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Original article

Assessment of nutrition facts label utilization and macro-nutrient intake among patients with chronic diseases in Saudi Arabia

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ABSTRACT

Objectives: To investigate and compare nutritional label use, influencing factors, and macro-nutrient intake among individuals with chronic diseases and other healthy individuals in the Kingdom of Saudi Arabia (KSA).
Design: A cross-sectional study in KSA.
Participants: N = 380 males/females aged 18–50 years, healthy and others with chronic diseases.
Variables measured: Data were collected using a self-reported questionnaire containing chronic disease factors, label use behavior factors and three 24-h dietary recalls.
Analysis: Several statistical tests were used, including the Chi-square (χ^2), the Independent Sample T-test, the ANOVA test, and Pearson's correlation with p-value $\leq$0.05.
Results: More chronic disease patients (56.1 %), especially hypercholesterolemia patients, than healthy individuals (43.9 %) reported that they checked and used the information on the nutritional fact labels. All the chronic disease patients consumed less than the recommended nutrient intake (RNI) for carbohydrates and fiber. However, the protein and total fat intake were more than the RNI. The highest intake was among diabetes/at risk of diabetes patients, with an average of 1710.9 kcal.
Conclusions: The present study concluded that chronic disease patients tend to demonstrate superior behaviour in reading food labels compared to those who are healthy. Thus, healthy individuals would benefit from reading the label information, possibly reducing their risk of developing chronic disease.

1. Introduction

Non-communicable diseases (NCDs) are the leading cause of mortality worldwide, accounting for 71 % of all deaths. The four main types of NCDs—cardiovascular diseases, diabetes, cancer, and chronic respiratory diseases—contribute to over 80 % of premature mortality.[1] Obesity, a significant public health concern, is closely linked to NCDs and is exacerbated by unhealthy dietary habits and sedentary lifestyles. Recent decades have seen an increase in NCD prevalence, likely due to widespread environmental changes promoting unhealthy behaviors compounded by genetic factors.[2]

The correlation between chronic diseases and poor dietary habits underscores the importance of nutrition labels and adherence to dietary guidelines in disease prevention.[3] Nutrition facts and menu labels play a crucial role in improving the quality of purchased food and have been associated with enhanced diet quality.[4]

In KSA, the prevalence of NCDs has risen, primarily attributed to lifestyle changes characterized by unhealthy dietary patterns and low physical activity levels.[5] Understanding the relationship between consumer awareness, attitudes, and nutrition label use is essential for promoting healthy dietary choices, particularly for reducing the risk of developing chronic diseases. However, the extent of nutrition label use among different chronic disease groups (hypertension, hypercholesterolemia, obesity, or diabetes), remains unclear. Thus, this study aims to investigate and compare nutrition label use, influencing factors, and macro-nutrient intake among individuals with chronic diseases and healthy individuals in KSA, shedding light on the relationship between nutrition label use and dietary behavior among those with chronic diseases.

2. Subjects and methods

2.1. Study design and participants

A cross-sectional survey design study was used for the study. The current study was conducted between December 2021 and October

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2022. Ethical approval was obtained from the Research Ethics Committee, Faculty of Medicine, KAU (Reference No 291-21). All participants signed an informed consent form. The informed consent form contained information about the study's aims, purposes and procedure. The sample size was determined of 385 participants within 0.05 of the total population with a 95 % confidence level.[6] The participants enrolled in this study were male and female adults with at least one of the mentioned chronic diseases, 18–50 years of age from all KSA regions. The exclusion criteria were the presence of diseases other than chronic diseases and pregnancy or lactation among women.

2.2. Data collection

Data was collected through a self-reported online survey. For content validity, the questionnaire was initially translated into Arabic and then adjusted to ensure cultural suitability. The questionnaire underwent a trial run with a small sample to verify clarity and precision.

2.2.1. Chronic disease items

Items from the 2005–2006 NHANES survey[7] as described were used to construct the chronic diseases categories, which included: 1) hypertension, 2) hypercholesterolemia, 3) diabetes/at risk of diabetes, and 4) overweight/obesity. For the analysis, the selected health problems are inherently related to unhealthy nutrition. These conditions were self-reported, while overweight/obesity was identified by calculating BMI according to its categories overweight (25.0 $kg/m^2 \leq$ BMI $<$30.0 kg/m^2) and obesity (BMI $\geq$30.0 kg/m^2).

2.2.2. Label use behavior items

The NHANES asked detailed questions about behaviors related to using food labels and being aware of nutritional information. Label use behavior consisted of 14 items, which were modified to fit the Saudi participants. The questions in this section contained five possible answers ("always", "often", "sometimes", "rarely", and "never").

2.2.3. Reported dietary behavior

Participants were asked to provide three (24-h recall) on nonconsecutive days. It was analyzed to calculate total energy and macronutrients (carbohydrate, protein, total fat, saturated fat and fiber) in grams. To analyze how participants in each chronic disease group are eating compared with national recommendations for macronutrients, the 3-day average of total energy was used as the denominator.

Because macro-nutrient variables were reported in grams, carbohydrate and protein grams were multiplied by 4 to get them in calories, while total fat and saturated fat grams were multiplied by 9 to get them in calories. To get the percentage daily intake, each nutrient was divided by the total energy. Then, the daily intake for each participant was expressed in terms of the percentage RNIs for United States (US) adults. Because of the current unavailability of published nutrient requirements for the Saudi population, the most recent version of US dietary reference values was used as a standard for the evaluation of the pattern of nutrient intake. Finally, the participants were dichotomized as either ''adherent'' or ''nonadherent'' to the guidelines for each macronutrient.

2.3. Statistical analysis

All data was analyzed using the SPSS version 29. The data was explored for their descriptive statistics. Several statistical tests were used, including the Chi-square (χ^2), Independent Sample T-test, ANOVA test, Kruskal–Wallis test, Factor analysis, Pearson's correlation and Regression analysis. Differences were considered significant at *p*-value $\leq$0.05.

3. Results

3.1. Demographic characteristics

The data illustrated that 46.3 % were male and 53.7 % were female. The highest percentage found was 77.6 % for participants who were from the western region and 77.9 % weren't married. Concerning the education, 63.4 % had a university degree. For income, the highest percent found was 40.3 % ($<$5000 SR). About half of the participants (54.5 %) were employed. Study participants (47.4 %) were citizens, while 52.6 % were residents. The participants' ages mean was 33.13 $\pm$ 8.93, while the BMI was 26.42 $\pm$ 6.91(kg/m^2).

3.2. Chronic diseases

More than half of the participants reported having at least one of the chronic diseases(56.1 %). Approximately 40 % of the sample were overweight/obese, followed by 17.4 % had hypercholesterolemia problems, 12.4 % had hypertension, and the least were diabetes/at risk of diabetes (14.2 %). On the other hand, 167(43.9 %) of the participants reported having no diseases (Fig. 1).

For gender, females had hypercholesterolemia with a higher rate of 20.6 % versus 13.6 % for males($p = 0.049$). Regarding education, participants with high school level showed hypertension with a higher rate of 23.2 % versus 12 % for university or 6.5 % for postgraduate($p = 0.024$). The unemployed person related significantly to hypercholesterolemia with a higher rate of 27.5 % than others ($p = 0.002$). Retired persons related significantly to diabetes (38.5 %) with($p = 0.002$) and with overweight/obese (76.9 %) with($p = 0.005$). Resident persons related significantly with hypertension($p = 0.035$), hypercholesterolemia and diabetes($p = 0.001$). Concerning age, there was a significant relation with all chronic diseases in favor of older ages (p-values$\leq$0.05). BMI showed a significant relation with all chronic diseases except hypercholesterolemia. Higher BMI participants were more likely to have suffered from chronic diseases. Otherwise, no significant relation was found between other demographic and BMI variables by chronic disease among participants ($p > 0.05$). Finally, patients are more likely to be female, older, unemployed, residents and with higher BMI($p = 0.001$) than healthy people. These findings suggest that chronic diseases have a significant impact on the lives of people(Table .1).

3.3. Reported dietary behavior

The participants' calorie average was 1523.08 $\pm$ 545.55 kcal. The highest average found for carbohydrate at 175.65 $\pm$ 75.22g, followed by protein at 83.46 $\pm$ 43.67g, total fat at 54.39 $\pm$ 24.45g, and saturated fat at 12.66 $\pm$ 7.81g, while fiber the lowest average was 11.31 $\pm$ 7.78g.

Table .2 shows the average food intake among participant groups according to the chronic diseases. In general, the intake between groups was not significantly different. The highest total energy, protein, carbohydrate, saturated fat, and fiber were among the diabetes/at risk of diabetes group with 1710.9, 97.4, 190.8, 13.1, and 13.1, respectively. In contrast, the lowest total energy, protein, saturated fat, and total fat were among the hypercholesterolemia group with 1471.2, 79.2, 12.1, and 51.5, respectively.

All the chronic disease groups were below the RNI for carbohydrates and fiber intake. However, the protein and total fat intake among all groups were above the RNI, while the saturated fat intake was within the RNI(Table .2).

3.4. Label use behavior items

All label use behavior items(14) had 5-point Likert scale, as 1 for (never) up to 5 for (Always), for an equal interval length of 5-point Likert scale (0.80). The first rank was for the item (How often do you use the health claim?) with mean score 3.56 $\pm$ 1.29, since 32.1 % of the

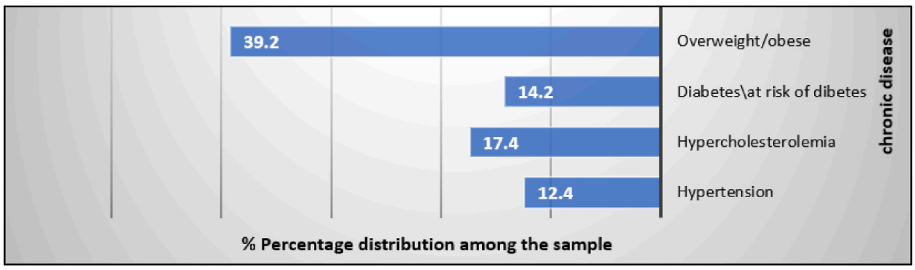

Fig. 1. Percentage distribution of chronic diseases among the study participants (n = 380).

participants always use the health claim, while the last rank was for (How often do you use information about cholesterol?) with mean score 2.33 ± 1.33, 36.3 % never use the information about cholesterol.

The factor analysis grouped into two factors, use and check information factors consisted of 5 and 9 items with loading ranging between 0.482-0.705 and 0.335–0.881, respectively. The Cronbach - α for the first factor (use) is 0.846 and 0.941 for the second factor (Check information) which is above 0.70 given a good reliability level.

The multivariate-adjusted means ± SD for the "Check'' and "Use'' scales for the disease groups, comparing those healthy and patients, are illustrated in Table .3. The hypercholesterolemia group checked nutrient information on labels more than other groups(P = 0.003). Moreover, participants who had diabetes/at risk of diabetes showed significant behaviors of checking nutrient information on labels(P = 0.01) than undiabetes. Overall, patients with a history of chronic disease were more likely to use and check nutrient information than healthy people.

Table .4 illustrates the using and checking information according to demographics. Female and postgraduates are significantly more likely to use and check information on food labels. The highest mean score for use and check of nutrient information is 16.08 ± 4.59 and 24.88 ± 10.09 for postgraduates.

In addition, people with the highest incomes are more likely to use and check information on food labels. Regarding employment status and age, retired people are less likely to check information on food labels 19.92 ± 11.27. People aged ≥40 years are more likely to check information on food labels with the highest mean of 25.03 ± 10.18. This means that the average person aged <25 years checks information on food labels slightly less than the average person aged ≥40 years.

Moreover, people with normal weight are more likely to use and check information on food labels than other groups. The mean ± SD for use information is 15.13 ± 5.1 and for checking information is 25.15 ± 10.19 for normal weight as the highest group. However, no significant difference was found with regions, marital status and citizens(p > 0.05).

4. Discussion

Saudi Arabia is a leading nation in the world with a high prevalence of chronic diseases and their associated risk factors.[1] The growing popularity of consuming soft drinks, artificially sweetened juices and fast food are becoming a part of the culture in KSA. All of these factors have a direct influence on the risk of chronic diseases.[8–10] Lifestyle changes are the largest challenge to the health status of the KSA population.

This population-based study of Saudis with different chronic diseases is known to have at least a partial dietary etiologic component. Our results demonstrated that the most prevalent disease is hypercholesterolemia and overweight/obese by 17.1 % and 39 %, respectively. These results were in agreement with Al-Zahrani et al.[11] who reported that a prevalence of hypercholesterolemia in KSA in 2016 was 12.5 %. This study's finding was also in agreement with Alqarni[12] future prediction regarding overweight/obese that prevalence of obesity is unfortunately increasing every year in KSA starting at 16.4 % in 1992 and ending at 59.9 % in 2022.

In the present study, hypercholesterolemia was statistically significantly higher among females, older age, and residents. A similar result was reached by Al-Nuaim et al.[13] and Wong et al.[14] who reported that the prevalence of hypercholesterolemia was significantly higher among females than males. These results might be due to the female sex hormone estrogen. A research suggested that cholesterol levels in women vary depending on the phase of the menstrual cycle, due to changes in estrogen levels.[15]

In addition, overweight/obese was statistically significantly higher among retirees, and older age. A similar result was reached in a study done in the UAE.[16] These results might be due to the lack of physical activity, increased age and current smoking.[17] Moreover, the mean BMI in our study was 26.42, which was also in agreement with Al-Kandari's results among the Kuwaiti population.[18]

The results indicated that all the chronic disease groups were non-adherent to dietary recommendations except the saturated fat intake. That was in agreement with Lewis et al.[19] study regarding the non-adherence to dietary recommendations for carbohydrate and protein consumption, and the adherence to dietary recommendations for saturated fat; however, the findings were in disagreement regarding fibre and total fat. The fibre intake was lower than dietary recommendation for all chronic disease groups, while the total fat was higher which is in contrast with the American study.[19] Compared to a Saudi study, the current findings were in agreement regarding the dietary intake for carbohydrate and fibre.[20]

Most NCDs can be prevented and treated through a balanced diet. Moreover, nutrition facts labels used with a balanced diet have been recognized as crucial to preventing NCDs.[21] The current study examined the nutrition label use by checking behaviors toward nutrition information on the label. Results of the present study revealed using the health claim on nutrition label was significantly the highest with 32.1 % of the participants always using the health claim, and 20 % often using it. This finding was broadly in line with Ollberding et al.[22] who reported that 43.8 % used health claims.

On the other hand, using the cholesterol information on the nutrition label was the lowest with 36.3 % of the participants never use it, and 20 % often use it. This may explain the high prevalence of hypercholesterolemia among the participants. Moreover, using the calorie label on the menu when ordering a meal from restaurants was low with 26.8 % of the participants never use it, and 25.3 % rarely use it. These findings agreed with Turkistani & Saaty who reported only 32.3 % of the participants claimed great use of calorie label.[23] However, these findings were in disagreement with Alassaf et al. who reported that 50 % of Saudi participants were significantly more likely to be influenced by the calorie labeling.[24]

In the present study, the results indicated that participants with hypercholesterolemia checked and used the dietary information more than the other groups. These findings were in disagreement with Lewis et al.[20]; however, our results indicated that diabetes/at risk of diabetes only checked the dietary information which is in line with the previous study.

Furthermore, in relation to all chronic disease groups, there was a significant use and check of nutrition facts label in chronic disease

Table 1
Demographic and BMI variables by chronic diseases among participants (n = 380).

Demographic	Groups	Hypertension			Hypercholesterolemia			Diabetes/at risk of diabetes			Overweight/obese			Patients vs healthy people		
		No (n = 333)	Yes (n = 47)	p-value	No (n = 314)	Yes (n = 66)	p-value	No (n = 326)	Yes (n = 54)	p-value	No (n = 231)	Yes (n = 149)	p-value	Healthy (n = 167)	Patients (n = 213)	p-value
Gender	Male	154 (87.5 %)	22 (12.5 %)	0.532	152 (86.4 %)	24 (13.6 %)	0.049[a]	147 (83.5 %)	29 (16.5 %)	0.240	106 (60.2 %)	70 (39.8 %)	0.459	81 (46.0 %)	95 (54.0 %)	0.449
	Female	179 (87.7 %)	25 (12.3 %)		162 (79.4 %)	42 (20.6 %)		179 (87.7 %)	25 (12.3 %)		125 (61.3 %)	79 (38.7 %)		86 (42.2 %)	118 (57.8 %)	
Regions	Eastern Region	24 (72.7 %)	9 (27.3 %)	0.098	29 (87.9 %)	4 (12.1 %)	0.837	28 (84.8 %)	5 (15.2 %)	0.811	19 (57.6 %)	14 (42.4 %)	0.863	16 (48.5 %)	17 (51.5 %)	0.796
	Western Region	263 (89.2 %)	32 (10.8 %)		243 (82.4 %)	52 (17.6 %)		255 (86.4 %)	40 (13.6 %)		182 (61.7 %)	113 (38.3 %)		128 (43.4 %)	167 (56.6 %)	
	Central Region	36 (87.8 %)	5 (12.2 %)		33 (80.5 %)	8 (19.5 %)		33 (80.5 %)	8 (19.5 %)		24 (58.5 %)	17 (41.5 %)		17 (41.5 %)	24 (58.5 %)	
	North Region	3 (100 %)	0 (0.0 %)		2 (66.7 %)	1 (33.3 %)		3 (100.0 %)	0 (0.0 %)		1 (33.3 %)	2 (66.7 %)		1 (33.3 %)	2 (66.7 %)	
	Southern Region	7 (87.5 %)	1 (12.5 %)		7 (87.5 %)	1 (12.5 %)		7 (87.5 %)	1 (12.5 %)		5 (62.5 %)	3 (37.5 %)		5 (62.5 %)	3 (37.5 %)	
Education	less than high school	6 (100.0 %)	0 (0.0 %)	0.024[a]	5 (83.3 %)	1 (16.7 %)	0.878	6 (100.0 %)	0 (0.0 %)	0.619	3 (50.0 %)	3 (50.0 %)	0.809	3 (50.0 %)	3 (50.0 %)	0.365
	High school	43 (76.8 %)	13 (23.2 %)		45 (80.4 %)	11 (19.6 %)		50 (89.3 %)	6 (10.7 %)		33 (58.9 %)	23 (41.1 %)		21 (37.5 %)	35 (62.5 %)	
	Undergraduate	212 (88.0 %)	29 (12.0 %)		202 (83.8 %)	39 (16.2 %)		205 (85.1 %)	36 (14.9 %)		145 (60.2 %)	96 (39.8 %)		103 (42.7 %)	138 (57.3 %)	
	Postgraduate (Master's - PhD)	72 (93.5 %)	5 (6.5 %)		62 (80.5 %)	15 (19.5 %)		65 (84.4 %)	12 (15.6 %)		50 (64.9 %)	27 (35.1 %)		40 (51.9 %)	37 (48.1 %)	
Marital status	Not Married	258 (87.2 %)	38 (12.8 %)	0.378	243 (82.1 %)	53 (17.9 %)	0.368	253 (85.5 %)	43 (14.5 %)	0.740	175 (59.1 %)	121 (40.9 %)	0.130	128 (43.2 %)	168 (56.8 %)	0.604
	Married	75 (89.3 %)	9 (10.7 %)		71 (84.5 %)	13 (15.5 %)		73 (86.9 %)	11 (13.1 %)		56 (66.7 %)	28 (33.3 %)		39 (46.4 %)	45 (53.6 %)	
Income	less than 5000 SR	132 (86.3 %)	21 (13.7 %)	0.406	133 (86.9 %)	20 (13.1 %0	0.227	136 (88.9 %)	17 (11.1 %)	0.268	98 (64.1 %)	55 (35.9 %)	0.317	73 (47.7 %)	80 (52.3 %)	0.106
	5000–10,000 SR	97 (90.7 %)	10 (9.3 %)		87 (81.3 %)	20 (18.7 %)		93 (86.9 %)	14 (13.1 %)		68 (63.6 %)	39 (36.4 %)		52 (48.6 %)	55 (51.4 %)	
	10,000–20,000 SR	76 (84.4 %)	14 (15.6 %)		69 (76.7 %)	21 (23.3 %)		72 (80.0 %)	18 (20.0 %)		50 (55.6 %)	40 (44.4 %)		30 (33.3 %)	60 (66.7 %)	
	More than 20,000 SR	28 (93.3 %)	2 (6.7 %)		25 (83.3 %)	5 (16.7 %)		25 (83.3 %)	5 (16.7 %)		15 (50.0 %)	15 (50.0 %)		12 (40.0 %)	18 (60.0 %)	
Employment	Employed	179 (86.5 %)	28 (13.5 %)	0.128	168 (81.2 %)	39 (18.8 %)	0.002[b]	172 (83.1 %)	35 (16.9 %)	0.002[b]	120 (58.0 %)	87 (42.0 %)	0.005[b]	82 (39.6 %)	125 (60.4 %)	0.002[b]
	Unemployed	63 (91.3 %)	6 (8.7 %)		50 (72.5 %)	19 (27.5 %)		59 (85.5 %)	10 (14.5 %)		50 (72.5 %)	19 (27.5 %)		32 (46.4 %)	37 (53.6 %)	
	Retired	9 (69.2 %)	4 (30.8 %)		10 (76.9 %)	3 (23.1 %)		8 (61.5 %)	5 (38.5 %)		3 (23.1 %)	10 (76.9 %)		1 (7.7 %)	12 (92.3 %)	
	Student	82 (90.1 %)	9 (9.9 %)		86 (94.5 %)	5 (5.5 %)		87 (95.6 %)	4 (4.4 %)		58 (63.7 %)	33 (36.3 %)		52 (57.1 %)	39 (42.9 %)	
Citizen	Citizen	164 (91.1 %)	16 (8.9 %)	0.035[a]	163 (90.6 %)	17 (9.4 %)	0.001[b]	166 (92.2 %)	14 (7.8 %)	0.001[b]	114 (63.3 %)	66 (36.7 %)	0.195	94 (52.2 %)	86 (47.8 %)	0.002[b]
	Resident	169 (84.5 %)	31 (15.5 %)		151 (75.5 %)	49 (24.5 %)		160 (80.0 %)	40 (20.0 %)		117 (58.5 %)	83 (41.5 %)		73 (36.5 %)	127 (63.5 %)	
AGE		32.53 ± 8.648	37.32 ± 9.818	0.001[b]	31.88 ± 8.627	39.08 ± 7.925	0.001[b]	32.24 ± 8.668	38.50 ± 8.654	0.001[b]	32.41 ± 8.745	34.24 ± 9.120	0.049[a]	30.02 ± 7.739	35.56 ± 9.059	0.001[b]
BMI (kg/m^2)		25.95 ± 6.630	29.81 ± 7.943	0.001[b]	26.34 ± 7.229	26.81 ± 5.172	0.619	26.08 ± 6.931	28.51 ± 6.476	0.017[a]	24.29 ± 6.125	29.73 ± 6.783	0.001[b]	24.08 ± 6.685	28.27 ± 6.534	0.001[b]

Results represent N(percentage) of participants for all demographic categorical, and mean ± SD of participants for Age & BMI.
p-value of Chi square test for all demographic categorical, Independent T test for continues variable (Age, BMI).
[a] Significant at 0.05.
[b] Significant at 0.01.

Table 2
Average food intake & adherence to dietary guidelines based on the daily intake among participants groups according to the chronic diseases.

Macronutrients	Groups			
	Hypertension (n = 47)	Hypercholesterolemia (n = 66)	Diabetes/at risk of diabetes (n = 67)	Overweight/obese (n = 149)
Total energy (kcal)	1660.1	1471.2	1710.9	1502.9
Carbohydrate (g)	188.8	176.9	190.8	170
Total fat (g)	61.7	51.5	61.5	55.2
Protein (g)	85	79.2	97.4	82.2
Saturated fat (g)	12.1	12.1	13.1	12.6
Fiber (g)	11.3	12.8	13.1	11.3
Carbohydrate (%)	45.5 ↓	48.1 ↓	44.5 ↓	45.3 ↓
Total fat (%)	33.5 ↑	31.5 ↑	32.3 ↑	33.1 ↑
Protein (%)	20.5 ↑	21.5 ↑	22.7 ↑	21.9 ↑
Saturated fat (%)	6.6 “	7.4 “	6.9 “	7.6 “
Fiber (g)	11.3 ↓	12.8 ↓	13.1 ↓	11.3 ↓

Values are presented as mean & percentage for protein, carbohydrate, total fat, and saturated fat, while is presented as gram for fiber.
↓Below the RNIs for adults.
↑Above the RNIs for adults.
“ Within the RNIs for adults.

Table 3
Linear regression analysis of the dietary label use behavior scales according to chronic diseases (n = 380).

Chronic disease/Label use		No (Healthy)	Yes (Patient)	p-value
Hypertension	Use	14.66 ± 5.074	14.66 ± 4.729	0.999
	Check information	24.08 ± 10.236	23.72 ± 10.576	0.825
Hypercholesterolemia	Use	14.32 ± 5.088	16.27 ± 4.415	0.004[b]
	Check information	23.31 ± 10.313	27.454 ± 9.374	0.003[b]
Diabetes/at risk of diabetes	Use	14.46 ± 4.965	15.89 ± 5.265	0.052
	Check information	23.61 ± 10.055	26.57 ± 11.217	0.049[a]
Overweight\obese	Use	14.26 ± 5.223	15.28 ± 4.655	0.053
	Check information	23.58 ± 10.472	24.73 ± 9.931	0.288
Patients	Use	13.69 ± 5.251	15.42 ± 4.719	0.001[b]
	Check information	22.69 ± 10.499	25.08 ± 9.977	0.024[a]

All values are means ± SD. The range of scores for each of the 2 factors was as follows: ‘‘Use (5–25) with mean (14.66 ± 5.027), ‘‘Check’’ (9–45) with mean (24.03 ± 10.27). Values were calculated by using linear regression analysis and were adjusted for age, BMI, Gender, Area, Education, Marital status, Income, Job and Citizen.
[a] Significant at 0.05.
[b] Significant at 0.01.

groups compared with the healthy group. This finding was similar to the results of the previous studies reported by Rose et al.[25] and Lewis et al.[20] These results might be due to improving their healthy dietary behaviors, given their greater use of nutrition labels and awareness of national nutrition recommendations. In contrast, Nieto and colleagues demonstrated that people with obesity, diabetes, and a combination of chronic conditions were less likely to use nutrition labels than people without these conditions.[21] Given that higher intakes of certain nutrients such as fat, saturated fat and trans fat are related to a bigger risk of chronic conditions,[26] healthy persons who do not use label information compared with those already diagnosed with NCDs would benefit from nutrition label and possibly reduce their risk of developing NCDs. Nonetheless, continued efforts at increasing the use of food labels and promoting awareness of nutritional information and recommendations.[20]

In the present study, females are significantly using and checking information on food label. This finding was similar to the results of the previous studies reported by Satia et al.,[27] Blitstein & Evans.[28] These results might be due to that women place a higher value on good nutrition than men, which may lead them to actively seek health-related information.

Furthermore, the present study showed that postgraduates are more likely to use and check information on food labels. This finding correlated with that obtained by Blitstein & Evans[28] who reported that higher levels of education are associated with greater food label use. It may be that higher-educated persons are more aware of the relationship between diet and health. However, the fundamental skills needed to interpret that information may also influence this association.

In addition, those with higher income are more likely to use and check information on food labels. This result was in consistent with previous studies[29] which stated the probability of using label information, except on health claims, increases with income. These results might be due to their higher probability of utilizing food labels for nutrition information than other consumers.

Moreover, the current results showed significant use and check of information on food labels among those with normal BMI than other groups. The present findings agreed with Nieto and colleagues. This may mean that those who are managing their weight and following healthier lifestyles are more interested in nutrition labels compared to those with chronic diseases.[21] In addition, the current result was in agreement with Blitstein & Evans research[28] who stated, “The average BMI for men who read nutritional labels is 0.12 point lower than men who do not read them, while women who are users of nutritional labels have 1.49 points lower BMI than women who do not read labels”.

Summing up, persons who use and check labels may want to reduce their fat and/or total energy, and/or increase fiber consumption. Our results were confirmed by Smith et al.[30] who stated that label users believed that nutrition information is essential in making food choices.

This study had several limitations that need to be considered. The inability to determine whether participants are using and checking labels only for some foods or all foods. Participants’ knowledge also was not determined, such as buying a product without the knowledge of the daily amount of these nutrients could be not as effective as someone with the right knowledge. The questionnaire was self-reported, making it susceptible to bias. In addition, it is important to note that these findings are based on a cross-sectional study, which means that they cannot be used to establish cause-and-effect relationships.

5. Conclusion

In conclusion, individuals with chronic disease tend to demonstrate superior behaviour in reading food labels compared to those who are

Table 4
Demographic and BMI variables by label use behavior in use and check.

Demographic	Groups	n	Use Mean ± SD	p-value	Check Mean ± SD	p-value
Gender[a]	Male	176	13.72 ± 5.308	0.001**	22.95 ± 10.656	0.028*
	Female	204	15.48 ± 4.632		24.97 ± 9.847	
Regions[c]	Eastern Region	33	13.97 ± 4.908	0.342	25.15 ± 10.18	0.532
	Western Region	295	14.82 ± 5.101		24.19 ± 10.349	
	Central Region	41	14.73 ± 4.105		23.02 ± 9.603	
	North Region	3	14.67 ± 4.933		23 ± 10.583	
	Southern Region	8	11.25 ± 6.735		19.13 ± 11.544	
Education[c]	less than high school	6	13.83 ± 6.08	0.018*	21.83 ± 11.197	0.035*
	High school	56	13.64 ± 5.545		22.41 ± 10.804	
	Undergraduate	241	14.46 ± 4.945		24.20 ± 10.186	
	Postgraduate (Master's - PhD)	77	16.08 ± 4.599		24.88 ± 10.098	
Marital status[a]	Not Married	296	14.92 ± 4.81	0.187	24.11 ± 10.191	0.774
	Married	84	13.75 ± 5.665		23.75 ± 10.578	
Income[b]	Less than 5000 SR	153	14.8 ± 5.096	0.025*	24.31 ± 10.003	0.044*
	5000–10,000 SR	107	14.01 ± 5.215		23.74 ± 10.687	
	10,000–20,000 SR	90	14.76 ± 4.382		23.42 ± 10.103	
	More than 20,000 SR	30	16.00 ± 5.681		25.53 ± 10.849	
Employment[c]	Employed	207	14.15 ± 4.965	0.273	23.5 ± 10.186	0.016*
	Unemployed	69	15.55 ± 5.293		25.81 ± 10.244	
	Retired	13	14.62 ± 3.429		19.92 ± 11.273	
	Student	91	15.15 ± 5.079		24.49 ± 10.213	
Citizen[a]	Citizen	180	14.72 ± 5.35	0.838	23.85 ± 10.608	0.740
	Resident	200	14.61 ± 4.731		24.2 ± 9.97	
Age[b]	Less than 25 years	84	14.61 ± 5.359	0.965	23.89 ± 10.371	0.045*
	25–39 years	194	14.62 ± 5.238		23.57 ± 10.28	
	40 years and above	102	14.77 ± 4.332		25.03 ± 10.181	
BMI[c]	Underweight range <18.5	22	12.59 ± 5.105	0.034*	18.5 ± 8.879	0.017*
	Healthy weight range 18.5–24.9	156	15.13 ± 5.103		25.15 ± 10.19	
	Overweight range 25–29.9	120	14.40 ± 4.778		23.09 ± 10.318	
	Obesity range 30 or higher	82	14.69 ± 5.139		24.78 ± 10.242	

[a] Independent sample T-test.
[b] ANOVA test.
[c] Kruskal-Wallis test.

healthy. However, this does not necessarily result in adopting healthier dietary habits. Encouraging healthy individuals to peruse food labels could potentially reduce their susceptibility of developing chronic disease.

Therefore, continuous efforts to enhance the utilization of food labels and to increase awareness of nutritional information are essential, particularly among those who are healthy. Lifestyle modifications can potentially lead to the reversal of symptoms associated with chronic disease. Furthermore, exploring alternative labelling methods, such as the Traffic Light Labelling system and Health Star Rating system, could further facilitate the promotion of healthier dietary choices. Further studies are needed to explore effective strategies for assisting patients in comprehending and effectively utilizing food labels.

Ethical Statement

The entire study procedures were ethically approved by the Research Ethics Committee, Faculty of Medicine, King Abdulaziz University (Reference No 291-21).

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Author Contributions

Conceptualization, Arwa Turkistani; Formal analysis, Maram Bamansoor; Funding acquisition, Maram Bamansoor; Investigation, Maram Bamansoor; Methodology, Arwa Turkistani; Supervision, Arwa Turkistani; Validation, Maram Bamansoor; Writing – original draft, Maram Bamansoor; Writing – review & editing, Arwa Turkistani.

Conflict of interest

The authors declares no conflict of interest.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References

1. Mahabalaraju D. *Noncommunicable Diseases*. Essentials Community Med Pract; 2017: 89–98. Published online.
2. Timlin MT, Pereira MA. Breakfast frequency and quality in the etiology of adult obesity and chronic diseases. *Nutr Rev*. 2007;65:268–281.
3. Gonzales D. Impact of menu labeling on food choices of Southern Undergraduate students. *J Obes Weight Loss Ther*. 2014;s4.
4. Saudi Food and Drug Authority. Obligate restaurants and cafes are required to display calories. https://www.sfda.gov.sa/en/node/1828 Accessed October 27, 2021.
5. Sharaf F. Impact of health education on compliance among patients of chronic diseases in Al Qassim, Saudi Arabia. *Int J Health Sci*. 2010;4:139–148.
6. General Authority for Statistics. Releases Results of Household Health Survey. https://www.stats.gov.sa/en/news/326 Accessed December 30, 2012..

7. CDC. NHANES 2005-2006 Overview. https://wwwn.cdc.gov/nchs/nhanes/continuousnhanes/overview.aspx?BeginYear=20Accessed October 17, 2021..
8. Aljulifi MZ, Aljulifi Z. Prevalence and reasons of increased type 2 diabetes in Gulf Cooperation Council Countries. *Saudi Med J*. 2021;42:481–490.
9. Alhabib KF, Batais MA, Almigbal TH, et al. Demographic, behavioral, and cardiovascular disease risk factors in the Saudi population: results from the Prospective Urban Rural Epidemiology study (PURE-Saudi). *BMC Publ Health*. 2020;20:1–14.
10. Alhowikan AM, Alsharqawy NE, Alazmaa NN, et al. Lifestyle habits and obesity indices among male adolescents in Riyadh, Saudi Arabia. *Sci Reports*. 2023;13.
11. Al-Zahrani J, Shubair MM, Al-Ghamdi S, et al. The prevalence of hypercholesterolemia and associated risk factors in Al-Kharj population, Saudi Arabia: a cross-sectional survey. *BMC Cardiovasc Disord*. 2021;21.
12. M Alqarni SS. A review of prevalence of obesity in Saudi Arabia. *J Obes Eat Disord*. 2016:2.
13. Al-Nuaim AR, Al-Rubeaan K, Al-Mazrou Y, Al-Attas O, Al-Daghari N. Prevalence of hypercholesterolemia in Saudi Arabia, epidemiological study. *Int J Cardiol*. 1996;54:41–49.
14. Wong ND, Lopez V, Tang S, Williams GR. Prevalence, Treatment, and Control of combined hypertension and hypercholesterolemia in the United States. *Am J Cardiol*. 2006;98:204–208.
15. Johansen AK, Bogsrud MP, Christensen JJ, et al. Young women with familial hypercholesterolemia have higher LDL-cholesterol burden than men: Novel data using repeated measurements during 12-years follow-up. *Atheroscler Plus*. 2023;51:28–34.
16. Mamdouh H, Hussain HY, Ibrahim GM, et al. Prevalence and associated risk factors of overweight and obesity among adult population in Dubai: a population-based cross-sectional survey in Dubai, the United Arab Emirates. *BMJ Open*. 2023;13.
17. Saquib N, Saquib J, Alhadlag A, et al. Chronic disease prevalence among elderly Saudi men. *Int J Health Sci*. 2017;11:11.
18. Al-Kandari YY. Prevalence of obesity in Kuwait and its relation to sociocultural variables. *Obes Rev*. 2006;7:147–154.
19. Lewis JE, Arheart KL, LeBlanc WG, et al. Food label use and awareness of nutritional information and recommendations among persons with chronic disease. *Am J Clin Nutr*. 2009;90:1351–1357.
20. Alissa EM, Bahjri SM, Al-Ama N, Ahmed WH, Ferns GAA. High cardiovascular risk in young Saudi males: cardiovascular risk factors, diet and inflammatory markers. *Clin Chim Acta*. 2006;365:288–296.
21. Nieto C, Tolentino-Mayo L, Monterrubio-Flores E, et al. Nutrition label Use is related to chronic conditions among Mexicans: data from the Mexican national health and nutrition survey 2016. *J Acad Nutr Diet*. 2020;120:804–814.
22. Ollberding NJ, Wolf RL, Contento I. Food label Use and its relation to dietary intake among US adults. *J Am Diet Assoc*. 2010;110:1233–1237.
23. Turkistani AM, Saaty AH. Nutritional knowledge and consumers' perception toward menu calorie labeling use in Saudi Arabia. *Journal of Organizational Behavior Research*. 2020;5:148–163.
24. Alassaf HI, Alaskar YA, Alqulaysh BF, et al. Assessment of knowledge, attitudes and practices of Saudi adults about calorie labeling in central Saudi Arabia. *Saudi Med J*. 2020;4:296–304.
25. Rose TM, Unni EJ, Jones GJ. Factors influencing nutrition label reading behavior in individuals with selected chronic diseases. *Am J Heal Educ*. 2018;49:296–304.
26. Oh K, Hu FB, Manson JE, Stampfer MJ, Willett WC. Dietary fat intake and risk of Coronary Heart disease in women: 20 Years of follow-up of the Nurses' health study. *Am J Epidemiol*. 2005;161:672–679.
27. Satia JA, Galanko JA, Neuhouser ML. Food nutrition label use is associated with demographic, behavioral, and psychosocial factors and dietary intake among African Americans in North Carolina. *J Am Diet Assoc*. 2005;105:392–402.
28. Blitstein JL, Evans WD. Use of nutrition facts Panels among adults who Make Household food purchasing Decisions. *J Nutr Educ Behav*. 2006;38:360–364.
29. Jackey BA, Cotugna N, Orsega-Smith E. Food label knowledge, usage and attitudes of older adults. *J Nutr Gerontol Geriatr*. 2017;36:31–47.
30. Smith SC, Taylor JG, Stephen AM. Use of food labels and beliefs about diet-disease relationships among university students. *Public Health Nutr*. 2007;3:175–182.