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Original Research Article

Physical Activity, Sedentary Behaviors and Dietary Habits among Adults Living in Riyadh City, Kingdom of Saudi Arabia

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ABSTRACT

Study Objective: The purpose of this cross-sectional study was to explore the differences in weight status, obesity and patterns of physical activity (PA), sedentary behaviors (SB) and dietary habits (DH) in relation to gender and age of adults living in city of Riyadh, Kingdom of Saudi Arabia (KSA).
Methods: A total of 128 males and 129 females (years) were randomly selected using a multistage stratified cluster sampling technique. Measurements included weight, height, body mass index (BMI), screen time (television viewing, and computer use), physical activity and dietary habits. The validated self-report questionnaire relating to patterns of PA, sedentary activity SA and DH allows the calculation of total energy expenditure in metabolic equivalent (MET-min) values per week.
Results: levels of PA, SB and DH were evident among the adults, with females being generally spent more time in moderate and vigorous –intensity physical activity/ week and were more physically active than males. The adults with higher BMI reported lower levels of PA and higher amounts of sedentary time. All adults- male and female did not meet the recommended daily physical activity levels (≥ 2520 MET-min/week, moderate to vigorous intensity and spending more than 2h/d guidelines recommended screen time. The large majority of the adults (males &females) reported skipping breakfast.
Conclusion: These findings highlight the diverse nature of obesity, overweight and patterns of PA, SB and DH of adults in different Saudi populations
Keywords: Physical activity, Sedentary behaviours, Dietary habits male and female Adult

INTRODUCTION

Saudi Arabia which has become increasingly westernized over the past few decades now has one of the highest prevalence rates of overweight and obesity due to Lake of PA, *increases* in SB and bad DH. This puts the population at great risk for increased rates of non-communicable disease (NCD) mortality. [1] According to the World Health Organization, [2] the most important risk factors of non-communicable diseases in the Gulf countries included high blood pressure, high concentrations of cholesterol in the blood, inadequate intake of fruit and vegetables, overweight or obesity and physical inactivity.

Completing cultures is partially to blame as the combination of persisting traditional Saudi cultural changes, modern cultural changes and economic prosperity has created an obesogenic environment that promotes unhealthy eating, sedentary life style and weight gain. Overweight and obesity are more prevalent in Saudi women than in Saudi men. [1]

Physical inactivity increased dietary intake of light-fat energy dense food and significant contributors to weight gain

leading to overweight and obesity. Overweight and obesity are two uniquely defined conditions according to the center of the disease control and prevention. [3]

The prevalence of overweight and obesity in Arab countries has increased significantly over the past six decades. [4] A recent study conducted in the city of Riyadh, KSA showed that 82% of participants were overweight or obese. [5] Rapid development in living standards and increased mechanization over the past quarter-century in the KSA have resulted in significant changes in physical activity and eating styles. [6] The majority of KSA population now lives in major cities where sedentary life styles, excessive dining on unhealthy foods and lack of physical exercise are usual. [6]

In addition to poor eating styles, physical inactivity is widespread in Saudi population. Nearly 70% of the total Saudi population does not perform an adequate amount of physical activity and physical inactivity is higher in Saudi women than in Saudi man. [7]

National survey data from the KSA showed that self reported physical inactivity in women increased from 84.7% in 1996 to 98.1% in 2011 and from 43.3% to 93% among Saudi men during that same period. [8] Adults rarely participate in sports and typically spend their leisure time in sedentary activities. [9]

Saudi women spend large amount of their time indoors. [9, 10] Furthermore access to physical activity is extremely limited for Saudi women in terms of accessible sporting venues, appropriate athletic attire role models. [9] Lack of facilities and time constraints are important and commonly cited barriers among Saudi man. [7]

There are several studies that have addressed the relationship of the dietary habits of Arab adolescents with physical activity and/or sedentary behaviours in large and representative samples using reproducible and validated instruments. [11-13] In addition, few studies were also conducted among Saudi adolescents and children reported a significant positive relationship between physical activity, sedentary behaviours and eating habits relative to obesity [14-17] However, it is not known whether physical activity levels and the sedentary behaviours of adults are independently associated with certain dietary habits or what effect gender plays in this association. [18] Previous study assessed physical activity levels among Saudi adults, and examined the relationships of physical activity with body mass index (BMI), waist circumference (WC) and obesity prevalence. Study showed inactivity prevalence (96.1%) was very high among adults. There were significantly more inactive females (98.1%) than males (93.9%). Inactivity was the highest in the central region and the lowest in the southern region of Saudi Arabia. Further, active individuals exhibited lower values of BMI.

Recently a systematic review has been also reported [19] about the associations between sedentary behavior and physical activity among adults aged 18-60years. All studied showed that types of (SB) were associated with lower levels of (PA) in adults. Findings of this review suggested inverse associations between (SB) and (PA) were weak to moderate. [15]

Furthermore, TV viewing associated with obesity due to reduction of energy expenditure or increase calorie intake and it may result of difficulty to become physically active. [20]

Most Saudi adults- men and women did not achieve the required physical activity to promote health and protection from diseases [18] therefore, sedentary lifestyle patterns become prevalent, especially among adults of Saudi society. However, there are no recent studies discussed the impact of the change in lifestyle, such as (PA), (SB) and (DH) among obesity and overweight Saudi adults living in capital city like Riyadh, KSA.

The purpose of the present study was to report on the prevalence of physical activity, sedentary behaviors and dietary habits among obesity and overweight Saudi

adults, using representative samples drawn from city of Riyadh, KSA. It was also the intent of this study to examine the interrelationships among the lifestyle factors as well as investigate whether there are gender differences in these associations.

MATERIALS AND METHODS

Study Participants

A total 257 subjects (128 male and 129 female) were selected randomly from Saudi population living in Riyadh City, KSA aged years. Informed consent was obtained from all Participants free from any physical health problems. This study was conducted at health education and health promotion chair, King Khalid University Hospital, Riyadh; Kingdom of Saudi Arabia The study was approved by the Ethics Committee of King Khalid Hospital, King Saud University, Riyadh, Saudi Arabia.

Anthropometric measurements were carried out in the morning by a trained researcher according to written standardized procedures. The body weight and height were recorded to the nearest 100 g and 100 cm respectively by using a calibrated portable scale and measurements were done with the participant in minimal clothing without shoes. The BMI calculated as a ratio of weight in kilograms by the square of height in meters. BMI cutoff reference standards for all participants identified by using WHO adult cutoff points of 25-29.9 kg/m^2 to define overweight and 30 kg/m^2 and higher for obesity. [21]

A validated self-report questionnaire was used to assess physical activity levels, sedentary behaviors and dietary habits of the selected sample. The instrument has been previously evaluated for reproducibility and validity and was found to have high reliability and acceptable validity. [22]

Physical activity assessment:

Physical activity was assessed using a self-reported questionnaire. This instrument has previously been evaluated for reproducibility and validity and was found to have high reliability [23] and acceptable validity. [22] The physical activity questionnaire covered a wide range of activities across different physical activity domains (transport, household, fitness and sports activities). Physical activities were classified as light-, moderate- and vigorous-intensity activities based on metabolic equivalent (MET) values according to the compendium of physical activity. [24] The total amount of exercise per week was then expressed in MET-min/week using 4 and 8 MET for moderate- and vigorous-intensity activities, respectively. [25]

To classify the participants who met the daily physical activity recommendations was calculated by using two different MET-min cut-off scores [26,27] (i) moderate-intensity physical activity of 1 h/d, corresponding to a total of 1680 MET-min/week (60min/d X 7d/week X 4MET); and (ii) moderate- to vigorous-intensity physical activity of 1 h/d, which corresponds to a total of 2520 MET-min/week (60min/d X 7d/week X 6 MET). Metabolic equivalent (MET) levels were ranged on a scale from (light <3 METs; moderate, 3-6 METs; vigorous > 6 METs).

Sedentary behaviors questionnaire

Questionnaire on sedentary behaviors was used to determine important information from adult participants related to the typical daily time spent on sedentary activities, including watching television (TV), playing video games and using computer. Participants were asked to provide average number of daily hours spent for each of the activities without differentiating between weekdays and weekends. For the total screen time cutoff points, we used the American Academy of Pediatrics guidelines of a maximum of 2 hours per day. [28]

Dietary habits questionnaire

The dietary questionnaire was designed to determine the frequency of certain dietary habits. The participants reported on how many times per week they consume breakfast, vegetables (cooked and uncooked), fruits, milk and dairy products, sugar-sweetened drinks (including soft

drinks), fast foods, donuts/cakes, sweets and chocolates and energy drinks They had a choice of answers ranging from zero intakes to a maximum intake of 7 d/week.

Statistical analysis

Data were analyzed by using the statistical software package SPSS, version 21. Descriptive statistics was presented as mean and standard deviation. Individual distribution were analyzed using explore procedure and normalcy estimated with Shapiro-Wilk. Kruskal-Wallis test was used to determine the differences in the percentages of male and female for physical activity, sedentary behaviors and dietary habits. Finally, Pearson correlation coefficients were calculated to evaluate the associations among BMI and selected lifestyle factors the level of significance was set at a p value of 0.05 or less.

RESULTS

The main findings and descriptive data, stratified by gender and study areas are summarized in tables 1-3. The demographic data of the participants in table 1 shows that out of the 257 participants, there were about equal sex ratio (males 128, females 129).Women were slightly older than men in mean age. Overall, males were significantly heavier and taller, than females (both *p values* <0.000) and there was significant difference in total BMI between men and women *p values* < 0.05.

TABLE 1. Demographic characteristics of the adult males (128) and females (129) Living in Riyadh city (*n* = 257)

Characteristic	Men			Women		
	Overweight	Obese	All Men	Overweight	Obese	All Women
Age (years)	34.4±15	29.2±10	28.7 ± 09.8	31±10	32±12	29.5±10.3
Weight (kg) **	81±10	113.6±19	102.2 ± 25.5	71±6	91±15	81.8±16.6
Height (cm) **	171±7	174.3±7.3	171.1 ± 13.8	161±5	160±7	160.2±6.1
All BMI (wt/ht^2) **	28±2	40±20	35.9 ± 18.3	27±2	36±5	31.7±6.9
Systolic blood pressure mm Hg	111±17	117.4±16	116.6 ± 17.4	114±12	123±22	119.2±19.2
Diastolic blood pressure mm Hg	74±23	66.5±11	69.7 ± 17.4	67±10	71±12	69±11.3

** Significantly different at < 0.01 level between groups using Kruskal-Wallis test.

The mean ± SD values for sedentary behaviors, physical activity measures and dietary habits relative to gender are shown in Table 2. No significant difference was observed for all variables.

Compared with females, Saudi males were more sedentary, much less active, especially in terms of moderate and vigorous intensity physical activity/ week. There were large differences between males and females especially in terms of total and vigorous physical activity. Obese females appeared to be much less active than their non-obese (overweight) counterparts, particularly in terms of total moderate and vigorous activity. They also had less frequent intake of breakfast, compared with overweight males.

Avery high proportion of participants (males and females) watched TV and used the computer for more than 2 hours per day. That means they do not met the recommended screen time guidelines of 2 hours or less per day. Overweight males spend more total screen time per day than females (overweight) however, overweight females and both obese males and females were found to spend about equal time per day watching television and using a computer.

The majority of adults did not have a daily intake of breakfast. It is worth noting that all males and females consumed breakfast more than 3 days per week.

Regarding daily physical-activity guidelines adults- males and females do not met the recommended 1 hour of moderate- to vigorous-intensity physical activity. When a level of moderate- to vigorous-intensity physical activity was considered as a cutoff value, all participants were only able to meet the minimal physical-activity (<1680 MET-min/week).

Compared with females, males on average were considerably more sedentary (9 versus 6 hours/ day, for the combined TV time and computer use), much less active (672 versus 1120 METs-min/ week),

especially with moderate-intensity physical activities (513 versus 973 METs-min/week) and on fewer days per week consumed breakfast. The total sedentary time for the males was about 150% that of the females, while the total energy expenditure in METs-min per week for the males was about 60% that of the females. In terms of minutes per week, the total physical-activity time for the males and females was 149 and 264 minutes, respectively.

The total times spend/week and total MET-min score per week was significantly higher in overweight and obese females than in counterpart males. However, both females and males do not meet the recommended moderate- to vigorous-intensity physical activity level of 1 h/d (2520 MET-min/week).

Compared with females (overweight), males (overweight) spent more time watching TV (5.73±9.49 hours/day) while female (overweight) spending more time on a computer (4.04±2.3 hours/day). The mean TV viewing and computer use was higher in males (overweight) but not significantly different between the obese genders. Both males and females spending more than the recommended screen time guidelines (2 h/d). Relatively more overweight males than females consumed breakfast per week however; there were no significant differences in the frequency of breakfast consumption in obese gender.

Table 2. Sedentary behaviors, physical activity measures and dietary habits for Saudi adults grouped by gender.

Variables	Overweight		Obese	
	Male	Female	Male	Female
TV Viewing (hours/day)	5.73±9.49	2.14±1.7	2.78±1.5	2.69±1.7
Computer use (hours/day)	3.38±1.8	4.04±2.3	4.06±2.12	4.30±2
Breakfast consumption (frequency/week)	4.08±2.6	3.44±2.4	3.22±2.3	3.73±2.5
Sleep duration (hours/night)	4.5±1.4	4.4±1.4	4±1.3	4.5±1.7
Time min spend in Moderate –intensity physical activity/ week	128.08±197	273.3±505	128.61±139	213.7±240
Time min spend in Vigorous –intensity physical activity/week	16.67±57.7	7.96±24.26	13.18±34.97	19.85±65.38
Total min Time spend in Moderate and Vigorous –intensity physical activity/ week	149.5±267	295.5±514	148.9±168	232.2±276
All METs-min/week of Moderate -intensityphysical activity (4MET)	512.31±788	1093±2022	514.4±556	854.8±958
All METs-min/week of Vigorous -intensityphysical activity (8MET)	133.3±462	63.7±194	105.4±280	158.8±523
Total METs-min/week of Vigorous and Moderate –intensity physical activity	670.9±1299	1224.4±2051	674.3±804	1020.2±1280
Kcal. Wk^{-1} Moderate –intensity physical activity	753±1242	1294±2378	941±1002	1274±1447
Kcal. Wk^{-1} Vigorous –intensity physical activity	212±735	70±211	208±557	225±761
Total Kcal. Wk^{-1} Moderate and Vigorous –intensity physical activity	1023±2071	1444±2410	1261±1570	1503±1908

Kruskal-Wallis Test show no significant differences between all variables
Kcal. Wk-1= kilocalorie per week

Table 3. Reasons for being active and barriers to physical activity of random cluster-sampling of Saudi adult

Variables	Overweight		Obese	
	Male	Female	Male	Female
Reason for being active Percent (%)				
Health	58.3	45.8	47.8	48.8
Loss weight	33.3	45.8	32.6	43.9
Recreation	8.3	4.2	10.9	2.4
Meet friends	0	4.2	2.2	2.4
Other reason	0	0	6.5	2.4
Total	100	100	100	100
Barriers Percent (%)				
Lack of time	63.6	84	75	68.3
Activity is not important	0	0	2.1	2.4
Lack of suitable place	27.3	4	12.5	14.6
Health problems	0	4	2.1	2.4
Embarrassment	0	0	0	2.4
Other barriers	9.1	8	8.3	9.8
Total	100	100	100	100

In Table 3 participants stated that both health and loss weight are the most relevant reason for being active however, lack of time and Lack of suitable place were the main reason impeded participants from doing exercise regularly. Only a small number of female obese indicated that embarrassment is the only barrier.

As shown in Table 4, lists the predictive value for Total physical activity energy expenditure (METs-min/week), sum of vigorous intensity physical activity and sum of moderate intensity physical activity. a history of fruit intake cake/donuts intake and chocolate/candy intake showed a strong significant inverse association with Total activity energy expenditure (METs-min/week); R^2 was 0.45 and fast food intake, cake/donuts intake and chocolate/candy intake showed a strong

significant inverse association with sum of vigorous intensity physical activity (METs-min/week); R^2 was 0.81. However chocolate/ candy intake associate proportionally with Sum of moderate intensity physical activity (METs-min/week) R^2 was 0.34.

Table 4 Results of Linear regression analysis of factors studied for the prediction of total activity energy expenditure, sum of moderate or vigorous physical activities in overweight and obesity Saudi males and females.

Dependent variable	Predictor variables *	Standardized Coefficient (Beta)	*p*-value	SEE	R^2
Total activity energy expenditure (METs-min/week)	Fruit intake	0.32	0.019	1829	0.45
	cake/donuts intake	- 0.37	0.009		
	chocolate/candy intake	0.28	0.030		
Sum of vigorous intensity physical activity (METs-min/week)	Fast food intake	- 0.72	0.03	846	0.81
	cake/donuts intake	- 0.70	0.02		
	chocolate/candy intake	-0.78	0.04		
Sum of moderate intensity physical activity (METs-min/week)	chocolate/candy intake	0.27	0.04	1528	0.34

* Entered predicted variables included average screen time, average sleep duration, breakfast intake, vegetables intake, milk/dairy products intake, sugar-sweetened drinks intake, fast food intake, French fries/potato chips intake, cake/donuts intake, chocolate/candy intake, body mass index, waist/height ratio.

DISCUSSION

Despite the formidable lifestyle changes experienced by Saudi society during recent decades, few researches have simultaneously been conducted on the physical activity, sedentary behaviors and dietary habits of Saudi adolescents. [14,16,17]

The present cross-sectional study reported the prevalence of the lifestyle factors including physical activity level, sedentary behaviours and dietary habits among obese and overweight adults aged years living in Riyadh city, KSA. We are not aware of any other adult study carried out in KSA that has characterized lifestyle behaviours including dietary habits of this population using a validated questionnaire that was comprehensive enough to gather information about physical activity patterns in terms of frequency, duration and intensity by transcribing it to a MET-min scale. The findings of this study provide evidence on the high prevalence of sedentary behaviors and the low level of physical activity, especially among males.

It is worth noting that the combined prevalence of overweight and obesity in many local and regional studies is higher in males than in females. [29] However, the sex differences in rates of obesity among adults are generally small and inconsistent. [30] It is worth noting that studies on socioeconomic status and obesity suggest that the rate of obesity is higher among low income groups in developed countries, and in high income groups in developing countries. [30,31]

In addition, insufficient vigorous physical activity was shown to be a risk factor for higher BMI in the United States. [32] An earlier study in Saudi Arabia [33] also showed that inadequate physical activity was associated with obesity in adolescents. Similarly, a lack of exercise was a significant risk factor for obesity among adolescents from southwestern Saudi Arabia.[33] Our finding that vigorous-intensity physical activity was inversely associated with adults obesity is also extensively supported by the literature.

It is also believed that sedentary behaviors are associated with adverse health outcomes in a way that seems to be different from those attributed to the lack of physical activity. [34] In the current study, total screen viewing time was associated with overweight or obesity. This finding is similar to those of several earlier studies have reported significant associations between screen viewing time and obesity in children and adolescents. [35-37] However, ethnic and cultural factors may, also partly, influence the associations between screen viewing time and obesity. [35]

Some studies have suggested that there is an interaction effect between screen viewing time and physical activity that may influence the associations between obesity and sedentary behaviors. [38] Studied the combined effects of physical activity and television viewing on the risk of overweight and found that female with high television viewing time and low physical activity had the highest probability of being overweight.

In the present study, we did not find any significant differences between television viewing time or computer use in relation to overweight or obesity; therefore, we combined both behaviors into a single variable.

Among all of the dietary habits assessed in the present study, overweight and obesity status was associated with less frequent consumption of breakfast. Our findings agree with those of many other studies. Indeed, skipping breakfast is a strong predictor of overweight and obesity in adults from many countries. [39-42]

In the present study, we used 1680 METs-min per week as cutoff scores to correspond to 1 hour of daily moderate-intensity physical activity and 2520 METs-min per week as cutoff scores corresponding to 1 hour of daily moderate- to vigorous-intensity physical activity which was considered performing recommended physical activity. [26] Based on these WHO cutoff scores, we found a considerably high prevalence of physical inactivity, among adults especially males living in Riyadh city and they do not met the current recommendations [26] Previous studies using objective physical-activity measurement indicated that 60% of males and 71% of females do not engage in health-enhancing physical activity of sufficient duration and frequency. [7,43] Major factors that contribute to inactivity in Saudi Arabia include a reliance on cars rather than walking for short-distance travel.

Males in the present study were found to be not just considerably more sedentary than females, but they were much less physically active too. Insufficient physical activity was shown to be a risk factor for higher BMI for adult males than females.

Modern life has to a great extent systematically reduced total energy expenditure. Moreover, urbanization and related environmental determinants may also be considered an important risk factor for physical inactivity in developing countries undergoing economic transition. [44] Before the recent economic growth surge, which started three decades ago, communities in major cities in Saudi Arabia were designed to support pedestrian travel in common daily activities. In contrast, major Saudi Arabian cities are now modernized, with large street networks and separate zoning for residential and commercial areas. This kind of design requires the use of automobiles for all trips and, therefore, totally discourages walking.

The prevalence of sedentary behaviors found in the present study among adults was remarkably high. The American Academy of Pediatrics (AAP) has expressed concern about the amount of time spend viewing TV and has issued guidelines recommending that screen time not exceed 2 hours per day. [28] All males and females in the present study actually do not meet the AAP recommendations on daily screen time. The implication of this finding is that there is a need to reduce the time spent by adults on TV viewing and computer use. In addition, it is now recognized that sedentary behaviors are associated with harmful health outcomes that are different from those attributable to the lack of physical activity. [34]

In the present study, we found that not only were males less active, especially in vigorous activities, than females, but males also reported spending more time engaged in sedentary activities, such as watching TV and using a computer. The present study revealed that majority of males and female spent more than 2 h/d on screen time.

The food intake patterns that are considered to be healthy include daily intake

of breakfast. Skipping breakfast is a well-recognized unhealthy dietary behaviour and we also observed a significant negative association of the number of days of consumption of breakfast with BMI. [45] A similar association was also reported for Saudi adolescents. [46] The present study revealed that all males and females do not consume breakfast daily. A similar proportion of Saudi adolescents were also found not to be having a daily breakfast. [46]

Further, both physical exercise and food intake patterns of adults tend to differ according to gender. [47] Understanding the gender differences in lifestyle-related risk factors of overweight and obesity among adults living in Riyadh city is crucial for devising public health policies and effective strategies to prevent and treat obesity. Despite these major considerations, there have been no systematic studies among Saudi adults to characterize their physical activity, sedentary behaviours and dietary habits simultaneously. The present study reports on the physical activity, sedentary behaviours and dietary habits of adults living in Riyadh city, KSA and presents gender differences.

Barriers to physical activity in a cohort of obesity and overweight in adults-men and women in Saudi Arabia are currently limited. Poor health emerged as the most important barrier to sufficient physical activity. Similarly, it was a frequently cited barrier in different cohorts of older adults in research conducted internationally. [48, 49]

The findings of the present study should be interpreted in light of its strengths and limitations.

This study collectively examined several lifestyle factors in a representative sample of Saudi adults living in Riyadh, using a validated and comprehensive physical-activity questionnaire, employing metabolic equivalents for calculating energy expenditure from physical activity. The information stemming from this study should add to existing knowledge about the lifestyle factors in a society experiencing a nutrition transition. One of the limitations of this study was that the information was based on self-report, although we made every effort to minimize any possible over- or under-reporting by the participants. Because this is a cross-sectional study, the temporality of the associations between sedentary behaviors, physical activity and dietary habits cannot be certain; however, many of the observed associations conform to biological plausibility.

Despite these limitations, the results of this study are strengthened by a reasonable sample size and the use of a well-validated instrument to elicit information.

This study provides the public health and education authorities in KSA with evidence of the beneficial effects of physical activity, SB and healthy eating habits on overweight and obesity, which are now well established. Proper interventions are needed to accommodate physical activities in health care and educational programs in KSA. A regular pattern of physical exercise must be included within the routine life.

Future research needs to address the demographic, socioeconomic and environmental determinants of these lifestyle factors to initiate interventional programmes that promote healthy eating and active living habits and reduce sedentary lifestyles among adults in Saudi Arabia.

CONCLUSIONS

In summary, the findings from the present study on Saudi adults also revealed a number of important findings: (i) All adults- males and females do not meet the current global recommendation for physical activity; (ii) virtually all of the males and females spend more than 2 h/d on sedentary activities; (iii) These adults do not eat breakfast daily. In addition, the low activity levels and high screen time of Saudi males are of great concern. The disparity in PA and weight status could be due to Saudi cultural and environmental differences such as the lack of opportunities to exercise, due

to societal norms and constraints as well as lifestyle habits.

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