

Review Article

Correlates of nutrition label use among college students and young adults: a review

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Abstract

Objective: Nutrition labels are an essential source for consumers to obtain nutrition-related information on food products and serve as a population-level intervention with unparalleled reach. The present study systematically reviewed existing evidence on the correlates of nutrition label use among college students and young adults.

Design: Keyword and reference searches were conducted in PubMed, EBSCO, PsycInfo, Cochrane Library and Web of Science. Inclusion criteria included: study design (randomized controlled trial, cohort study, pre–post study or cross-sectional study); population (college students and young adults 18–30 years old); main outcome (nutrition label use); article type (peer-reviewed publication); and language (English).

Setting: College/university.

Subjects: College students and young adults.

Results: Sixteen studies based on data from college surveys in four countries (USA, UK, Canada, South Korea) were identified from keyword and reference search. Reported prevalence of nutrition label use varied substantially across studies; a weighted average calculation showed 36.5 % of college students and young adults reported using labels always or often. Females were more likely to use nutrition labels than males. Nutrition label use was found to be associated with attitudes towards healthy diet, beliefs on the importance of nutrition labels in guiding food selection, self-efficacy, and nutrition knowledge and education.

Conclusions: The impact of nutrition labelling on food purchase and intake could differ by population subgroups. Nutrition awareness campaigns and education programmes may be important mechanisms for promoting nutrition label use among college students and young adults. Future research is warranted to assess the role of label use on improved dietary decisions.

Keywords
Nutrition labels
Label use
Dining hall
University students
Young adults

Improving diet quality is a key health promotion strategy. Since 1980, a major theme of the US federal dietary guidelines has been to increase consumption of nutrient-rich foods and reduce consumption of energy-dense foods⁽¹⁾. However, a large majority of the American population fails to meet these guidelines, with insufficient consumption of nutrient-rich foods such as fruit and vegetables and excessive discretionary calorie intake⁽²⁾.

Nutrition labels are an essential source for consumers to obtain nutrition- and health-related information on food products and serve as a population-level intervention with unparalleled reach⁽³⁾. A substantial proportion of US consumers report regular use of nutrition labels to guide

their food selection^(4–7). The perception on the credibility of nutrition labels appears high, whereas findings on the relationship between nutrition label use and diet quality remain largely inconclusive^(4–7). Multiple systematic reviews suggest that nutrition labelling alone may not effectively reduce calorie selection or intake in general populations^(8,9), although labelling appears somewhat effective when paired with interpretational aides such as statements about daily nutritional needs⁽⁹⁾. The substantial variability in study results could be partially due to heterogeneities in nutrition label use and dietary habits across population subgroups. Children, adolescents, obese older adults, individuals with less education and/or nutrition

knowledge, people with lower disposable income and those with limited health awareness are found less likely to use labels and/or effectively process the nutrition information presented^(7,10,11).

One population subgroup that has received less attention in the literature is college-aged students and young adults. These individuals are often included in the general adult population studies; however, there is evidence to suggest this particular subgroup warrants specific attention. During the college time period, many young adults are making the transition from living at home with their family members to living independently. This transition forces young adults to start developing their own habits, routines and preferences (including food and dietary decisions)⁽¹²⁾, many of which persist into adulthood. Unfortunately, two patterns have emerged for this age group: weight gain⁽¹³⁾ and decreased dietary quality⁽¹⁴⁾. Nelson *et al.*⁽¹²⁾ noted that the transition from adolescence to adulthood is associated with decreased fruit and vegetable consumption, increased fast food and soft drink consumption, and lower levels of physical activity. More concerning, longitudinal studies show that poor dietary quality in young adulthood is associated with long-term risk of cardiovascular⁽¹⁵⁾ and metabolic disease⁽¹⁶⁾.

Nutrition labels may serve as an important preventive tool for college students and young adults by encouraging the formation of habitual behaviours that could profoundly impact their food preferences and diet quality later in life⁽¹²⁾. To date, much of the research assessing comprehension, predictors and the impact of nutrition label use on food behaviours and intake focuses on the general adult population. Limited research in young adults suggests that individuals in this subgroup may use nutrition labels, but frequency and predictors of usage are not well known. While the impact of food environment interventions has been reviewed in college students⁽¹⁷⁾, no reviews have focused on predictors or correlates of label usage in college students and young adults. Documenting factors that influence nutrition label use in this subgroup is particularly important for informing targeted nutrition interventions and improving the effectiveness of nutrition education programmes and awareness campaigns. The objective of the present study was to systematically review existing scientific evidence on the correlates of nutrition label use among college students and young adults 18–30 years of age.

Methods

Study selection criteria

Studies that met all of the following criteria were included in the review: study design was a randomized controlled trial, cohort study, pre–post study or cross-sectional study; population was college students and young adults 18–30 years of age; main outcome was nutrition label use (Nutrition Facts labels, labels within dining halls or nutrition labels

in general); article type was a peer-reviewed publication; and language was English. Studies were excluded from the review if they met one or more of the following criteria: case reports or case–control studies; non-English publications; non-peer reviewed articles; experiments that require nutrition label reading as a prerequisite for study participation; and studies that assess participants' preference for alternative label formats, belief on the accuracy of information presented on labels, label comprehension or intent to use some hypothetical rather than actual labels.

Search strategy

Keyword search was performed in PubMed, EBSCO, PsycInfo, Cochrane Library and Web of Science. The search algorithm included all possible combinations of keywords from the following three groups: (i) 'nutrition', 'calorie', 'food', 'diet' or 'menu'; (ii) 'label', 'labeling' or 'labelling'; and (iii) 'college student', 'university student', 'young adult', 'university cafeteria' or 'college cafeteria'. Articles with one or more of the following keywords were excluded: 'supplement', 'pharmacology', 'medication', 'allergy', 'mice' or 'cigarette'. Titles and abstracts of the articles identified through keyword search were screened against the study selection criteria. Potentially relevant articles were retrieved for evaluation of the full text.

A cited reference search (forward reference search) and a reference list search (backward reference search) were also conducted based on the articles identified from the keyword search. Articles identified through forward/backward reference search were further screened and evaluated using the same study selection criteria. Reference searches were repeated on all newly identified articles until no additional relevant article was found.

Data extraction and synthesis

A standardized data extraction form was used to collect the following methodological and outcome variables from each included study: author(s), publication year, study design, setting, sample size, sample demographics, response and/or completion rate, participant recruitment criteria, nutrition label use, correlate(s) of nutrition label use, main findings and conclusions.

A meta-analysis could not be conducted due to the dissimilar nature of study designs and outcome measures (i.e. alternative definitions and instruments on nutrition label use). Analysis included a narrative review of the included studies with general themes summarized⁽¹⁸⁾, in addition to a weighted average of nutrition label usage prevalence for the thirteen studies with similar Likert-scale responses for label usage frequency (most studies used 3-, 4- or 5-point scales). Responses were grouped into three categories: (i) always or often; (ii) sometimes; and (iii) rarely or never. Overall prevalence for each category was calculated by dividing the number of students in each category by the total sample size of all the included studies.

Table 1 Definitions of study quality criteria

Item	Criterion of study quality
1	Study design and data collection procedures clearly documented (yes = 1, no = 0)*
2	Sample size (400 or more participants = 1, less than 400 participants = 0)†
3	Response or completion rate reported (yes = 1, no = 0)
4	Survey instrument validated (yes = 1, no = 0)‡
5	Considered demographic correlates of usage (yes = 1, no = 0)§
6	Considered non-demographic correlates of usage (yes = 1, no = 0)¶
7	Used regression analysis to examine the relationship between label usage and multiple predictor variables/correlates simultaneously (yes = 1, no = 0)
8	Non-restricted population (yes = 1, no = 0)¶¶

*At a minimum, how subjects were recruited and mode of data collection (e.g. in-person, online) should be indicated.

†Using the most conservative estimate of 50 % nutrition label usage prevalence, a power analysis indicates that at the 95 % confidence level, a sample size of 384 people would be needed to detect significant differences in usage.

‡Surveys were considered validated if they were either adapted from previously published surveys or first pilot-tested with the population of interest.

§Demographic correlates included: gender, age, class, education level, race/ethnicity, BMI and marital status.

¶Non-demographic correlates included: knowledge, attitudes, beliefs, self-efficacy, behaviours and nutrition education.

¶¶Indicates the population was not restricted by any factor other than age or student classification.

Study quality assessment

The quality of each study included in the review was assessed by the following eight criteria, adapted from the US National Institutes of Health⁽¹⁹⁾ recommendations and tailored specifically for assessing the cross-sectional studies included: (i) study design and data collection procedures were clearly documented (yes = 1, no = 0); (ii) sample size (400* or more participants = 1, less than 400 participants = 0); (iii) response or completion rate was reported (yes = 1, no = 0); (iv) survey instrument was validated (yes = 1, no = 0); (v) demographic correlates of usage (yes = 1, no = 0) were considered; (vi) non-demographic correlates of usage (yes = 1, no = 0) were considered; (vii) regression analyses were performed to examine the relationship between label usage and multiple predictor variables/correlates simultaneously (yes = 1, no = 0); and (viii) non-restricted population wherein participants were not excluded from eligibility for any factor other than age or student status (yes = 1, no = 0). Full definitions for all study criteria are available in Table 1. Given these criteria, total study quality score ranged between 0 and 8. Study quality score helped measure the strength of study evidence but was not used to determine the inclusion of studies.

Results

As Fig. 1 shows, among a total of 235 unduplicated articles identified through keyword and reference searches, 197 were excluded in title and abstract screening. The remaining thirty-eight articles were reviewed in full texts, in which twenty-two studies were excluded due to the following reasons: age ineligibility ($n\ 3$)^(20–22), no assessment of nutrition label use ($n\ 11$)^(23–33) and an ineligible study design ($n\ 8$), which included six experiments that required participants to read a nutrition label^(34–39), one semi-structured

interview⁽⁴⁰⁾ and one case-control study⁽⁴¹⁾. The remaining sixteen articles were included in the review.

Basic characteristics of selected studies

Tables 2 and 3 summarize the sixteen peer-reviewed journal articles included in the review. All but two studies were published in 2005 or later. Studies were conducted in four countries: the USA ($n\ 13$)^(42–54), the UK ($n\ 1$)⁽⁵⁵⁾, Canada ($n\ 1$)⁽⁵⁶⁾ and South Korea ($n\ 1$)⁽⁵⁷⁾. Among the US-based studies, two were conducted in the West (California, Oregon)^(48,54), four in the South (Georgia, Missouri, Louisiana, Texas)^(42,49,51,53), four in the Northeast (Pennsylvania, New York, Vermont, Connecticut)^(43,46,47,50) and three in the Midwest (Nebraska, Minnesota, Ohio)^(44,45,52). All studies were surveys conducted in college or university settings. Ten of these surveys were administered in person, four online^(43,45,54,55), one via telephone⁽⁴⁷⁾ and one did not state the administration method⁽⁵¹⁾.

Prevalence of nutrition label use

Although most of the studies had slightly different measures of label use, the majority of studies shared similar response categories for the frequency of label usage (3-, 4- or 5-point Likert scales that were typically anchored by 'never' and 'always'). In order to merge the different scales, we look at usage frequency using a 3-point scale ('always/often', 'sometimes', 'rarely/never').† Thirteen out of the sixteen studies were included in this analysis; the remaining three were excluded for only reporting usage as a dichotomous (yes/no) variable⁽⁵⁷⁾, not reporting overall usage frequency⁽⁴²⁾ and only reporting usage as a continuous number from the frequency scale⁽⁵²⁾.‡ Table 4 provides the

† It should be noted that some studies used slightly different wording (e.g. 'none of the time', 'every single time', 'always or almost always'); however, all scale points could be classified into one of these three categories. For exact wording, refer to the 'Measure of nutrition label use' column in Table 2.

‡ Cha *et al.*⁽⁴²⁾ and Misra⁽⁵²⁾ did not report the breakdowns of their 5-point frequency scales. Both authors were contacted by email but were unable to provide this information by the deadline given.

* Since usage prevalence in college students and young adults has not been previously reviewed, we used the most conservative estimate of 50 % prevalence for our power analysis calculation to gauge necessary sample size to detect significant correlates of usage at the 95 % confidence level.

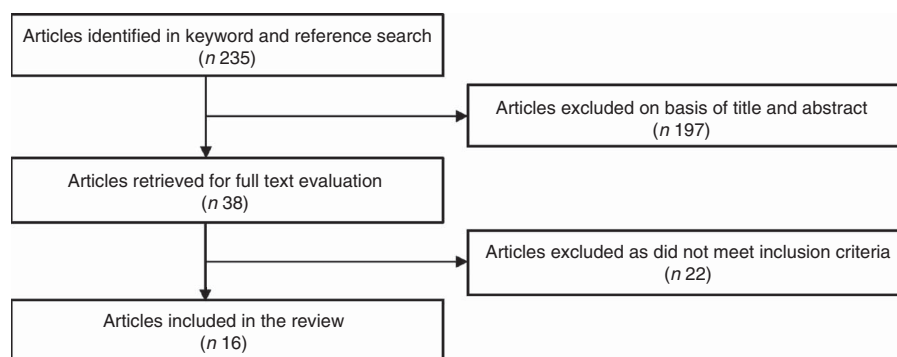


Fig. 1 Study selection flowchart

breakdown for each frequency category across the thirteen studies. Using this information, we calculated a weighted average of label usage frequency among college students and young adults. As shown in Table 4, 36.5 % of college students reported using nutrition labels always or often. Almost the same percentage (36.7 %) of students reported using labels sometimes, whereas 26.8 % reported rarely or never using labels.

Correlates of nutrition label use

Twelve of the thirteen studies that assessed gender differences in nutrition label use found being female was significantly associated with higher label use^(43–50,52–54,56). In the remaining study, Cha *et al.*⁽⁴²⁾ found that gender and food label use were not correlated; however, this study surveyed only 103 participants, 70 % of whom were female. One study had female participants only and thus was unable to test for gender differences in nutrition label use⁽⁵⁷⁾, whereas the other two studies did not report the presence/absence of gender differences^(51,55).

Seven studies reported participants' BMI or body weight status based on BMI (i.e. underweight, normal weight, overweight and obesity), five of which were self-reported^(47,48,50,55,57) and two based on objectively measured height and weight^(42,45). Martinez *et al.*⁽⁵⁰⁾ found that overweight or obese college students were significantly more likely to use nutrition labels in making lower-calorie and healthier food choices in dining halls. In contrast, Li *et al.*⁽⁴⁸⁾ and Krukowski *et al.*⁽⁴⁷⁾ found no association between BMI and nutrition label use among college students and young adults. While Cooke and Papadaki⁽⁵⁵⁾ did not report on any relationship between BMI and nutrition label use directly, they documented that BMI was related to nutrition knowledge and attitudes towards healthy eating – two variables that were related to label use. Specifically, they found that normal-weight college students had higher nutrition knowledge than their underweight counterparts, whereas overweight college students had lower attitudes towards healthy eating than their underweight counterparts. Other studies found no difference in height or weight⁽⁵⁷⁾ or average BMI⁽⁴⁵⁾ between

label users or non-users. Although Rasberry *et al.*⁽⁵³⁾ did not assess BMI, they found frequent label users were nearly three times more likely than non-users to select 'weight control' as a reason for using labels.

The findings on nutrition label use in relation to age and student classification (undergraduate students including freshmen, sophomores, juniors and seniors, and graduate students) remain mixed. Age was found to be positively associated with nutrient label use in two studies^(42,52). In terms of student classification, one study found that juniors and seniors were more likely to use nutrition labels compared with freshmen and sophomores⁽⁵¹⁾, whereas Jasti and Kovacs⁽⁴⁶⁾ found that graduate students were less likely to use nutrition labels than undergraduates, possibly due to the higher proportion of international students among the graduate student body. A third study by Misra⁽⁵²⁾ found undergraduate and graduate students were equally likely to use labels; this result is somewhat surprising given the author also found age was positively related to a higher label reading behaviour score. Others found no significant changes in nutrition label use by age^(45,49) or student classification⁽⁴⁸⁾.

There is limited evidence on nutrition label use in relation to race/ethnicity or marital status. Two studies reported that white⁽⁴⁵⁾ or non-Hispanic white students⁽⁴⁶⁾ were more likely to use nutrition labels than all other races/ethnicities, whereas another study reported no difference in nutrition label use by race/ethnicity⁽⁴⁸⁾. Only one study assessed marital status but did not find it to be associated with nutrition label use⁽⁴⁸⁾.

A few studies examined nutrition label use in relation to attitudes, beliefs and self-efficacy. Four studies^(45,49,52,55) found that attitudes towards healthy eating or preparing healthy meals positively predicted nutrition label use. Smith *et al.*⁽⁵⁶⁾ found that the only significant predictor of nutrition label use in both genders was the belief on the importance of nutrition labels in guiding food selection, although beliefs in the truthfulness of labels and diet–disease relationships also significantly predicted usage in men. Jasti and Kovacs⁽⁴⁶⁾ found that belief on the importance of eating a low-fat diet predicted label use, while Rasberry *et al.*⁽⁵³⁾ found that health reasons and looking for specific information related to usage. Increased

Table 2 Basic characteristics of the studies included in the review

Author(s), year	Study design and setting	Recruitment and sampling procedure	Sample characteristics	Correlate(s) studied	Measure of nutrition label use
Cha <i>et al.</i> ⁽⁴²⁾ , 2014	Cross-sectional; colleges and universities, Atlanta, Georgia, USA	Self-referral and flyers posted at colleges, universities, student clinics and via university emails to recruit students who were physically inactive and overweight/obese. Those under physician-supervised diet/exercise regimens or with diabetes or blood diseases excluded. Out of 234 recruits, 106 enrolled in the study; three participants were removed from data analysis	103 inactive overweight or obese young adults; 78.6 % female; mean age of 23.99 (sd 3.25) years; 70 % African-American; 59.2 % undergraduates	Age, gender, education, BMI, health literacy, self-efficacy	'How often do you use the food label when making a food selection?' (5-point Likert scale where 1 = 'never', 5 = 'always')
Conklin <i>et al.</i> ⁽⁴³⁾ , 2005	Cross-sectional; land-grant university, Pennsylvania, USA	Housing and Food Services sent 3290 first-year students an email invitation for the study during the second week of classes. 1317 students (40 %) responded	1317 college freshman who ate in campus dining commons; 49.3 % female	Gender, information sources, knowledge, motivations	'I use nutrition and ingredient information on food products' (3-point Likert scale where 1 = 'never', 3 = 'always'); and 'Nutrition and ingredient information supplied in the dining commons affects my choice of food' (7-point Likert scale where 1 = 'strongly disagree', 7 = 'strongly agree')
Cooke and Papadaki ⁽⁵⁵⁾ , 2014	Cross-sectional; UK universities	134 UK universities from the Universities and Colleges Admission Service database were invited; thirty-seven sent the survey web-link to students. Survey closed when a convenience sample of 500 participants was reached	524 college students; 75 % female; mean age of 24.9 years; mean BMI of 23.1 kg/m ² ; 77 % undergraduates	Attitudes, knowledge	'How often do you read the nutrition labels on food labels before purchasing foods or beverages?' (4-point Likert scale where 1 = 'never or rarely', 4 = 'always or almost always'; students responding 3 or 4 were categorized as frequent label users)
Driskell <i>et al.</i> ⁽⁴⁴⁾ , 2008	Cross-sectional; University of Nebraska, USA	Participants entering or leaving dining halls were recruited during a midweek lunch period during week 7 of the semester. Twenty respondents were excluded from data analysis for not listing gender or being under age 19 years	205 college student dining hall patrons; 44.3 % female; 83 % were 19–21 years of age; 87 % undergraduates	Gender, education, knowledge	Current use of Nutrition Bytes (dining hall labelling system). If user, frequency of usage was asked (3-point Likert scale where 1 = 'never', 3 = 'nearly always')
Graham and Laska ⁽⁴⁵⁾ , 2012	Cross-sectional; community college and 4-year university, Minneapolis/St. Paul, Minnesota, USA	Data collectors gave students on campus an online survey web-link and code	1201 college students; 598 from community college and 603 from public 4-year university; 52.5 % female; mean age of 21.5 years; 53.4 % non-white	Age, gender, BMI, race/ethnicity, dietary behaviours, nutrition knowledge, attitude towards preparing healthy meals	'How often do you read the nutrition labels on food labels before purchasing foods or beverages?' (4-point Likert scale where 1 = 'never or rarely', 4 = 'always or almost always'; students responding 3 or 4 were considered frequent users)
Jasti and Kovacs ⁽⁴⁶⁾ , 2010	Cross-sectional; Queens College, Queens, New York, USA	Students from five undergraduate and graduate non-nutrition classes were surveyed at the end of classes in summer and autumn. Those under 18 years old were excluded. Overall response rate of 83 %	222 college students; 56 % female; mean age of 23.9 (sd 5.6) years; 63 % non-white; 82 % undergraduate	Age, gender, race/ethnicity, shopping, attitudes, knowledge, nutrition education	Participants were asked if they used food labels to help them make better food choices (3-point Likert scale where 1 = 'always', 3 = 'never'; students responding 1 or 2 categorized as users)
Krukowski <i>et al.</i> ⁽⁴⁷⁾ , 2006	Cross-sectional; Vermont, USA	A random sampling telephone survey was used on two populations: (i) community sample and (ii) college sample.* Those under 18 years old were excluded. Overall response rate of 60.4 % for college sample	316 college students; 56 % female; mean age of 20.5 (sd 3.5) years; 22.3 % overweight (BMI \geq 25.0 kg/m ²)	Gender, BMI, food behaviours	Usage frequency of food labels was measured on a 3-point Likert scale where 1 = 'often', 3 = 'rarely'
Li <i>et al.</i> ⁽⁴⁸⁾ , 2012	Cross-sectional; Oregon State University, USA	Students were recruited in general education classes and given the link to an online survey at the beginning and at the end of academic terms. 582 students completed the survey; however, ninety-four observations were removed for incomplete responses	488 college students; 65 % female; mean age of 19.6 (sd 2.4) years; 75 % white; 63 % freshmen; mean BMI of 23.8 (sd 4.3) kg/m ²	Age, gender, marital status, race/ethnicity, BMI, class	How often they read food labels before buying (5-point Likert scale where 1 = 'never', 5 = 'always')

Table 2 Continued

Author(s), year	Study design and setting	Recruitment and sampling procedure	Sample characteristics	Correlate(s) studied	Measure of nutrition label use
Lim <i>et al.</i> ⁽⁵⁷⁾ , 2015	Cross-sectional; women's university, Seoul, South Korea	300 female students were recruited; those with incomplete responses (<i>n</i> 15) and majoring in food or nutrition (<i>n</i> 10) were excluded, for a total of 275 students	275 female college students; mean age of 20.6 years; mean height and weight of 162.4 cm and 52.6 kg; 34.2 % freshmen, 29.4 % sophomores, 16.4 % juniors, 20.0 % seniors	Age, height, weight, class, beliefs	Participants were asked if they read nutrition labels when selecting or purchasing processed foods or snacks; 'yes' responses = users; 'no' or 'don't know' responses = non-users
Marietta <i>et al.</i> ⁽⁴⁹⁾ , 1999	Cross-sectional; Southeast Missouri State University, Cape Girardeau, Missouri, USA	Undergraduates taking a basic life science class were recruited and surveyed in class	208 undergraduates; 67.8 % female; mean age of 21.7 (sd 5.6) years	Age, gender, attitude, knowledge, nutrition education	'When you purchase a food product for the first time, do you look at the Nutrition Facts label on the package?' (5-point Likert scale where 1 = 'never', 5 = 'always')
Martinez <i>et al.</i> ⁽⁵⁰⁾ , 2012	Cross-sectional; Yale University, Connecticut, USA	Students were recruited over a 4-month period and received \$US 2 for a 5 min survey about the dining halls. Non-undergraduates and those under 18 years old were excluded	487 undergraduates; 56 % female; mean BMI of 22.5 (sd 2.9) kg/m ² ; 17 % overweight or obese	Gender, BMI	'How often do you look at food labels on packaged foods?' (5-point Likert scale where 1 = 'never', 5 = 'always')†
McLean-Meynsse <i>et al.</i> ⁽⁵¹⁾ , 2011	Cross-sectional; Louisiana, USA	Students were surveyed on campus during spring and autumn semesters	441 college students; 58 % female; mean age of 20 years; 35 % freshmen; 87 % African-American	Class year	'How often do you read Nutrition Facts labels?' (4-point Likert scale where 1 = 'never', 4 = 'often')
Misra ⁽⁵²⁾ , 2007	Cross-sectional; two Midwestern universities, USA	Survey was mailed to 1500 students (1000 undergraduate, 500 graduate) randomly selected from the registrars' student directories. The return rate was 36 % (184 graduate and 353 undergraduate students)	537 college students; 67 % female; mean age of 23 (sd 6.1) years; freshmen and juniors (66 %); 21 % were overweight and 8 % obese	Age, gender, supplement use, nutrition education, attitudes, knowledge	Four questions based on the Label Reading Survey assessed the general use of the Nutrition Facts panel – exact wording not provided (5-point Likert scale where 1 = 'never', 5 = 'always')
Raspberry <i>et al.</i> ⁽⁵³⁾ , 2007	Cross-sectional; large university in Texas, USA	Students were recruited from eighty-eight physical education activity programme courses; 1294 out of an estimated 2756 eligible participants (47 % response rate) completed surveys. Those under age 18 years were excluded	1294 college students; 52 % female; 48 % freshmen/sophomores	Gender, weight control, knowledge, attitudes, beliefs	Four items related to usage – exact wording for all items not provided (4-point Likert scale where 1 = 'never', 4 = 'always')
Smith <i>et al.</i> ⁽⁵⁶⁾ , 2000	Single-stage cluster sampling; University of Saskatchewan, Canada	Second-year classes offered in the College of Arts and Science (twenty-five classes contacted, of which seventeen participated) were randomly sampled; the response rate was 92 %	553 college students; 46.8 % female; 80.1 % between the ages of 18 and 24 years	Gender, beliefs	'How frequently do you use the nutrition information panel?' (5-point Likert scale where 1 = 'none of the time', 5 = 'every single time'). Participants were also asked about use of nutrient claims using same 5-point scale
Wie and Giebler ⁽⁵⁴⁾ , 2014	Cross-sectional; 4-year university in Sacramento, California, USA	Contacted faculty randomly, who distributed an online survey. Students (<i>n</i> 819) in the rosters were invited to participate via an email including a survey and one follow-up email reminder sent to faculty. The response rate was 342 out of 819 (42 %)	342 college students; 75 % female; 54 % were aged 21–30 years and 31 % were aged 20 years or younger; 70 % juniors/seniors	Gender, nutrition education	'I consider the calorie content of menu items at restaurants before making my choices' (5-point Likert scale where 1 = 'never', 5 = 'always')

*For the purposes of the present review, we focus on the college sample results. However, in some cases, the authors only report results on the combined sample (these instances are identified in the findings section in Table 3).
†Exact usage questions not provided in the manuscript; the wording of this measure was obtained via personal communication with the corresponding author.

Table 3 Main findings and conclusions of the studies included in the review

Author(s), year	Main finding	Conclusion
Cha <i>et al.</i> ⁽⁴²⁾ , 2014	Food label usage was significantly correlated with education, age and eating behaviour self-efficacy. In a regression, health literacy and self-efficacy explained almost 10 % of the variability in food label use; in the full model, only self-efficacy was significantly correlated with label usage	Strategies to enhance health literacy, self-efficacy and food label use should be developed in an effort to improve dietary quality
Conklin <i>et al.</i> ⁽⁴³⁾ , 2005	21.7 % of students said they use nutrition and ingredient information on food products always (56.6 % responded sometimes, 21.6 % responded never). Almost 30 % of students agreed that nutrition information supplied in the dining commons affects their food choice. Females were more likely to use labels. Using dining hall labels was significantly related to a self-reported good understanding of nutrition, using nutrition labels on food products and obtaining information on food choices from weight-loss programmes. Usage was not related to wanting to be healthy now, avoiding poor health later, food allergies or losing weight	One-third of students used labels to help make food choices in the dining commons; females were more likely use labels and report eating in the dining hall because information was available
Cooke and Papadaki ⁽⁵⁵⁾ , 2014	34.7 % of students said they always or almost always read the nutrition labels on food before purchasing foods/beverages, 28.8 % said often, 23.3 % said sometimes and 13.2 % said never or rarely.* Logistic regression results showed that for every one-point increase in nutrition knowledge and attitudes score, the odds of nutrition label use significantly increased by 0.03 (3 %) and 0.2 (20 %) times, respectively. Usage was significantly correlated with knowledge (0.203) and attitudes (0.137)	Nutrition knowledge and attitudes significantly predict usage
Driskell <i>et al.</i> ⁽⁴⁴⁾ , 2008	Nutrition Bytes labels were used by 58.5 % of the 205 subjects. More women (79.1 %) than men (42.1 %) reported using Nutrition Bytes labels ($P=0.0001$). Education on nutrition labels resulted in label usage; however, nutrition knowledge was not related to label usage. Reasons for using labels were general knowledge (51.7 %), concern about overall health (49.2 %), calorie counting (46.7 %) and concern about a certain nutrient(s) (43.3 %). Common reasons for non-use were 'it will not change my mind about food items I select' (64.7 %) and not having enough time (27.1 %)	The majority of patrons used the Nutrition Bytes labelling system. Females and those who had been educated on nutrition labels were more likely to use labels. More efforts on label education and linking nutrition, diet and health may improve label use, diet quality and health outcomes
Graham and Laska ⁽⁴⁵⁾ , 2012	35 % of students were classified as frequent label readers. Females and white students were significantly more likely to be frequent label readers; age and BMI were not related to frequent label reading. Nutrition label readers had greater nutrition knowledge, better estimates of how many calories and fruit/vegetable servings are needed to be healthy, and were more likely to perform healthy dietary behaviours compared with the infrequent label readers. Regression analysis revealed attitude towards preparing healthy meals was significantly related to frequent label reading	Frequent use mediated the relationship between the importance of preparing healthy meals and dietary quality, showing that it may be a tool that people who value nutrition may use to change behaviour
Jasti and Kovacs ⁽⁴⁶⁾ , 2010	24 % of students reported always using food labels, 61 % reported sometimes and 14 % reported never using labels. Females, non-Hispanic whites and undergraduates were significantly more likely to use food labels than their male, non-white and graduate counterparts, respectively. Additionally, students with prior nutrition education and grocery shoppers were more likely to use food labels. Logistic regression showed good <i>trans-fat</i> knowledge, importance of eating a low-fat diet, younger age group and positive grocery shopping status were strong predictors of food label use; prior nutrition education, gender and college level were not	White students, undergraduates, females, grocery shoppers and those with prior nutrition education or who thought a low-fat diet was important used labels more frequently
Krukowski <i>et al.</i> ⁽⁴⁷⁾ , 2006	48.4 % of college students said they always used food labels; 22.9 % said sometimes and 28.7 % said rarely. Females were significantly more likely than males to use labels often ($P<0.001$). For the combined (college and community) sample, participants eating 50 % or more home-cooked meals were more likely to report looking at food labels often compared with those who had <50 % home-cooked meals ($P<0.001$), and those who ate fast food more than once ($v. 0$ or 1 meal) in the past week were more likely to report rarely looking at food labels ($P<0.001$). Weight status did not influence food label use	Women were more likely to use food labels than men. Eating home-cooked meals and less fast food were related to greater food label use while weight status was not

Table 3 Continued

Author(s), year	Main finding	Conclusion
Li <i>et al.</i> ⁽⁴⁸⁾ , 2012	On a 5-point scale (where 1 = 'never', 5 = 'always'), the average label usage score was 2.9 (SD 1.3); 14.6 % of students reported always using labels; 21.7 % reported often, 20.5 % reported sometimes, 26.8 % reported rarely and 16.4 % reported never.* Females exhibited a significantly higher usage score than males. Regression analysis further revealed that only gender was significantly associated with label usage (females more likely to use than males; $P=0.002$); ethnicity, marital status, class year and BMI were not associated with usage	Females were more likely to use labels than males; label usage, in turn, was related to more healthful eating habits
Lim <i>et al.</i> ⁽⁵⁷⁾ , 2015	Label users (37.8 %) and non-users (62.2 %) did not differ in age, class year, height or weight. Label users had higher positive behavioural beliefs and beliefs in the benefits of label usage than non-users, and lower scores for negative behavioural beliefs (e.g. 'using labels is annoying'). Label users also had significantly higher normative belief scores, indicating these individuals perceived more influence from significant others regarding the use of nutrition labels relative to non-users. Finally, label users reported greater control over constraints such as time, knowledge, impulsive eating, food expense and preference for specific foods. Non-users had significantly lower confidence in understanding information such as nutrients, % daily value, nutrient content per serving size, and serving size	Label users had more favourable beliefs about using labels and in the immediate benefits of reading labels; however, beliefs about long-term benefits (e.g. disease prevention) did not differ between users and non-users. Label users had higher perceived control and did not perceive as many constraints to using labels. Nutrition education efforts should focus on increasing perceived control over label use
Marietta <i>et al.</i> ⁽⁴⁹⁾ , 1999	20.2 % of students said they always looked at labels when purchasing a food product for the first time; 23.6 % said often, 26.4 % said sometimes and 29.8 % said rarely or never. Females looked at labels significantly more often than men and were more likely to use labels to fit a food into their daily diet. Regression analysis revealed knowledge, attitude, age, gender and previous experience with nutrition labels explained 14 % of the variation in label use, with attitude ($r^2=0.08$, $P<0.001$) and gender ($r^2=0.04$, $P<0.01$) being significant independent predictors. Knowledge ($r=0.87$, $P<0.0001$) and attitude ($r=0.27$, $P<0.0001$) were correlated with label use	Females and those with higher knowledge and attitudes were more likely to use labels. More label education efforts are recommended to increase label usage and improve food choice
Martinez <i>et al.</i> ⁽⁵⁰⁾ , 2012	19.5 % of students said they always look at food labels on packaged foods; 28.4 % said often, 26.1 % said sometimes, 20.8 % said rarely and 5.1 % said never.* Most students (88 %) reported nutrition information sometimes, often or always affects their food choices. Women were more likely to look at information online, looked more frequently at posted information in dining halls and reported that dining hall labels influenced them to choose healthier options. Overweight/obese individuals were more likely to report that labels influenced them to make lower-calorie and/or healthier food choices in dining halls relative to normal-weight individuals	Most students read labels at least sometimes, and nearly half reported selecting a lower-calorie and/or healthier option because of the labels. Females and overweight and obese students were more likely to report that labels influenced them to choose lower-calorie/healthier options
McLean-Meynsse <i>et al.</i> ⁽⁵¹⁾ , 2011	31.3 % of students said they read food labels often, 28.6 % sometimes, 16.8 % rarely, 11.8 % never and 11.6 % did not comment. Juniors and seniors were more likely to use labels sometimes or often than freshmen and sophomores	Upperclassmen used labels more frequently
Misra ⁽⁵²⁾ , 2007	On a 5-point scale (where 1 = 'never', 5 = 'always'), the average label usage was 3.28 (SD 1.12). Undergraduates had higher nutrition knowledge and more positive attitudes towards labels than graduate students, but were equally likely to use labels. Two-thirds used Nutrition Facts when purchasing a food for the first time, comparing products and purchasing foods with health claims. Regression analysis showed that being female, older, having a positive attitude towards food labels, using nutritional supplements and previous nutrition education were related to a higher label reading behaviour score and accounted for 44 % of the variance in label reading behaviour. Attitude mediated the relationship between nutrition education, knowledge and label reading behaviour	Most students used labels, had positive attitudes towards labels and thought they were useful, accurate and understandable; however, a third could not perform label comparisons. Undergraduates were more knowledgeable and positive towards labels than graduate students; positive attitudes, prior nutrition education, older age and being female were significantly and positively associated with label usage

Table 3 Continued

Author(s), year	Main finding	Conclusion
Rasberry <i>et al.</i> ⁽⁵³⁾ , 2007	15.2 % of students said they always look at nutrition facts panels when purchasing foods; 27.2 % said often, 43 % said sometimes and 14.6 % said never. Label users exhibited greater knowledge of nutrition, label use and diet–disease relationships and more favourable attitudes towards label use than non-users. Females also exhibited significantly higher label usage than males. Logistic regression results revealed that frequent label use was predicted by: health reasons (e.g. diabetes control, balancing diet, being healthier), looking for specific nutrient information (e.g. calories, fat, carbohydrates), weight control and knowledge. Three variables predicted infrequent use: buying the foods one wanted regardless of nutrition content, time constraints and didn't care	Females were more likely to use labels than males. Frequent label use was related to health reasons, looking for specific nutrition information, weight control, favourable attitudes, and knowledge of nutrition and diet–disease relationships. Infrequent use was related to desiring specific foods, time constraints and not caring about nutrition information
Smith <i>et al.</i> ⁽⁵⁶⁾ , 2000	29.5 % of students said they use the nutrition information panel on food labels every single time or more than half the time; 12.3 % said about half the time and 56.4 % said less than half the time or none of the time. Females were significantly more likely to use labels than males. Both male and female nutrition label users were more likely to believe in the importance of nutrition information on labels. For females, usage was related only to believing in the importance of nutrition information on food labels when making food choices; for males, believing in the truthfulness of the nutrition information panel and of a relationship between dietary fibre and cancer were significantly higher in users relative to non-users	Females use food labels more often than males. Label users were more likely to believe in the importance of nutrition information on food labels than non-users
Wie and Giebler ⁽⁵⁴⁾ , 2014	14.3 % of students said they always consider the calorie content of menu items at restaurants before making their choices; 26 % said frequently, 25.7 % said sometimes, 20.2 % said rarely and 12.9 % said never. Females were more likely to report perception and behaviour change following label exposure. Nutrition majors or non-nutrition majors who were enrolled in a nutrition class exhibited more positive perceptions of calorie counts on menus than non-nutrition majors who had not taken a nutrition course	Females were more likely to change their perceptions and behaviour following food label exposure. Nutrition education may improve attitudes towards nutrition labels, although more educational efforts may be needed to turn perceptions into behavioural change

*Percentage breakdowns for each frequency category were not provided in the original manuscript. These numbers were provided through personal communication with the corresponding author.

self-efficacy was also documented to be positively associated with nutrition label use^(42,57).

Several studies found that nutrition knowledge and education predicted nutrition label use. Driskell *et al.*⁽⁴⁴⁾ found that education on nutrition labels, but not nutrition knowledge, was related to higher usage. Others found that nutrition education⁽⁵²⁾, nutrition knowledge^(53,55) and self-

reported understanding of nutrition⁽⁴³⁾ were associated with greater usage. Raspberry *et al.*⁽⁵³⁾ documented nutrition label use to be related to improved knowledge linking diets to certain diseases. Wie and Giebler⁽⁵⁴⁾ reported college students majoring in nutrition were more likely to use nutrition labels compared with their counterparts with other majors.

A few studies assessed nutrition label use in relation to behaviours; Conklin *et al.*⁽⁴³⁾ reported that students obtaining information on food from weight-loss programmes were more likely to use labels. Performing healthy dietary behaviours⁽⁴⁵⁾, increased grocery shopping⁽⁴⁶⁾, eating more meals at home and not eating fast food in the past week⁽⁴⁷⁾, and use of nutritional supplements⁽⁵²⁾ were also positively related to label usage.

Study quality

Table 5 reports the overall study quality assessment results as well as the results for each of the sixteen studies included in the review. On average, studies scored 6.2 out of 8 points (range: 3–8), but the distribution of qualifications differed substantially across criteria. The large majority (94 %) of studies clearly documented the study design and data collection procedures; however, sample size was much more variable, ranging from 103 to 1317. Only nine of the sixteen studies (56 %) met the sample size quality criterion of 400 or more participants. Thirteen studies (81 %) documented the study response or completion rate and twelve (75 %) adopted a previously validated or pilot-tested measure on nutrition label use. Almost all studies (94 %) reported usage in relation to at least one demographic correlate and 81 % of studies reported usage in relation to at least one non-demographic

Table 4 Estimated label usage prevalence, by study and in aggregate

Study lead author*	Total N	Label usage prevalence		
		Always/often (n)	Sometimes (n)	Rarely/never (n)
Conklin ⁽⁴³⁾	1317	286	746	285
Cooke ^{(55)†}	524	333	122	69
Driskell ⁽⁴⁴⁾	205	14	96	95
Graham ^{(45)†}	1193	418	442	333
Jasti ⁽⁴⁶⁾	222	54	136	32
Krukowski ⁽⁴⁷⁾	316	153	72	91
Li ^{(48)†}	488	177	100	211
Marietta ⁽⁴⁹⁾	208	91	55	62
Martinez ^{(50)†}	486	233	127	126
McLean-Meynsse ⁽⁵¹⁾	390	138	126	126
Raspberry ⁽⁵³⁾	1285	545	553	187
Smith ⁽⁵⁶⁾	543	163	68	312
Wie ⁽⁵⁴⁾	341	142	116	83
All studies	7518	2747	2759	2012
	–	36.5 %	36.7 %	26.8 %

*Three of the sixteen studies could not be included in the review. Cha *et al.*⁽⁴²⁾ and Misra⁽⁵²⁾ did not report the breakdowns of their 5-point frequency scales. Both authors were contacted by email but were unable to provide this information by the deadline given. Lim *et al.*⁽⁵⁷⁾ was not included in this calculation because their usage was measured as a dichotomous yes/no question rather than usage frequency.

†Percentage breakdowns for each frequency category were not provided in the original manuscript. These numbers were provided through personal communication with the corresponding author.

Table 5 Study quality assessment for each study included in the review and average quality across all studies

Study lead author	Documented study design and data collection procedures	Sample size	Reported response or completion rate	Validated or pilot-tested survey	Considered demographic correlates of usage	Considered non-demographic correlates of usage	Used regression analysis	Non-restricted population	Total points
Cha ⁽⁴²⁾	1	0	1	1	1	1	1	0	6
Conklin ⁽⁴³⁾	1	1	1	0	1	1	0	1	6
Cooke ⁽⁵⁵⁾	1	1	1	1	0	1	1	1	7
Driskell ⁽⁴⁴⁾	1	0	1	1	1	1	0	1	6
Graham ^{(45)*}	1	1	0	1	1	1	1*	1	7
Jasti ⁽⁴⁶⁾	1	0	1	1	1	1	1	1	7
Krukowski ⁽⁴⁷⁾	1	0	1	1	1	1	0	1	6
Li ⁽⁴⁸⁾	1	1	1	1	1	0	1	1	7
Lim ⁽⁵⁷⁾	1	0	1	1	1	1	0	0	5
Marietta ⁽⁴⁹⁾	1	0	0	1	1	1	1	1	6
Martinez ⁽⁵⁰⁾	1	1	1	0	1	0	0	1	5
McLean-Meynsse ⁽⁵¹⁾	0	1	0	0	1	0	0	1	3
Misra ⁽⁵²⁾	1	1	1	1	1	1	1	1	8
Raspberry ⁽⁵³⁾	1	1	1	1	1	1	1	1	8
Smith ⁽⁵⁶⁾	1	1	1	1	1	1	0	1	7
Wie ⁽⁵⁴⁾	1	0	1	0	1	1	0	1	5
Average of all studies	0.94	0.56	0.81	0.75	0.94	0.81	0.50	0.88	6.19

*Graham and Laska⁽⁴⁵⁾ do use regression analysis where label usage is modelled as a function of attitude towards healthy eating, gender, age and race/ethnicity; however, only the regression coefficient for attitude is reported in the paper.

correlate. Only half of the studies used regression analysis to examine the relationship between label usage and multiple predictor variables/correlates simultaneously. Finally, most of the studies (88 %) examined free-living college students and young adults in general (no population restrictions).

Discussion

The present study systematically reviewed existing evidence on the correlates of nutrition label use among college students and young adults 18–30 years of age. A total of sixteen studies based on college surveys in four countries (USA, UK, Canada and South Korea) were identified from keyword and reference search. Reported prevalence of nutrition label use varied substantially across studies; however, a weighted average across all studies revealed 36.5 % of college students and young adults reported using labels always or often (36.7 % said sometimes, 26.8 % said rarely or never). Twelve of the thirteen studies that assessed gender differences reported that females were more likely to use nutrition labels. Nutrition label use was also found to be associated with attitudes towards a healthy diet, belief on the importance of nutrition labels in guiding food selection, self-efficacy, and nutrition knowledge and education. In contrast, findings on nutrition label use in relation to age, student classification, race/ethnicity, marital status and body weight status were largely inconclusive.

Our results are consistent with studies that examined label use in the general population. Guthrie *et al.*⁽⁵⁸⁾ and Campos *et al.*⁽³⁾ reported prevalence estimates of 71 % and 75 % in US populations (label usage is defined as using information at least sometimes), similar to our prevalence estimate of 73.8 % for young adults who use labels at least sometimes. Additionally, Cowburn and Stockley⁽⁶⁾ and Campos *et al.*⁽³⁾ conducted reviews examining predictors/correlates of label use in the general population and found many of the same relationships we identified in the present review. Similarly to our results, women were more likely to use labels than men, as were individuals with high nutrition knowledge or nutrition education, positive attitudes towards diet and health, or who practised healthy eating habits and dietary behaviours. Both reviews also found that label use was related to general education level and income; however, due to our restricted population, we were unable to assess the relationship between these variables and label usage. Surprisingly, the reviews on the general population did not report the relationship between BMI or weight status and label usage, which was a common variable of interest for many of the studies included in our review.

It is important to note that in many of the studies reviewed (both in young adult and general adult populations) label use is typically based on self-reported data,

which may not reflect actual use. Although a majority of US consumers report regular use of nutrition facts labels, in-store observations suggest actual use during food purchase can be lower⁽⁵⁹⁾. Moreover, whether consumers can understand and use nutrition facts label is contingent upon the purpose of the task^(4–7). Regular label users can understand some of the terms but may be confused by other types of information. A majority appears capable of retrieving basic facts and making simple calculations/comparisons between products using numerical information on the label, but their ability and accuracy decline as the complexity of the task increases.

Further, while it is critical to understand which types of individuals are more likely to use nutrition labels, the question remains whether label use actually leads to improved dietary behaviour. In their review of the general population, Campos *et al.*⁽³⁾ discussed several studies that found an association between nutrition label use and diet. Some studies found label users to have healthier diets overall while others found label users had lower intake levels of certain nutrients (e.g. fat, cholesterol) than non-users. In the present review, five studies examined the relationship between label use and dietary quality in college students and young adults^(42,45,46,48,55). Four of the five studies found that label use led to improved dietary quality^(42,45), lower consumption of fried foods⁽⁴⁶⁾, decreased fat intake and increased fibre intake⁽⁴⁸⁾. Interestingly, Cooke and Papadaki⁽⁵⁵⁾ found that label use was negatively related to dietary quality when nutrition knowledge and attitudes were controlled for. Looking beyond standard nutrition labels on packaged foods, there were also several studies that had examined the link between calorie label use in restaurants and food choice. While this portion of the literature considered a different meal setting (eating away from home instead of eating at home), it had the advantage of examining the relationship between label use and food choice in more natural settings (actual restaurants). In contrast to the majority of studies included in Campos *et al.*'s⁽³⁾ review, these studies did not solely rely on self-reported data; label use may have been self-reported, but diet quality and food choice were often directly observed. Generally speaking, this body of research provided a less optimistic view on the ability of labels to impact dietary quality. Systematic reviews in adults suggested that simply posting calorie information may not impact calorie purchases or consumption^(8,60); thus, the link between label use and dietary behaviour remains unclear.

A few limitations are present in the existing literature on the prevalence and correlates of nutrition label use in college students and young adults. There remains no standardized instrument to assess nutrition label use, and often there is a lack of distinction between the nutrition facts labels on food packages and nutrition/calorie labels on food venue (e.g. fast-food outlet, full-service restaurant, cafeteria or dining hall) menus and between nutrition label

formats (e.g. front-of-pack, traffic light label, front-of-pack + traffic light label)^(49,50,56). While many studies examined two or more of the correlates of nutrition label use, very few studies assessed a comprehensive list of psychosocial factors that enabled within-study comparison. Many potentially important correlates of nutrition label use among college students and young adults have not been assessed in any of the studies included in the review, such as health and/or risk behaviours (e.g. smoking,* drinking, drugs use), mental and/or physical health, and neighbourhood or campus food environment. In addition, only three of the included studies were published outside the USA, and even within the included thirteen US-based studies, geographic regions such as the Southwest, West and Northwest were under-represented. Lastly, our review only observed correlates of reported use; whether and how usage relates to dietary intake must be further assessed, particularly comparing the effect of different labelling schemes, comparing and combining label interventions with other nutrition interventions, and surveying large samples over time.

Conclusion

The present study reviewed correlates of nutrition label use among college students and young adults. Reported prevalence of nutrition label use varied substantially across studies, but a weighted average reveals that 36.5% of college students and young adults said they use nutrition labels always or often. Female gender, attitudes towards healthy diet, beliefs on the importance of nutrition labels in guiding food selection, self-efficacy, and nutrition knowledge and education were found to predict nutrition label use. While providing nutrition information at the point of purchase may nudge consumers towards a healthier diet⁽⁶¹⁾, findings from the present review indicate the potential heterogeneity in the impact of nutrition labelling across population subgroups. Nutrition awareness campaigns and education programmes may be important mechanisms to promote nutrition label use among college students and young adults; however, they should be rigorously evaluated to determine whether label use leads to improvements in diet quality.

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