

The role of health-related, motivational and sociodemographic aspects in predicting food label use: a comprehensive study

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Abstract

Objective: Previous studies focused on a limited number of determinants of food label use. We therefore tested a comprehensive model of food label use consisting of sociodemographic, health-related and motivating variables. These three predictor groups were chosen based on the previous literature and completed with new predictors not yet examined in a comprehensive study of frequency of label use.

Design: We sent questionnaires to a random sample of households in the German-speaking part of Switzerland.

Setting: The respondents filled in the questionnaire at home and returned it by mail.

Subjects: We analysed the data of 1162 filled-in questionnaires (response rate = 38 %). Of the respondents, 637 were women (55 %), and their mean age was 53·54 (SD 15·68) years.

Results: Health-related variables were the most important group of predictors of label use, followed by motivating factors and sociodemographic variables. Placing importance on health, healthy eating and nutritional value of food, perceived vulnerability for diet-related diseases, nutrition knowledge, numeracy and gender were positively associated with frequency of food label use whereas shopping habits and seeing eating as something positive were negative predictors of frequency of label use.

Conclusions: People's health consciousness should be raised in order to increase the frequency of food label use. Furthermore, it should be stressed that reading labels and keeping a healthy diet do not contradict 'good eating', and that both of these aspects can be combined with the help of food labels.

Keywords

Food label
Nutrition table
Comprehensive model
Predictors of food label use

Nutrition labels on food products are often praised as an important instrument for health promotion and prevention of diseases associated with overweight and obesity^(1–4). To find out how this preventive strategy can be used optimally and where the potential starting points for further improvement could be, it is very important to understand what determines use of food labels. This knowledge would help public health communicators to decide to whom and how they need to promote food label use. However, to our knowledge, existing studies investigating food label use have focused mainly on either sociodemographic and economic variables or on health-related factors. No study has systematically included factors inhibiting label use. The aims of the present study were, therefore, to provide a comprehensive framework of determinants of nutrition label use and to shed light on the motivators and inhibitors of nutrition label use. Thereby, we paid attention to three groups of potential determinants of label use: (i) a person's sociodemographic and economic background; (ii) health-related aspects; and (iii) factors which discourage people

from using food labels (see Fig. 1). We now discuss the relevant factors of each of these three determinants, based on previous studies. One difficulty of studying label use is the number of different labels in the different international markets and the difference in measuring label use (e.g. frequency of label use *v.* are labels used at all – yes or no). As we are interested in factors predicting the frequency of label use, we focus mainly on studies investigating frequency of label use (i.e. how often people use labels) and less on studies investigating whether labels are used at all.

First, regarding sociodemographic and economic variables, review studies suggest that women, better educated people and younger people usually report looking at nutrition labels more often^(1,2,5). Furthermore, additional situational factors, for example, type of household and perceived importance of price, seem to play a role in determining whether people look at nutrition labels or not^(3,5). However, in studies in which several types of sociodemographic and situational variables were looked at together, the picture is not that clear any more^(6–10).

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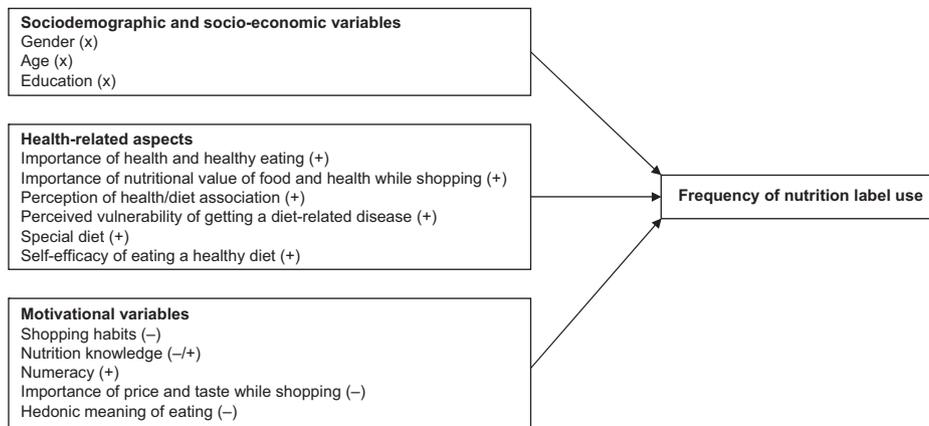


Fig. 1 A comprehensive model of determinants of label use. Expected direction of associations, based on previous literature: –, negative relationship expected; +, positive relationship expected; –/+, relationship expected, unclear in which direction; x, no relationship expected

There were no clear and consistent associations between the sociodemographic variables and frequency of label use. For example, two studies found that men used labels less often than women^(7,8); however, others did not find any effect of gender on degree of label use. In one study, age had a negative effect on frequency of label use⁽⁷⁾ whereas no other studies found significant effects for age. Furthermore, no studies found associations between education or income and degree of label use except one study which found that higher education was associated with more label use and higher income with less label use⁽⁶⁾. One reason for these inconsistent findings could lie in the different sets of predictor variables used in these studies. For example, the studies that found no effect for gender included importance of price, nutrition and taste^(6,9,10) whereas the ones that found a gender effect did not include these variables in the set of predictors^(7,8). Therefore, it seems as if the effects of sociodemographic variables sometimes disappear when underlying variables are included in the model. Our aim is to clarify the role of sociodemographic variables in label use by including all main predictor variables that have been investigated separately in one model. Following this procedure, we intend to investigate which of the sociodemographic variables might be genuine predictors of label use and which are rather proxies for underlying factors.

Second, these studies measured several health-related variables that may influence label use. These variables, for example, being on a special diet^(6,8,9), believing that there is a relationship between diet and disease^(8,10), placing importance on nutrition^(9,10) as well as placing importance on following dietary guidelines^(9,10), seem to be related to more frequent label use. Other studies also supported the importance of health-related aspects for label use (see references (1), (2) and (5) for reviews of this literature). For example, having a strong belief in a relationship between diet and cancer, interest in healthy eating and being confident that one is able to eat healthily

were associated with whether participants used labels at all^(11–14). Furthermore, Petrovici and Ritson⁽¹⁵⁾ found that self-reported nutrition knowledge and health motivation were positively related to frequency of label use. Perceived threat of nutrition-related diseases was negatively related and perceived effectiveness of diet to decrease the risk of disease was positively related to self-reported healthiness of diet. However, these two latter variables were not associated with label use.

In sum, health-related aspects, such as the importance of health and a healthy diet, seem to play an important role in why some people use labels. However, everybody is not interested in health and healthy eating, and mere exposure to food labels does not necessarily lead to food label use and decisions to use healthy food products^(13,14). Thus, one should additionally consider a third group of determinants; namely, the motivational reasons people do *not* use labels. Gorton *et al.*⁽¹⁶⁾ asked their participants about their reasons for not using nutrition labels. In addition to not being interested in healthy eating, the participants mentioned not needing more information about food, not understanding labels and having priorities other than healthy eating⁽¹⁶⁾.

Reading labels might, therefore, sometimes simply not be necessary for picking healthy food products because people always buy the same products and, therefore, know the products very well. Similarly, one reason people gave for not looking at health endorsements on products in a study by Rayner *et al.*⁽¹⁷⁾ was that buying food products was a habit, making reading labels superfluous. Shopping habits might therefore be associated with less label use. Food and nutrition knowledge might play a similar role in determining food label use. People who know a lot about healthy eating might not consider looking at labels necessary because they already know enough about the nutritional value of the food product they are buying. Some studies point in this direction as they showed no effect of nutrition knowledge on the

probability of label use^(7,9,10). However, this might not be the only way in which nutrition knowledge can interact with label use because other studies suggest that nutrition knowledge is positively associated with label use^(6,13–15,18). Thus, having high nutrition knowledge might reflect a basic interest in healthy eating and could, therefore, be associated with even more label use.

Another reason why the participants in Gorton *et al.*'s study⁽¹⁶⁾ did not use labels was that the participants did not understand the labels. According to Grunert *et al.*'s^(13,14) conceptual framework of food label use, the relationship between the perception of labels and the actual and meaningful use of the information in the labels is influenced by factors associated with understanding the label. Similarly, perceived ease of label use and observed efficiency of label use have been shown to be associated with more label use^(7,8). Therefore, factors that are negatively associated with actual understanding of labels and/or confidence in understanding labels might also be negatively related to label use. Numeracy is such a potentially inhibiting factor, as it is associated with less understanding of nutrition labels⁽¹⁹⁾. In the same study, there was also a weak indication that label use was different for persons with high numeracy and for persons with low numeracy⁽¹⁹⁾.

Finally, participants in Gorton *et al.*'s study⁽¹⁶⁾ mentioned having priorities other than healthy eating as a reason why they do not use labels. Importance of price was negatively associated with frequency of nutrition label use in Drichoutis *et al.*'s study⁽⁶⁾. Furthermore, the perception of eating as a primarily hedonic experience might also inhibit people from looking at labels. The results of an eye tracking study suggested that being motivated to look for tasty food was associated with less attention to nutrition tables than being motivated to choose healthy products⁽²⁰⁾. Furthermore, Drichoutis *et al.*⁽⁶⁾ found importance of taste to be negatively related to whether people used labels at all or not (irrespective of how often they use it). Thus, having priorities such as having a tight budget for buying food products or placing importance on the hedonic aspects of eating might keep people from using labels whereas health motivation may enhance label use.

We included all of these aspects described above in one comprehensive model of determinants of label use (see Fig. 1). We thereby aimed to answer the question which determinants influence whether people do or do not use labels and, based on these important determinants, to suggest implications for public health practice. Based on the literature described above, we expect that the health-related variables are the most important positive predictors of label use, followed by the motivational variables, which we expect discourage people from using labels (see Fig. 1). Because the studies described above showed very inconsistent results regarding socio-demographic and economic variables, we hypothesise

that these variables are rather proxies of underlying health-related motivators and inhibitors of label use and will therefore not be associated with label use when controlling for the other two groups of variables.

Method

Procedure and sample

We sent a questionnaire to a sample of households in the German-speaking part of Switzerland. This sample was randomly chosen from the Swiss telephone book, the best available directory for the Swiss general population. The first questionnaire was sent to the households in September 2009. Seven weeks later, we sent a reminder letter to the households from which we had not yet received a filled-in questionnaire. Following this procedure, we received 1162 filled-in questionnaires (response rate 38%) from 637 women (55%) and 508 men (44%). Seventeen persons (1%) did not specify their gender. In our sample, 109 persons (9%) had finished primary or lower secondary school, 530 (46%) upper secondary vocational school, 194 (17%) upper secondary school and 309 (26%) university/technical university; twenty (2%) persons did not state their educational background. The respondents' mean age was 53.54 (SD 15.68) years. According to Swiss Federal Statistical Office data⁽²¹⁾, men, people with primary or lower secondary school education and younger people were slightly under-represented in our sample. Nevertheless, our sample was a good representation of the German-speaking part of Switzerland.

Questionnaire

The questionnaire contained questions about all of the variables and constructs listed in Fig. 1. Most of the predictor concepts and the outcome variable label use were assessed in scales consisting of several items (see Table 1). We based the items of these scales on several previous studies that had examined knowledge, attitudes and beliefs in a health and nutrition context, or numeracy^(15,22–28), and completed them with our own questions. Table 1 presents the scales used in the study with one item example each, the internal reliability, mean sum score, number of respondents and original sources*. We calculated the means of the scales for all persons who had filled in more than half of the items of a scale.

We measured our outcome variable label use by asking the respondents how important labels are when they are choosing food products, and how often they used labels in three different situations (choice of food products one has never bought before, decision between two or more food products, judging how healthy a product is).

* Due to space restrictions, not all items on the questionnaire can be listed here. However, the items can be obtained from the first author upon request.

Table 1 Description of predictors and outcome variables measured on 6-point Likert-scales (1 = do not agree, 6 = agree, if not mentioned otherwise) and example items

	Number of items	Mean	SD	<i>n</i>	α
Outcome variable					
Food label use	4	3.33	1.59	1149	0.934
How often do you use labels when you buy a product for the first time? [†]					
Health-related predictors					
Importance of health	8	4.37	0.88	1138	0.783
Living in the best possible health is very important to me [‡]					
Importance of healthy eating	4	3.90	0.99	1139	0.712
I am prepared to leave a lot to eat as healthy as possible [§]					
Importance of nutritional value of food while shopping	1	4.53	1.27	1142	–
How important is the nutritional value of food for you when you are buying food?					
Importance of health while shopping	1	5.10	0.95	1146	–
How important is health for you when you are buying food?					
Perception of health/diet association	4	4.68	0.90	1139	0.748
Diet is something very important for my health [¶]					
Perceived vulnerability for diet-related disease	3	2.06	1.01	1136	0.844
I am worried about becoming ill in the future because of my diet					
Self-efficacy of eating a healthy diet	2	4.85	0.96	1141	0.643
I can eat a healthy diet when I want to					
Motivational predictors					
Shopping habits	4	4.19	0.95	1148	0.583
I always buy approximately the same food products					
Self-reported nutrition knowledge	4	4.67	1.01	1149	0.720
I know better how a healthy diet looks like compared with the average person ^{††}					
Nutrition knowledge	10	6.41	2.06	1150	0.548
Bacon contains more calories than ham ^{‡‡,§§}					
Numeracy	8	4.14	0.89	1138	0.829
How good are you at working with percentages? ^{,¶¶}					
Importance of price while shopping	1	4.34	1.34	1145	–
How important is price for you when you are buying food?					
Importance of taste while shopping	1	5.44	0.79	1144	–
How important is taste for you when you are buying food?					
Hedonic meaning of eating	5	5.35	0.70	1145	0.786
Eating well means quality of life for me					

[†]1 = never to 6 = very often.

[‡]From the health consciousness attitude scale by Dutta-Bergman (2004)⁽²⁵⁾.

[§]From the health consciousness scale by Schifferstein and Oude Ophuis (1998)⁽²³⁾.

^{||}1 = not important at all to 6 = very important.

[¶]Based on an item from the attitudes about diet and health scale by Kristal *et al.* (1990)⁽²⁶⁾.

^{††}Based on the health knowledge scale by Jayanti and Burns (1998)⁽²⁴⁾.

^{‡‡}From the consumer-oriented nutrition knowledge questionnaire by Dickson-Spillmann *et al.* (2011)⁽²⁸⁾.

^{§§}1 = correct answer, 0 = incorrect answer/don't know (maximum score = 10).

^{|||}From the subjective numeracy scale by Fagerlin *et al.* (2007)⁽²⁷⁾.

^{¶¶}1 = not at all good to 6 = very good.

We chose these situations based on the study by Higginson *et al.*⁽²⁹⁾, which showed that these situations are important application fields of food labels. In Switzerland, labels in the form of nutrition tables are the standard form of food labelling, although recently front-of-package labels have been appearing more and more in stores. We focused our questions on the standard nutrition table to be sure that all respondents have been exposed to the labels we are studying. As can be seen in Table 1, knowledge was measured in two ways. On the one hand, it was assessed as self-reported knowledge ('subjective knowledge') and on the other hand as a score on a short knowledge scale ('objective knowledge'). We chose to measure these two aspects of knowledge as both have been shown to be important for label use^(6,15,18).

In addition to the scales shown in Table 1, age, gender (0 male/1 female) and education (four categories, see sample description) were assessed as sociodemographic

characteristics. Education was turned into three dummy variables with the reference category as 'upper secondary vocational school' (i.e. the largest group) so that we could enter this variable into the linear regression model. Furthermore, being on a special diet was measured with one single dichotomous item ('do you have to adhere to a special diet due to a disease or are you on a diet?'; 0 no/1 yes).

Data analysis

We analysed the data by running a hierarchical regression analysis with the SPSS statistical software package version 17.0 (SPSS Inc., Chicago, IL, USA). The model in Fig. 1 was used as the theoretical framework for the analysis, and we entered the variables blockwise into the regression model. As the previously most examined group of predictors, sociodemographic variables were entered first (step 1), followed by the second already studied group of health-related variables (step 2). Finally, the

new set of motivational variables was entered into the model as the last step (step 3).

Results

Mean degree of label use was 3.33 (sd 1.59) on a scale from 1 ('never') to 6 ('very often'). More respondents reported they never used labels (13%) than reported they always used labels (5%); the rest of the answers were distributed approximately equally between these two extreme points of the scale (25th percentile = 2.0, 50th percentile = 3.5, 75th percentile = 4.75). These results suggest a medium frequency of label use in our sample.

The results of the regression analysis are shown in Table 2. All of the variable groups (steps) significantly improved the regression model. Overall, sociodemographic, health-related and motivational variables explained 32% of the variance in label use in our sample. The largest part of the explained variance was due to the health-related variables ($R^2 = 0.190$), whereas motivational ($R^2 = 0.070$) and sociodemographic variables ($R^2 = 0.055$) were less important for predicting label use.

In the group of the health-related variables, importance of healthy eating, importance of nutritional values while choosing foods in the supermarket and importance of health in general significantly predicted label use. Thinking that health in general, healthy eating and nutritional values of food are important was associated with more label use. Interestingly however, importance of health while shopping or self-efficacy of eating a healthy diet was not significantly

related to label use. There was also one significant albeit weaker association of label use with a disease-related concept: feeling at risk for diet-related diseases was associated with more label use. Being aware of a diet-disease association, on the other hand, was not associated with label use. Therefore, wanting to live healthily seemed to be a more important motivator for label use in our sample than wanting to prevent disease.

The strongest predictor of label use in the group of motivational variables was nutrition knowledge. Being more knowledgeable ('objective knowledge') and also feeling knowledgeable about nutrition and healthy eating ('subjective knowledge') were associated with more label use. Furthermore, the factors that might keep people from using food labels were also important in our model. The strongest inhibiting predictor was numeracy, which was positively related to label use. This suggests that people who do not like numbers and report that they are not good at using numbers use food labels less. Furthermore, having stronger shopping habits and, finally, the hedonic meaning of eating were negatively associated with label use. Therefore, respondents who often buy the same food products and who see eating as something positive use labels less. One predictor of this group turned out to be a motivating and not an inhibiting factor: we expected importance of price to be a negative predictor as it mirrors priorities other than health. However, in this model, placing importance on price while shopping was associated with more label use.

Of the sociodemographic variables, only gender was a significant predictor of food label use, even after controlling

Table 2 Regression analysis for label use predicted by sociodemographic, health-related and motivational variables (*n* 1013)

Predictor variable	<i>B</i>	SE <i>B</i>	β	R^2	F	df
Step 1: Sociodemographic variables				0.055	11.647***	5, 1007
Gender	0.357	0.098	0.112***			
Age	0.000	0.003	0.000			
Education (primary/lower secondary school)	-0.107	0.155	-0.020			
Education (upper secondary vocational school)†	-	-	-			
Education (upper secondary school)	0.079	0.123	0.019			
Education (university)	-0.016	0.110	-0.004			
Step 2: Health-related variables				0.190	24.914***	13, 999
Importance of health	0.249	0.081	0.139**			
Importance of healthy eating	0.274	0.070	0.172***			
Importance of nutritional value while shopping	0.167	0.046	0.134***			
Importance of health while shopping	-0.087	0.067	-0.053			
Perception of health/diet association	0.013	0.062	0.008			
Perceived vulnerability for diet-related disease	0.133	0.045	0.084**			
Special diet	0.070	0.155	0.012			
Self-efficacy of eating a healthy diet	-0.037	0.054	-0.022			
Step 3: Motivational variables				0.070	22.763***	20, 992
Shopping habits	-0.147	0.045	-0.089**			
Self-reported nutrition knowledge	0.185	0.055	0.119**			
Nutrition knowledge	0.130	0.023	0.168***			
Numeracy	0.203	0.054	0.114***			
Importance of price while shopping	0.071	0.033	0.060*			
Importance of taste while shopping	0.022	0.060	0.011			
Hedonic meaning of eating	-0.174	0.067	-0.076**			

$F_{\text{Change}}(8, 999) = 31.446, P < 0.001$ for step 1/2; $F_{\text{Change}}(7, 992) = 14.418, P < 0.001$ for step 2/3; $R^2 = 0.315$ for the final model.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

†Reference category.

for all other possible predictors. Age and education, on the other hand, were not significantly associated with food label use in our model. In sum, health-related aspects, knowledge and inhibiting factors were the most powerful predictors of label use in our model whereas sociodemographic variables were of little importance.

Discussion

To the best of our knowledge, the present study is the first to apply a more comprehensive model of food label use. In addition to the quite well-established sociodemographic and health-related variables, we included inhibiting factors of label use in our model. Furthermore, our comprehensive model showed that not all variables which appeared important for label use in previous studies were significantly associated with label use when entered into the model together with other predictors.

Two main influence factors on label use emerge from our findings: attitudes toward health and inhibiting factors. First, the most important predictor of label use was importance placed on health and eating. Respondents who considered health, healthy eating and the nutritional value of food as important reported more frequent label use than respondents who did not place importance on these aspects. This finding confirms the crucial role that health-related factors played in earlier studies^(9–15). Disease-related aspects, on the other hand, were less important for predicting label use. In sum, these findings imply that people rather use labels because they are interested in health and healthy eating and not primarily because they are afraid of falling ill. Interestingly, people who saw eating as something positive and hedonic reported less label use. Thus, people might perceive food labels as something that spoils the enjoyment of eating or that they do not perceive healthy eating as something positive.

Second, people's skills and usual behaviour seem to be important for how often they use labels. Lower numeracy seems to inhibit food label use. It is thus possible that the merely numerical presentation of nutritional information on the package as is mostly the case in Switzerland might be problematic from a public health perspective. On the one hand, this format may decrease understanding of the label⁽³⁰⁾ and on the other might cause people to not even look at the label if they think they will not understand the numbers on it anyway. Furthermore, shopping habits were associated with less frequent label use in our study. If somebody's diet is already healthy, this association does not have to be a bad sign for the promotion of healthy eating as label use is not necessary in this case. However, if somebody's diet is not healthy, habits do become a problem for public health as they impede a diet change toward a healthier diet. Interestingly, neither importance of price nor importance of taste played an inhibiting role for label use in our model. Thus, behavioural

and skill-related obstacles to label use were more important in our sample than having potentially concurring priorities when shopping. Knowledge seemed rather to be part of a more general interest in healthy eating and less an inhibiting factor for label use as knowledge was associated with more label use.

As expected, the sociodemographic variables we measured did not play a major role in predicting the frequency of label use. Age and education may be correlated with the more crucial underlying factors such as attitudes or behaviours, and become important only when these factors are not measured. This might explain the mixed results regarding these variables in previous studies^(6–10). Gender, on the other hand, was still a significant predictor in our model. This might imply that women use labels more often than men, even when controlling for health consciousness. However, although we included many potential predictors in our model, it did not explain a large part of the variance of label use. We might not have measured an important underlying factor that is correlated with gender. Further studies are thus needed to find out which factors additionally influence food label use.

Apart from the rather large amount of unexplained variance, several further limitations of our study should be considered. Compared with more direct measures of label use, for example, verbal protocol analysis, in-shop observations or eye tracking, measures of label use that rely on self-reported data such as questionnaires might have the disadvantage of resulting in over-reported label use^(4,13,14,17,31,32). Direct measures may thus be the instrument of choice when one wants to know whether people understand the labels and apply them correctly. However, when people do not look at labels, one cannot induce from such measures whether this was the case because of implicit knowledge about the product or shopping habits making looking at the label superfluous, or because of a lack of interest in labels. Therefore, we decided to take the potential disadvantage of over-reporting and investigate our research question with a questionnaire. Furthermore, even if there was no over-reporting in our study, we cannot know whether people who use labels more often use these labels as a decision aid to buy the healthiest product. In other words, we do not know whether label use translates into a healthier diet (see the last part of Grunert *et al.*'s conceptual framework of food label use^(13,14)). As our results suggest that people who are generally interested in health and healthy eating use labels more often than others, we can speculate that they may use labels for choosing healthy foods. However, even if persons interested in health and healthy eating do use labels for this purpose, this does not imply that persuading persons who are not interested in health and nutrition to use labels will have the same effect on this group's behaviour. Finally, another limitation may be that we used short and partly new scales that had not been tested before, and some did not have excellent

scale properties. Therefore, these results should be replicated and confirmed in further studies.

Conclusions

Our findings can help public health communicators to focus on crucial determinants of label use in order to promote label use. On the one hand, as an interest in health and healthy eating seems to be the central element in determining the frequency of label use, people's health consciousness should be raised in order to also increase the frequency of food label use. Additionally, if communicators want to directly promote label use and not indirectly via health consciousness, labels should be promoted primarily as an instrument to maintain health rather than as a measure to prevent illnesses. Furthermore, it should be stressed that reading labels and maintaining a healthy diet do not contradict enjoying eating, and that both of these aspects can be combined with the help of food labels. On the other hand, communicators should keep in mind the obstacles of food habits and of perceived low skills that might lead to a decreased frequency of label use. Food labels should be designed in a way which is understandable for everyone. Perhaps some graphical and/or verbal explanations for the numbers should be used on the label or in dietary counselling⁽³⁰⁾. Public health communicators should take shopping habits into account when promoting label use. People with strong shopping habits and an unhealthy diet should be encouraged to use labels to compare and choose food.

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References

- Baltas G (2001) The effects of nutrition information on consumer choice. *J Advert Res* **41**, 57–63.
- Cowburn G & Stockley L (2005) Consumer understanding and use of nutrition labelling: a systematic review. *Public Health Nutr* **8**, 21–28.
- Grunert KG & Wills JM (2007) A review of European research on consumer response to nutrition information on food labels. *J Public Health* **15**, 385–399.
- Mhurchu CN & Gorton D (2007) Nutrition labels and claims in New Zealand and Australia: a review of use and understanding. *Aust N Z J Public Health* **31**, 105–112.
- Drichoutis AC, Lazaridis P & Nayga RM (2006) Consumers' use of nutritional labels: a review of research studies and issues. *Acad Mark Sci Rev* **2006**, issue 9; available at <http://www.amsreview.org/articles/drichoutis09-2006.pdf>
- Drichoutis AC, Lazaridis P & Nayga RM (2005) Nutrition knowledge and consumer use of nutritional food labels. *Eur Rev Agric Econ* **32**, 93–118.
- Drichoutis AC, Lazaridis P, Nayga RM *et al.* (2008) A theoretical and empirical investigation of nutritional label use. *Eur J Health Econ* **9**, 293–304.
- Kim S-Y, Nayga RM & Capps O (2001) Health knowledge and consumer use of nutritional labels: the issue revisited. *Agric Resour Econ Rev* **30**, 10–19.
- Nayga RM, Lipinski D & Savur N (1998) Consumers' use of nutritional labels while food shopping and at home. *J Consum Aff* **32**, 106–120.
- Nayga RM (2000) Nutrition knowledge, gender, and food label use. *J Consum Aff* **34**, 97–112.
- Satia JA, Galanko JA & Neuhouser ML (2005) 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* **105**, 392–402.
- Neuhouser ML, Kristal AR & Patterson RE (1999) Use of food nutrition labels is associated with lower fat intake. *J Am Diet Assoc* **99**, 45–53.
- Grunert KG, Fernandez-Celemin L, Wills JM *et al.* (2010) Use and understanding of nutrition information on food labels in six European countries. *J Public Health* **18**, 261–277.
- Grunert KG, Wills JM & Fernandez-Celemin L (2010) Nutrition knowledge, and use and understanding of nutrition information on food labels among consumers in the UK. *Appetite* **55**, 177–189.
- Petrovici DA & Ritson C (2006) Factors influencing consumer dietary health preventative behaviours. *BMC Public Health* **6**, 222.
- Gorton D, Mhurchu CN, Chen M-H *et al.* (2009) Nutrition labels: a survey of use, understanding and preferences among ethnically diverse shoppers in New Zealand. *Public Health Nutr* **12**, 1359–1365.
- Rayner M, Boaz A & Higginson C (2001) Consumer use of health-related endorsements on food labels in the United Kingdom and Australia. *J Nutr Educ* **33**, 24–30.
- Fitzgerald N, Damio G, Segura-Perez S *et al.* (2008) Nutrition knowledge, food label use, and food intake patterns among Latinas with and without type 2 diabetes. *J Am Diet Assoc* **108**, 960–967.
- Rothman RL, Housam R, Weiss H *et al.* (2006) Patient understanding of food labels: the role of literacy and numeracy. *Am J Prev Med* **31**, 391–398.
- Visschers VHM, Hess R & Siegrist M (2010) Health motivation and product design determine consumers' visual attention to nutrition information on food products. *Public Health Nutr* **13**, 1099–1106.
- Swiss Federal Statistics Office (2011) Population size and population composition. <http://www.bfs.admin.ch/bfs/portal/en/index/themen/01/02.html> (accessed June 2011).
- Lee SY, Hwang H, Hawkins R *et al.* (2008) Interplay of negative emotion and health self-efficacy on the use of health information and its outcomes. *Commun Res* **35**, 358–381.
- Schifferstein HNJ & Oude Ophuis P (1998) Health-related determinants of organic food consumption in the Netherlands. *Food Qual Prefer* **9**, 119–133.
- Jayanti RK & Burns AC (1998) The antecedents of preventive health care behavior: an empirical study. *J Acad Mark Sci* **26**, 6–15.
- Dutta-Bergman MJ (2004) Health attitudes, health cognitions, and health behaviors among Internet health information seekers: population-based survey. *J Med Internet Res* **6**, 8.
- Kristal AR, Bowen DJ, Curry SJ *et al.* (1990) Nutrition knowledge, attitudes and perceived norms as correlates of selecting low-fat diets. *Health Educ Res* **5**, 467–477.

27. Fagerlin A, Zikmund-Fisher BJ, Ubel PA *et al.* (2007) Measuring numeracy without a math test: development of the subjective numeracy scale. *Med Decis Making* **27**, 672–680.
28. Dickson-Spillmann M, Siegrist M & Keller C (2011) Development and validation of a short, consumer-oriented nutrition knowledge questionnaire. *Appetite* **56**, 617–620.
29. Higginson CS, Kirk TR, Rayner MJ *et al.* (2002) How do consumers use nutrition label information? *Nutr Food Sci* **32**, 145–152.
30. European Heart Network (2003) *A Systematic Review of the Research on Consumer Understanding of Nutrition Labelling*. Brussels: European Heart Network.
31. Jones G & Richardson M (2007) An objective examination of consumer perception of nutrition information based on healthiness ratings and eye movements. *Public Health Nutr* **10**, 238–244.
32. Goldberg JH, Probart CK & Zak RE (1999) Visual search of food nutrition labels. *Hum Factors* **41**, 425–437.