this area of research.

- To answer this request, we added that: "Further work is needed to test this mediation relationship in larger samples and to verify the potential effects of sleep duration and quality of sleep in this relationship" (lines 73-75, 101-103, and 521-523).

2) Key words: Are these key words are Mesh keywords? If not, it is possible to include some?

- We added the following Mesh keywords: migrants, dietary sugars, sleep and depression (lines 77-79).

-Article focus

3) Second point: Please change "verify" alternative mediating models for "test" or "examine" alternative mediating models.

- The word "verify" was replaced with "test" or "examine" for all occurrences in the revised manuscript

-Introduction

4) First paragraph (lines 4 to 6): When you talked about obesity in other ethnic groups in Canada, you mainly talked about Asiatic populations (Chinese, Japanese, and South Asians) with the exception of White. Is it possible to give proportions of obesity (or to inform the reader) about other Canadian ethnic groups? Is it also possible to better define the "White" construct? Does it refer to Canadian natives or it refers to another construct?

- To address the reviewer's suggestion, we expanded our sentence and included all major ethnic groups in our statement, which now reads: "After adjusting for socioeconomic factors, Arab Canadians are less likely to be obese than Black, Latin, and Aboriginal groups, however more likely to be obese than Chinese, Japanese, South Asian groups, as well as the White reference group". (lines 130-133).

- The question concerning the "White" construct is complex. The reference cited used data from the 2001, 2003 and 2005 Canadian Community Health Surveys, in which the White group is the reference group which excludes Aboriginal populations and visible minorities (defined as "persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in colour"). To date, I am not aware of a formal definition of the white reference group, and it seems that it is rather based on exclusion criteria (i.e., people not aboriginal and not from visible minorities.) rather than any criteria for self-identification.

5) Page 6 (2nd paragraph, line 3): When you write: This mediating effect is supported in the literature for several of Baron and Kenny's criteria to establish mediation. There are only 4 available criteria to

establish mediation according to these authors. Maybe the term “several” is a little bit too strong. Please change the term “several” in this sentence.

- In this sentence, the word “several” was replaced with “some”.

6) Page 6 (2nd paragraph, line 6): I think you forgot to format a reference (Gaina, 2007). Please adjust this in consequence as well as all other references in the text.

- This reference was corrected

7) Page 6 (last line of the page): Please change “report on” for “establish” or “estimate” or “assess”. I think these expressions are better suited to express your idea.

- The word “report on” was replaced with “assess”.

-Method

8) Page 7 (Last paragraph): Physical activity was assessed by asking the question “how many times per week do you exercise enough to sweat?”. Is it a continuous measure or did you categorize possible answers?

- Five response categories were provided to this question ranging from 0 to 4 or more times per week. No combination were done afterwards and physical activity was used as an ordinal measure with the five answer choices. This information was added in the revised manuscript (lines 245-246, and 300-302).

9) Page 8 (1st paragraph): Is it possible to inform the reader about the psychometric properties of the FFQ?

- The FFQ was previously developed and pretested with the study community. Pre-testing contributed to the instrument’s face validity, cultural relevance, readability and comprehension. To address the reviewer’s comment, we added the following information to the text: “the questionnaire is easy to read and to understand, and culturally relevant to the study community”(lines 252-253).

10) Page 8 (2nd paragraph): The high test-retest reliability of the EES was based on a period of what time? One week? Two weeks? One month?

- The high test-retest reliability of the EES was based on a period of 5 months. This information was added in the text (line 268).

11) Page 8 (2nd paragraph): Please give more information about the daytime sleepiness measure. It is an important measure to understand your results and discussion. What are the eight items of this measure? Does this variable refer to the total number of hours slept in one night or it also refers also to possible nap in the afternoon?

- To answer the reviewer comment, the following information was added in the text (lines 262-266): “Respondents used a four-point scale (0 to 3) to express their perceived likelihood of falling asleep

during the day in eight different situations (sitting and reading, watching television, sitting inactive in a public place, as passenger in a car for an hour without a break, lying down to rest in the afternoon when circumstances permit, sitting and talking to someone, and sitting quietly after a lunch without alcohol)".

12) Page 8 (3rd paragraph): Is it possible to inform the reader about the psychometric properties of the K10?

- The following information was added to the text (lines 280-283): "The K10 instrument has a high internal consistency (Cronbach's alpha = 0,92) [42]"

13) Page 9 (all 1st paragraph): The information about the categorization of your variables should be placed in the Methods section of your manuscript when you described your measures.

- To answer the reviewer comment, the categorization of BMI, daytime sleepiness and psychological distress for descriptive purposes was placed in the Methods section of the manuscript where we described each instrument (lines 250-251, 268-273 and 280-283).

14) Page 9 (Last paragraph, line 307): I think the first word of the line ("and") have to be removed.

- This was corrected

-Results

15) To respect APA guidelines, you have to change "n" or "N" in parentheses for "n". The abbreviation "n" should be italicized as well as in small letters. Using a capital n such as (N) refers to all Catholic Middle Eastern Canadian and not to a subsample of this population. This is why the "n" should be in small letter.

- This was corrected.

16) Please define (SD) prior using this expression for the first time as (Standard Deviation (SD)).

- This was done

17) Page 12 (1st paragraph): Please change "was not significant" for "was no longer significant".

- This was done

-Discussion and Conclusion

18) Does the association between daytime sleepiness and psychological distress could be explained by quality of sleep? If an individual does not sleep well in the night, he or she will be more likely to fall asleep in the day. If it is the case, my hypothesis will be that his quality of sleep will also be associated with psychological distress rather than daytime sleepiness. Maybe you can discuss of this possibility in your discussion?

- Quality of sleep and daytime sleepiness are indeed related; we stated in our paper (lines 175-177) that sleep duration and obstructive sleep apnea are the most common causes of daytime sleepiness [22]. Daytime sleepiness can therefore be seen as a symptom of poor quality of sleep. Also, sleep disorders including daytime sleepiness are associated with depression symptoms and anxiety. The nature of the relationships between quality of sleep, daytime sleepiness and psychological distress was not, however, a focus of this paper. Since we did not collect other sleep measures, this question cannot be addressed in our paper. We did, however, mention in our conclusion that “Further work is needed to test this mediation relationship in larger samples and to verify the potential effects of sleep duration and quality of sleep in this relationship” (lines 520-523).

19) Page 15 (limitations): When you write on lines 5-6 (Second, study is based on self-reported subjective measures), you forgot to mention that it was also based on self-reported objective measures such as height and weight.

- To simplify, here we wrote: “Second, the study is based on self-reported measures”. (line 500-501).

-Tables

20) To respect APA guidelines, you have to change “n” or “N” in parentheses for “n”. The abbreviation “n” should be italicized as well as in small letters. Using a capital n such as (N) refers to all Catholic Middle Eastern Canadian and not to a subsample of this population. This is why the “n” should be in small letter.

- These changes were made

21) In the legend under table 1, it is written (T-test performed for sex). I’m not able to see where you performed those T-test. You do not talk about t-test in the analysis section of your paper.

- We thank the reviewer for bringing this to our attention. All analyses were performed using univariate regression. The correction was made under table 1.

22) Table 2: What is the unadjusted model? If it is the association between daytime sleepiness and daily sugar intake, why the  $P = 0.04$  is different from table ( $p = 0.03$ )?

- We thank the reviewer for pointing this out,. In fact, the unadjusted model is the one presented in table 1, and the p value should be 0.04 in both tables. This was corrected.

-Overall comment (not related to any section)

23) Throughout the entire manuscript, you are talking about a partial mediation “partially mediated. I thought that a partial mediation using Baron & Kenny procedures to establish mediation was when the association between the independent and dependent variables was still significant with the inclusion of the mediator. In your case (as your Table 2 shown), this association was no longer significant when you adjust the association for psychological distress. So, according to my knowledge, I thought it was a complete mediation rather than a partial mediation.... Please verify this point and adjust your manuscript in consequence

- Baron and Kenny’s (1986) original criteria to establish mediation were recently updated by Kenny



(<http://davidakenny.net/cm/mediate.htm#BK>). In this update, step 4 states that in order for the mediator (M) to completely mediate the relationship between the independent (X) and dependent variables (Y), the effect of X on Y controlling for M should be zero. It is important here whether the coefficient is 0 or non-zero. Statistical significance of the coefficient does not factor into step 4: it did in Baron & Kenny (1986) – but not in their updated version of the 4-step criteria.

- In our analysis, the first three steps were met, however, step 4 was not met. The effect of daytime sleepiness on the consumption of sweetened products controlling for psychological distress was reduced but it was not zero. In this case, according to Barron and Kenny, if the first three steps are met but Step 4 is not, then partial mediation is indicated.

- To address the reviewer comments, we used in our revised manuscript the updated Barron and Kenny criteria for Step 4. Changes were made accordingly in the abstract (lines 61-62, 66-67), methods (lines 314-318), results (391-393), and discussion (lines 425-428). We also added the updated reference for Barron and Kenny's criteria (<http://davidakenny.net/cm/mediate.htm#BK>).

## ANSWERS TO REVIEWER #2 COMMENTS

Moubarac et al, test the hypothesis that psychological distress mediates the association of subjective daytime sleepiness with consumption of sugary food. This study is interesting in terms of novelty and sound in terms of statistical approach of the proposed mediation model, however there are some major concerns:

1. This study is limited by the small sample size and by the lack of important data known to be associated with excessive daytime sleepiness, i.e. subjective and objective sleep variables, respiratory data, objectively measured anthropometric data. Addition of these variables in the described model could have significantly altered the results and thus the reliability of the current findings is questionable.

- We acknowledge this limitation of our study and did address it in our original manuscript in the limitations section, stating in lines 496-499 that “the sample size was small and thus statistical power was limited. However, the composition of our sample reflects the characteristics of the general Catholic Middle Eastern Canadian community in terms of birthplace, religious affiliation, education and income”. Also, we stated in lines 502-507 that “we did not account for other sleep problem measures, including duration of sleep and sleep deprivation, as well as other potential confounding disorders. Sleep duration and obstructive sleep apnea are the most common causes of daytime sleepiness, but studies examining the relationships between sleep duration, dietary intake and obesity have produced mixed results”. To further acknowledge these limitations, we added in our abstract and conclusion that “Further work is needed to test this mediation relationship in larger samples and to verify the potential effects of sleep duration and quality of sleep in this relationship” (lines 73-75, 101-103, and 521-523).

2. Body Mass Index (BMI) has been shown to correlate with sleepiness, psychological distress and sugar consumption but in the current study such associations were not confirmed. Is there any explanation for this discrepancy? Could it be attributed to the major limitation stated above, i.e. the absence of objectively measured data?

- In our analysis, BMI had a positive, but not significant association with daytime sleepiness. In another paper, we observed an inverse (but not significant) relationship between consumption of sweetened products and BMI (Moubarac, J-C, Receveur, O, Cargo, M, & Daniel, M (2012)

Consumption patterns of sweetened food and drink products in a Catholic Middle Eastern Canadian Community. Public Health Nutrition. doi:10.1017/S1368980012005460). We agree with the reviewer that these results must be interpreted by taking into account that overweight and obese subjects may have under-reported their weight or under-reported their consumption of sweetened products, but also the cross-sectional design. Indeed, at the time of the study, subjects carrying excessive weight reported a higher preoccupation with watching/restricting their consumption of sweetened products than normal weight individuals (data not shown). The above explanations were added in the discussion (lines 489-494)

- BMI was not related to psychological distress. In our original paper, we stated in lines 472-483 that since the prevalence of high psychological distress (K10>30) at 11.8% is nearly one-half that of the Canadian average, reported to be 20.7%, it is possible that sociocultural factors such as family social support or having a religious faith protect against anxiety and depression in this community.

3. Psychological distress was assessed using the Kessler Psychological Distress Scale (K10) and was found to be significantly associated with daytime sleepiness.

a. First, the item #1 of the questionnaire assesses tiredness/fatigue, which by definition could be expected to correlate highly with subjective sleepiness, since these terms are commonly used interchangeably. Thus in order to avoid this possible bias and make their findings more robust, we suggest that the authors repeat the analyses using the new total score of the K10 after excluding item #1 and compare and contrast the results of the two analyses.

- The K10 first item is “During the last 30 days, about how often did you feel tired out for no good reason?” This item is indeed correlated with daytime sleepiness, but the correlation was rather weak with  $r=0.18$  ( $p<0.02$ ), which does not suggest the presence of a strong bias. Following the reviewer’s comment, we repeated our analyses using a new total score K9 (i.e. K10 score after excluding item #1).

- To address the reviewer comments, we included in the revised manuscript a new paragraph in lines 410-419 in which we state: “Lastly, the robustness of our analyses could be biased by the moderate association that exists between daytime sleepiness and the K10 instrument first item (K1) that assesses fatigue/tiredness ( $r =0.18$ ;  $p<0.02$ ). To verify this, we repeated our analyses by using a total score of K9 (i.e., K10 after excluding item #1). This did not change the nature of our results because 1) daytime sleepiness and K9 were still significantly correlated ( $r=0.14$ ;  $p<0.04$ ); 2) K9 was associated with the consumption of sweetened products ( $\beta =0.17$ ;  $p<0.02$ ) when both K9 and daytime sleepiness were entered as predictors in the multivariate regression model, and 3) the effect of daytime sleepiness on consumption of sweetened products controlling for psychological distress was reduced but it was not zero.”. Considering these results, we feel the analyses presented in our paper are sufficiently robust, when using the K10 scale as a whole, like it is usually done.

b. Second, the K10 Scale assesses both anxiety and depressive symptoms. Previous studies in adults have shown an association of daytime sleepiness with depression (for example Bixler et al, 2005). Thus it would also be of interest to explore which of the two, i.e. anxiety or depression correlate stronger with sleepiness in the current study as well.

- We thank the reviewer for this suggestion. It would be interesting to explore whether anxiety or depression correlates stronger with daytime sleepiness. However, we verified that the K10 scale is only used as a single scale because anxiety and depression items are highly correlated (we asked the author of the K10 scale, Dr Kessler). Furthermore, previous studies that have reported an association

between depressive symptoms or depressive disorders and daytime sleepiness have used different instruments (for example, Bixter et al. (2005) study assessed depression by asking if the respondent was currently treated for depression or suicidal thoughts/attempts). Nevertheless, the only study we know of that looked at both anxiety and depression is the study by Theorell-Haglow et al. (2006) which used the Hospital Anxiety and Depression scale (HAD). They report that both the anxiety and depression subscales, as well as the combined subscales (anxiety and depression) were associated ( $p < 0.001$ ) with excessive daytime sleepiness.

- To answer the reviewer's suggestion, the following affirmation was added to the discussion of our paper in lines 456-460: "It would be interesting to explore which of anxiety or depression correlate stronger with daytime sleepiness since the K10 instrument contains items that assesses both symptoms. However, this instrument is used as a single scale because anxiety and depression items are highly correlated. There is nevertheless evidence that both anxiety and depression are highly correlated with excessive daytime sleepiness and fatigue (Theorell-Haglow et al., 2006)."

Minor comments:

Please replace the commas (,) with dots (.) to separate decimals in Table 1. Currently for some numbers the dot is used and for some others the comma.

- This was corrected

#### ADDITIONAL CHANGES

- We change the words "sweet products" for "sweetened products" in the text.
- We added the standardized coefficients in table 2, and reported these in the result section.

#### VERSION 2 – REVIEW

<b>REVIEWER</b>	Mathieu Roy, Ph.D  Postdoctoral fellow Research Center on Aging, Health & Social Services Center- University Institute of Geriatrics of Sherbrooke, University of Sherbrooke, Quebec, Canada  No competing Interests
<b>REVIEW RETURNED</b>	18-Jan-2013

<b>THE STUDY</b>	No supplemental data because it was not needed
<b>GENERAL COMMENTS</b>	Thank you to the authors for having include my previous comments.