Chapter

Knowledge of Sugar in Sugar-Sweetened Beverages in South Africa: A Survey of Postgraduate Students

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Abstract

This survey investigated the level of knowledge of sugar in sugar-sweetened beverages by postgraduate students enrolled at the University of Limpopo in the 2019 academic year. A survey questionnaire was sent to three hundred and fifty-nine (359) students as a target population, and two hundred and seventy-eighth (278) questionnaires were returned. The results are based on 77% of the target population. On average, the respondents correctly answered just over half of the items on added sugar in SSBs, with M = 56.02% and SD = 22.03%. There is sufficient evidence to say that the level of knowledge of added sugar between male and female University of Limpopo postgraduate students are different (t (177) = 2.763, p = .011), using the 5% level of significance. Knowledge and awareness of added sugar are not sufficient components to influence the use of nutrition labels. The findings conclude that there is a relationship between gender and knowledge of added sugar in sugar-sweetened beverages and found that no relationship exists between BMI and knowledge of added sugar in sugar-sweetened beverages. There is a need for user-friendly terminology on nutrition labels.

Keywords: knowledge, sugar tax, sugar-sweetened beverages, postgraduate students, South Africa

1. Introduction

Sugar consumption has increased globally from 130 to 178 million tonnes (World Cancer Research Fund, 2015), and the general consumption of sugar was noted to exceed the WHO guidelines in many countries. This global rise in the consumption of added sugars has been linked to obesity which causes the prevalence of most Non-Communicable Diseases (NCDs) that have resulted in strained national health budgets [1]. Regrettably, South Africa has a population that is increasingly adopting poor dietary habits with the South African Demographic and Health Survey

(2003) reporting adult men and women across all races who are obese using their measure of body index at 29.8% and 54.7% respectively.

In a study conducted in Gauteng in 2006, health awareness and lifestyle behaviour were associated with reading nutrition labels. Habitual readers of food labels who also understood their interpretation proved to be concerned and more conscious about their health.

This research sought to investigate the level of knowledge of added sugars in sugar-sweetened beverages (SSBs) by the University of Limpopo postgraduate students.

2. Problem statement

There is a lack of understanding of nutritional labels that are contributing to a lack of usage of those labels and overconsumption of sugar [2, 3]. The consumption of sugar has increased both globally and in South Africa over the last few decades [4]. It has become increasingly necessary to assist consumers to choose healthier foods [5].

Theoretically, consumers should rely on food labels to make healthy purchasing choices, as they "provide nutritional information" [2]. However, as demonstrated by Jacobs et al., [2] and Heike & Taylor [5], this has not been the case, since the nutrition labels consist of technical language that most consumers cannot comprehend. The "lower the educational level of respondents, the less commonly they read food labels" [2]. It is against this background that the University of Limpopo's postgraduate students become relevant as the unit of analysis for this research study. There is limited research available on the South African consumer's level of knowledge of sugar in SSBs.

3. Research question

The main research question was:

1. What is the University of Limpopo postgraduate students' level of knowledge of sugar in SSBs?

Sub-questions:

1. What is the University of Limpopo postgraduate students' knowledge of nutrition labels on SSBs?

2. What is the University of Limpopo postgraduate students' use of nutrition label information on SSBs?

4. Literature review

Studies based on the impact of the level of knowledge of added sugar in SSBs point toward a global need for improved awareness and consciousness of the effects of excessive consumption of added sugars. Finkelstein, Ruhm, & Kosa [6], support this notion by suggesting that consumers are aware that the

overconsumption of SSBs increases the risk of NCDs such as obesity. The prevalence of these NCDs including obesity has become public health concern [7]. The concept of added sugar in food is well clarified in several studies; however, the issue of consumers' knowledge about how sugar relates to nutrition, general nutrition knowledge and the role that food and nutrition labels play in knowledge acquirement is still unclear [3–5, 8–19].

5. The concept of added sugar in SSBs

Added sugars are sugars and syrups such as sucrose and high fructose corn syrup added to different types of food and beverages during the preparation or processing stages [16]. SSBs come in the form of drinks, from sports drinks, and fruit drinks to ice tea and coffee [8]. Sugar found in fruit, milk or nuts are naturally occurring, meaning that they are not added through an artificial process, therefore they do not fall under the abovementioned group of added sugars [16].

In a study conducted by Erzse et al. [12], and Vorster et al. [20], it was found that to reduce the risk of becoming obese, consumers should ensure that the total energy intake from SSBs does not exceed 10% of added sugars. Further, Vorster et al. [20] found that there is a 'positive correlation between the consumption of added sugar and Body Mass Index (BMI)'. Interestingly, men and women differ in their intake of sugar, which results in a difference in the relationships between their dietary intake versus their BMI.

6. Nutritional knowledge of added sugar in SSBs

The notion of nutrition knowledge has been found by Worsley [19] to be very vague and hence there is evidence of a lack of clarity between what nutritionists deem as knowledge about nutrition and what consumers think is important to know about nutrition [19]. Worsley [19] argues that nutrition knowledge cannot affect consumers' food behaviours to the extent that it can change them. For instance, once an individual is aware of the amount of added sugar in their favourite SSB they will not necessarily stop consuming the SSB purely based on the fact that they possess the nutritional knowledge [19]. However, although nutrition knowledge may not have the power to create change on its own, Worsley [19] acknowledges that if nutrition knowledge is paired with other variables, for example, if a consumer has nutrition knowledge but also has goals to lead a healthier lifestyle, their food behaviours have a good chance of changing [19]. This is confirmed by Grunert et al. [21] that nutrition knowledge is associated with being able to understand the nutrient content depicted on the food label.

7. Food and nutritional labelling

Food and nutrition labels are one of the most common sources of knowledge about food products [3, 9, 13]. These labels are essential as they assist consumers in making healthy choices [22]. Therefore, consumers are encouraged to use food and nutritional labels as part of their healthy dietary habits.

Debates have emerged that added sugars tend to be hidden in the food label [23]. This contributes to consumers having difficulties in comprehending the level of added sugars by looking at the food label, as this is usually not depicted [24].

Emerging questions from food label studies range from looking at the use of food labels, whether that information is translated into knowledge and if that knowledge is of any practical value to the purchasing power of a consumer [25–28]. The use of food and nutrition labels is attributed to the nutrition knowledge of a consumer and is affected by socio-demographic factors [29].

The ineffectiveness of labels to perform the functions that they are supposed to can be attributed to two factors, the motivation to use the information and the confusing information on food and nutrition labels [3, 5, 9, 10, 15, 19, 30].

Consumers are influenced by various social factors; this is especially concerning their food behaviour and choices. An individual's background, personal beliefs, values and opinions play an important role in not only what they choose to purchase and consume but also whether food and nutrition labels can influence their food behaviour [5]. Therefore, consumers have been found to take from food labels what is most relevant and convenient for them and disregard information that they may not believe or makes them uncomfortable [5]. A study conducted by Graham and Laska [31] discovered that there was a relationship between the frequent use of nutrition labels and food behaviour. By frequently using nutrition labels, consumers value their health and dietary intake [31].

The level of knowledge of added sugar in food is linked to the use of nutritional labels. Often the frequent use of these labels influences the purchasing power of the consumers which helps them in making healthier choices about their beverage intake. Demographic factors such as gender and the body mass index (BMI) are considered when assessing the level of knowledge of added sugar in SSBs. This is due to the difference in their nutritional needs as it is recommended that men consume slightly more sugar than women.

8. Research hypothesis

The research hypotheses that were tested are as follows:

- Hypothesis (*H0*): There is no relationship between gender and the knowledge of added sugar in SSBs among the University of Limpopo postgraduate students.
- Hypothesis (*H1*): There is a relationship between gender and the knowledge of added sugar in SSBs among the University of Limpopo postgraduate students.
- Hypothesis (*H0*): There is no relationship between body mass index (BMI) and the knowledge of added sugar in SSBs among the University of Limpopo postgraduate.
- Hypothesis (*H2*): There is a relationship between body mass index (BMI) and the knowledge of added sugar in SSBs among the University of Limpopo postgraduate.

The literature is non-directional about the relationship between gender and knowledge of sugar in SSBs or food; it shows a 'correlation between BMI and added sugar consumption' [20].

9. Methodology

This section discusses the research and sample methods that were applied in this study. It further discusses the data collection methods and how the ethical considerations were addressed. Additionally, the data analysis procedure is discussed. The section concludes with the reliability and validity of measurements of the whole study.

10. Research design

A survey was used to conduct this study. A questionnaire was designed and pilot tested before it was emailed and self-administered by the University of Limpopo postgraduate students. This design was used for its convenience to the target population, as they had access to emails and the internet, and for cost-effectiveness for the research team, as they did not have to travel or call to collect data for this study.

11. Sample

A probability census sampling method was used, targeting all the University of Limpopo postgraduate students. A questionnaire was circulated to 359 students. Of these 300 respondents returned the survey questionnaire. The analysis and results of this study are based on only 278 respondents after removing the incomplete questionnaires from the data, constituting a 77% response rate of the target population (**Table 1**).

Sample	Frequency	%
Final sample	278	77%
Returned	300	83%
Discarded	22	6%
Population size	359	100%

Table 1.
Response rate.

12. Ethical issues

The respondents were informed of the study's purpose and that their responses will be analysed and compiled into a report solely to fulfil the requirements of independent publication. Furthermore, the respondents were informed about their right to voluntary participation, the confidentiality in which their responses will be treated and the survey ensured their anonymity by not collecting identifying information such as names, surnames or photos. By completing and submitting a questionnaire, it was taken that the respondents have consented to the ethical considerations. Ethical clearance was sourced from Turfloop Research Ethics Committee (TREC) and the certificate (TREC No: TREC/221/2019: IR) was issued on 04 September 2019.

13. Procedure

A survey questionnaire was designed on Google Form and comprised three sections. The questionnaire was first sent to the University Statistician at the Research Administration and Development. Email addresses of the University of Limpopo postgraduate students were obtained from the University's IT system. The questionnaire that comprised a consent was circulated to the respondents.

14. Survey instrument

The questionnaire comprised of three sections namely, the demographics, the knowledge of added sugar and the use of nutrition labels. The questionnaire had only two measurement scales namely, the 'simple category and multiple-choice' ([32]:105) for demographic and knowledge questions. Additionally, a picture depicted in **Figure 1** was used to test the respondents' understanding and interpretation of the terminology used on the nutrition label.

Figure 1.
Nutrition label of 330 ml Coca-Cola can.

15. Data analysis

Data obtained from the questionnaires were analysed using IBM SPSS statistics (version 26). Data analysis entailed categorising, ordering, cleaning and summarising the data. The demographic and knowledge questions were analysed through 'descriptive statistics such as mean, standard deviation, minimum and maximum values' for all scaled questions and frequency tables were used to illustrate these data [32].

The inferential statistical analysis, that is, the t-test was used to compare knowledge scores based on the independent variables of gender and BMI. Additionally, 'Cronbach's Alpha was used to test the internal consistency' of measurement used for the knowledge variable ([33]:209). Equally, data were coded for nominal scale data, replacing the text with actual values. The responses that had more than fifty per cent of data missing were removed from the data. Additionally, knowledge scores were calculated for questions measuring similar constructs.

16. Reliability and validity

16.1 Internal reliability

The internal consistency of the knowledge scale was calculated using 'Cronbach's Alpha and the average inter-item correlation' ([33]:209). These values are presented in **Table 2** below.

Although the values of 'Cronbach's Alpha and average inter-item correlation' ([33]:209) are 0.483 and 0.130 respectively, below the minimum acceptable values, they are acceptable since it was expected that the respondents would possess some knowledge on the level of added sugar in SSBs depending on their exposure and usage of nutrition labels of the SSBs.

16.2 Validity

Face and content validity were tested for this study. The face validity of the knowledge scale is the extent to which the respondents perceived that the knowledge scale is measuring the knowledge of SSBs; and content validity refers to the "extent to which the measurement was representative" of all aspects measuring the SSBs ([33]:212).

Both the 'face and content validity' ([33]:212) were tested through piloting of the questionnaire and feedback received from the respondents on the content of the questionnaire, that is, the logical flow, the ambiguity and the terminology.

Scale	Cronbach's Alpha	Average inter-Item correlation	Number of items
Knowledge	0.483	0.130	8

Table 2.
Internal consistency reliability values of scales.

17. Results

This section begins with a discussion on the data preparation procedure and then the structure of the results. The research questions for the level of knowledge of added sugar in SSBs, the knowledge of nutrition labels and its use are tested through the item level responses, as depicted in **Figure 2**. The results present the item level responses, followed by the scale level responses, the tests of the hypotheses, and lastly the effect size.

17.1 Level of knowledge of sugar in SSBs, and food and nutrition labelling

This section below discusses the knowledge scores in SSBs, and food and nutrition labelling.

17.2 Knowledge scores at item-level

To investigate the level of knowledge of added sugar in SSBs, eight questions were asked. **Figure 2** illustrates the responses to these questions.

More than a third quarter (64%) of the respondents were knowledgeable about the effect of added sugar on health, while less than half (44.5%) of the respondents

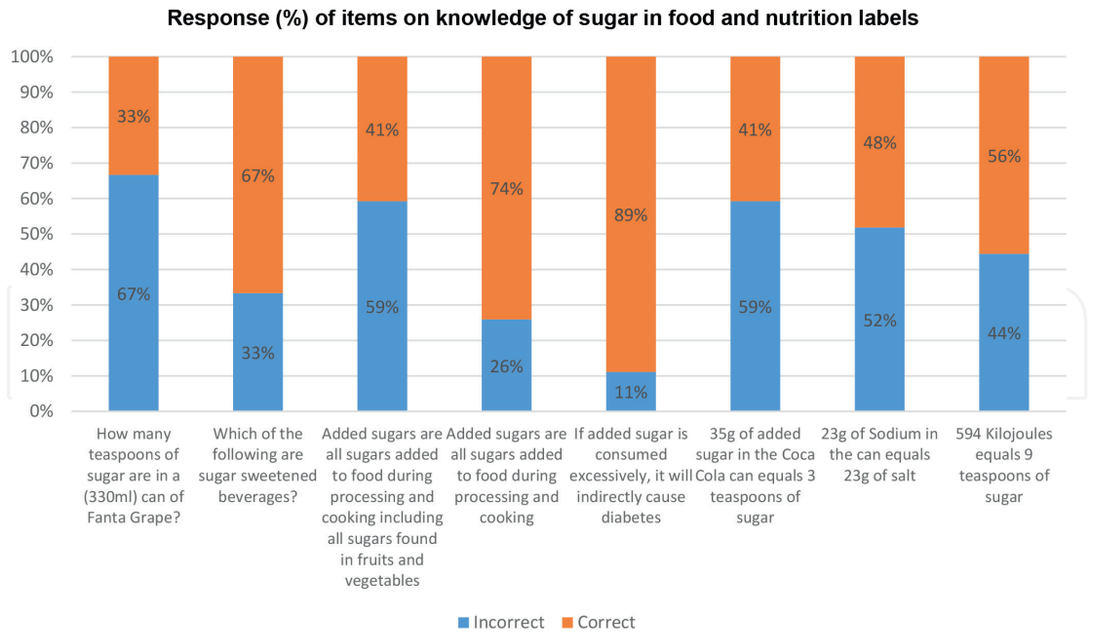

Figure 2.
Summary of responses to items measuring knowledge of sugar (n = 278).

could interpret the added sugar content of SSBs as the equivalence of teaspoons of sugar. Overall, the respondents were split between either knowing or not on questions relating to knowledge of added sugar and understanding of nutrition labels on SSBs.

17.3 Knowledge scores at scale-level

The item-level responses are summated to scale level and the summary statistics and frequency distribution are supplied in **Table 3** and **Figure 2**.

Based on the summary statistics supplied in **Table 3**, more than one-half of the respondents have knowledge of added sugar in SSBs, with M = 56.02%, SD = 22.03%. The skewness value of −58.20% is similar to its standard error (44.80%) and is thus considered significant. Furthermore, the histogram in **Figure 3** below appears to be approximately normally distributed.

	Statistic	Std. error
Mean	56.02%	4.24%
Median	62.50%	
Std. Deviation	22.03%	
Minimum	0.00%	
Maximum	100.00%	
Range	100.00%	
Interquartile Range	25.00%	
Skewness	−58.20%	44.80%

Table 3.
Summary statistics of mean knowledge scores (n-278).

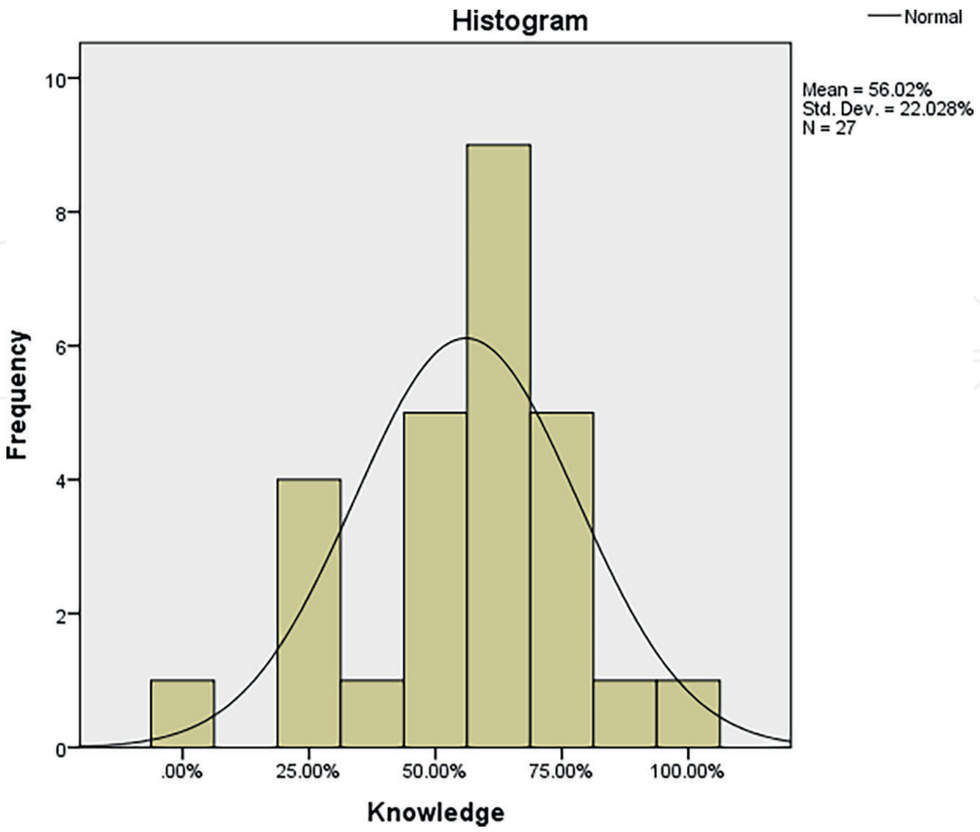

Figure 3.
Distribution of knowledge scores (n=278).

17.4 Hypothesis testing

The results of the hypotheses tests and t-test are discussed in the section below.
Hypothesis:

1. H_o: There is no relationship between gender and the knowledge of added sugar in SSBs among the University of Limpopo postgraduate students
H_1: There is a relationship between gender and the knowledge of added sugar in SSBs among the University of Limpopo postgraduate students.

2. H_o: There is no relationship between BMI and the knowledge of added sugar in SSBs among the University of Limpopo postgraduate students.
H_1: There is a relationship between BMI and the knowledge of added sugar in SSBs among the University of Limpopo postgraduate students.

The assumptions of the t-test for independent samples were tested based on visual inspection of the normality of the distribution of mean level of knowledge scores (**Figure 2**) and the 'Levene's test for equality of variance' ([32]: 222). There does not appear to be a significant deviation from normality, based on the figure. Furthermore, homogeneous variances are assumed ($F = 0.598$, $p = .218$) using the 5% level of significance. Thus, all assumptions are satisfied.

Based on the results of the study, there is sufficient evidence to say that the level of knowledge of added sugar between male and female University of Limpopo

postgraduate students are different (t (25) = 2.763, p =.011). The mean and standard deviation of male University of Limpopo postgraduate students are M = 46.67 and SD = 21.89, and for females' M = 67.71 and SD = 16.39, indicating a significant difference in the knowledge of sugar between University of Limpopo postgraduate female and male students, using the 5% level of significance. The null hypothesis is rejected, in favour of the hypothesis – there is evidence of the difference between males and females of the knowledge of sugar in SSBs.

Second hypothesis shows that there does not appear to be a significant deviation from normality. Furthermore, homogeneous variances are assumed (F = 0.508, p = .483) using the 5% level of significance. Thus, all assumptions are satisfied.

Based on the results, there is sufficient evidence to say that the level of knowledge of added sugar of male and female University of Limpopo postgraduate students are different (t (22) = −1.228, p = .232). The mean and standard deviation of 'normal weight' University of Limpopo postgraduate students are M = 51.25 and SD = 6.58, and for obese M = 62.50 and SD = 6.15, indicating that the level of knowledge of both 'normal weight' and obese are but not sufficiently different to be significant, using the 5% level of significance. The null hypothesis is not rejected, there is no evidence of the difference between obese and 'normal weight' of the knowledge of sugar in SSBs.

17.5 Cohen's effect size

Cohen's effect size for the knowledge of sugar of the SSBs between male and female University of Limpopo postgraduate students. The Cohen's effect size for the independent variable of gender and the dependent variable of knowledge is d = 1.07. The value of *d* represents a substantially big effect and difference in the knowledge of sugar of the SSBs between male and female University of Limpopo postgraduate students.

17.6 Cohen's effect size for the knowledge of sugar of the SSBS and BMI

The effect size for BMI and knowledge is d = 0.51. The value of *d* represents a moderate effect and difference in the knowledge of added sugar of the SSBs between BMI levels of University of Limpopo postgraduate students.

17.7 The use of nutrition labelling on SSBs

Fifty-nine percent of the respondents reported not looking at the nutrition label. The number of those reported to look at the nutrition label before they purchase SSBs is lower than the mean value, that is, M = 56.02%, of the respondents knowledgeable about added sugar in SSBs.

18. Discussions

18.1 Level of knowledge of sugar in SSBs, and food and nutrition labelling

More than fifty percent of the students were knowledgeable about the sugar contents of the SSBs. Females were more knowledgeable about the sugar contents of SSBs than their male counterparts. The difference in the knowledge of added sugar

was significant between the two genders and therefore, there is sufficient evidence to conclude that there is a relationship between gender and knowledge. Furthermore, the relationship between BMI and knowledge did not yield a positive result.

Just over eighty per cent of the respondents displayed knowledge of the effects of added sugar consumption on health. This supports the findings of Finkelstein et al., [6] that there is awareness among consumers that excessive consumption of sugar contributes to the risk of non-communicable diseases. However, the awareness of the risk factors of excessive consumption of sugar and knowledge of consumers of the sugar contents in food products does not necessarily translate into consumption behaviour change.

18.2 Level of knowledge and understanding of the nutrition labelling

Tierney et al., [24] reported that the technical language used on nutrition labels tends to be a barrier to serving its primary objective of ensuring that consumers know the nutrition contents of food products they purchase and then make informed consumer choices. This study tested this finding by using a picture of a Coca-Cola 330 ml can and asked questions regarding its nutrition label. The per cent of those respondents who could comprehend with this technical language used on the nutrition label ranged from forty-one to fifty-six.

Given that this study targeted Postgraduate students who do not necessarily represent the average South African, and still scored lower than 60%, as they could not interpret terminologies such as sodium, kilojoule and a number of grams of sugar, and what these mean in terms of the number of teaspoons of sugar or salt, these findings confirm that the terminology used on nutrition labels pose a challenge to consumers.

18.3 The use of nutrition labels on SSBs

The number of respondents who reported looking at the nutrition label before they purchase food products is lower (i.e., 41%) than the mean value, that is, M = 56.02% of the respondents knowledgeable about sugar in SSBs. Although this fact has not been fully established in this study, the respondents' knowledge of the sugar content in food products and consumers' understanding of nutrition labels alone seems not to be sufficient factors to influence the purchasing behaviour of consumers. Heike and Taylor [5] reported that social factors such as an individual's background, beliefs, values and opinions about what is important and not, play a very critical role in the consumers' behaviour. Therefore, nutrition literacy interventions should consider behaviour change as a key component of these interventions to influence consumer purchasing behaviour since knowledge alone is insufficient.

19. Conclusions and Recommendations

More than three-quarter of the respondents are knowledgeable about the effect of sugar on health, while only one-third of the respondents could interpret the sugar content of SSBs as the equivalence of teaspoons of sugar. More than one-half of the respondents have knowledge of sugar in SSBs, with M = 56.02%, SD = 22.03%.

There is sufficient evidence that there is a relationship between the gender of University of Limpopo postgraduate students and their level of knowledge of added sugar in SSBs, with more females having more knowledge of sugar in SSBs than their male counterparts, with the value of ($t(25) = 2.763$, $p = .011$). The mean

and standard deviation of male University of Limpopo postgraduate students are M = 46.67 and SD = 21.89, and for females' M = 67.71 and SD = 16.39, indicating a significant difference in the knowledge of sugar between WSG female and male students, using the 5% level of significance. Furthermore, there is no evidence to support the hypothesis that suggests a relationship between BMI and knowledge of added sugar on SSBs.

Less than half (i.e., 41%) of the respondents reported not looking at the nutrition label before they purchase food products. Regardless of this study targeting post-graduate students, the respondents fared in a range of forty-one to fifty-six per cent to questions relating to interpreting technical language, such as sodium, kilojoules and grams of sugar, on the nutrition label confirming the findings by earlier studies that the technical language used on food products is a barrier to serve the primary purpose it was initiated, as consumers struggle to comprehend it and thus make informed purchasing decisions.

These findings similar to earlier studies recommend user-friendly language that ordinary people would understand to be used on the nutrition labels and this could be either in a form of images or a number of teaspoons of sugar, to enable ordinary citizens to understand the contents of the food they purchase.

As reported earlier, University of Limpopo postgraduate students' knowledge and awareness of added sugar in food products did not seem sufficient to influence their purchasing and consumption behaviours, thus supporting the recommendations made by Drichoutis et al. [29]; Hieke and Taylor [5], that additional focus must be on the social factors such as that knowledge and awareness consumer beliefs, values and opinions, since awareness to change consumers' behaviour.

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