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THE RELATIONSHIP BETWEEN KNOWLEDGE AND THE USE OF NUTRITION INFORMATION ON FOOD PACKAGE

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Nutrition labelling, soon obligatory for all food circulating on the EU market, is a topic of interest since being an important tool that shapes consumers´ conscious food choices. The study tested the influence of nutrition knowledge on the use of labelled nutrition information on 200 Croatian consumers. A comprehensive three-section questionnaire comprising demographic data, a nutrition knowledge test, and questions about the use of nutrition information provided on food labels was employed. Cluster analysis identified three participating clusters (having good, medium, or poor nutrition knowledge). Answers to 70% of the questionnaire items were correct, but the application of nutrition knowledge in an everyday food selection scored low. Best knowledgeable participants (middle-aged with university degree) tend to browse the nutrition label per se, information on sugar content, fat content, the list of ingredients, and the list of additives. The same group of consumers consider nutrition labelling policy helpful and find the information provided on nutrition labels understandable and useful in conscious food choices. Multivariate logistic regression confirmed the use of labelled nutrition information to be significantly influenced by education and nutrition knowledge. Bottom-line, consumers consider nutrition labelling important, but do not pay close attention to information on certain nutrients.

Keywords: consumer behaviour, education, food label, nutrition knowledge

Nutrition information provided on food labels is regarded as an important tool intended to encourage consumers to make healthier food choices (Grunert et al., 2010). In light of this, developed countries have adopted regulations that specify the information that must be stated on a food label, since well-designed labels may positively influence national diets (Temple & Fraser, 2014). Since food labelling became mandatory in the US, studies have shown labelled information use to be correlated with an improved diet quality (Lin et al., 2004), reduced energy intake (Temple et al., 2010), an increased consumption of fruit and vegetables (Staser et al., 2011), and other health-promoting activities. The systematic review by Campos and co-workers (2011) showed that consumer groups most likely to make use of nutrition labels are adults with higher income, young to middle-aged, white and female. Use and understanding of nutrition information provided on food labels are also affected by the differences in the interest shown in healthy eating, differences in nutrition knowledge and social status (Grunert et al., 2010; Acheampong & Haldeman, 2013).

Knowing the level of consumers' nutritional knowledge is also a very useful tool for promoting their dietary habits according to influential variables such as understanding of food labelling (Carillo et al., 2012). Although it was previously shown that nutrition knowledge per se has low influence on food selection (Wardle et al., 2000), it can affect label perception and significantly influence consumers choice of healthier food products (Barreiro-Hurlé et al., 2010; Grunert et al., 2010; Ahmadi et al., 2013). Several researchers

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have established that older consumers and those with more years of formal education have better nutrition knowledge (Wardle et al., 2000; Hendrie et al., 2008; De Vriendt et al., 2009). However, studies on the direct effect of socio-demographic and lifestyle factors on nutrition knowledge have given no clear indications as to why such relationships exist.

According to the current European legislation, the inclusion of nutrition information is voluntary, unless a nutrition-related claim has been made. However, starting from 13 December 2016, nutrition labelling of all packaged food shall become mandatory (European parliament and Council of the European Union, 2011). It is only in the past few years that nutrition labelling has found a wider penetration into the Croatian market, while at the same time, nutrition knowledge as well as understanding and usage of nutrition labels of Croatian consumers has been investigated only sporadically (Krešić et al., 2009; Kenđel Jovanović et al., 2011; Ranilović & Colić Barić, 2013). Consequently, it is important to establish the relationship between consumers' nutrition knowledge and the use of information provided on food labels, as well as to identify factors that influence labelled information use. By identifying these factors, it is possible to outline the profile of consumers who either do or do not make use of nutrients content information. To the best of our knowledge, no research on the relationship between nutrition knowledge and labelled nutrition information use has been conducted in Croatia insofar, so we hope that the present study will aid in filling this gap.

In view of the above, this study has a triple objective: to estimate the level of nutrition knowledge among consumers; to estimate their habits regarding labelled nutrition information use; and to determine whether this habit is influenced by the level of nutrition knowledge.

1. Materials and methods

1.1. Study participants

Data were collected in autumn 2013 across Croatia, by means of interviewing face-to-face a total of 200 consumers by two trained dieticians. The participants were sampled in the purposive convenience sampling fashion, which is common in qualitative studies, whose aim is to get a gross estimate of the results related to the research topic without the cost of spending time to select a random sample (Gravetter & Forzano, 2012). In the present research, the sample selection criterion was chosen so as to obtain a balanced age, gender, and educational background representation (Table 1). However, study population does not represent the general Croatian population.

1.2. Survey instrument

All participants completed a specially designed three-section questionnaire consisting of demographic data, a nutrition knowledge test, and questions related to labelled nutrition information use and attitudes towards nutrition labelling. Nutrition knowledge was assessed using the General Nutrition Knowledge Questionnaire for Adults (Parmenter & Wardle, 1999). The questionnaire in reference was originally divided into four sections appearing in the following order: expert recommendations on increased or decreased intake of different foodstuffs, nutrition knowledge, food choice, and the relationship between dietary habits and various diseases. For the purpose of this research, only the first three sub-sections were used. Modification and validation of the Questionnaire is described in details elsewhere (Krešić et al., 2009).

Table 1. Demographic characteristics of study sample and their nutrition knowledge score (mean ±SD) (n=200)

Sample composition	Number and percentage (%) of participant	Nutrition knowledge score (% of the total score)
Gender		
Male	100 (50.0)	70.19 ±0.81
Female	100 (50.0)	70.08 ±0.90
P-value		0.923*
Age		
18 to 29	69 (34.5)	65.14 ±7.20[b]
30 to 44	64 (32.0)	73.94 ±7.24[a]
≥45	67 (33.5)	71.55 ±8.73[a]
P-value		<0.001**
Educational level		
Primary and Secondary	95 (47.5)	68.85 ±0.79
University degree	105 (52.5)	71.45 ±0.90
P-value		0.032*
Family status		
Singles / families without children	117 (58.5)	68.56 ±0.77
Parents with children	83 (41.5)	72.37 ±0 .93
P-value		0.002*

**t*-test; **ANOVA: Means tagged with different superscripts point towards statistically significant differences (established based on the Bonferroni test)

In the third section of the survey tool, the participants were asked about the use of nutrition labels: "When you purchase a foodstuff for the first time, how often do you read the nutrition label? How often do you check the energy value and/or the amounts of total fat, saturated fat, cholesterol, protein, dietary fibres, salt and sugar stated on the label?" On top of the aforementioned, the participants were asked about their habit to check other components of a food label. The answers to these questions ranged from "never" (1) to "always" (5), and were expressed as mean values of the obtained scores. This section of the Questionnaire also included four questions about attitudes towards nutrition labelling (Loureiro et al., 2006).

1.3. Data analysis

Since data were distributed normally, as confirmed by the Shapiro-Wilks test, descriptive statistics is represented by means±standard deviations. Statistically significant difference between two means was established using the *t*-test, while three means were compared using a one-way ANOVA followed by the Bonferroni post hoc test. In all tests, a P-value of <0.05 was considered as statistically significant. In order to identify consumer groups mutually differing in their nutrition knowledge level, a hierarchical cluster analysis of scores with Euclidian distances and Ward aggregation method was performed. The existence of differences between the clusters' demographic characteristics distribution was evaluated using Chi-square test. To identify the key predictors of frequency at which nutrition labels are browsed, a multivariate logistic regression model was used. We aimed to determine whether

gender-, age-, family status-, education-, or nutrition knowledge-based differences are associated with nutrition label browsing habits. Data were analysed using the Stata Statistical Software, Release 12 (StataCorp., College Station, TX: StataCorp LP. 2011).

2. Results and discussion

2.1. Nutrition knowledge

On average, participants showed a medium level of nutrition knowledge, given that about 70% of the questions were answered correctly (Table 1). Gender-specific differences in overall nutrition knowledge failed to be found. The highest mean scores relative of nutrition knowledge were found in consumers aged 30 to 44 ($P<0.001$), consumers having a university degree ($P=0.032$) and those living in a family with at least one child ($P=0.002$). The average level of nutrition knowledge was similar to that reported in studies using the same questionnaire, conducted in other European countries (Parmenter & Wardle, 1999; Wardle et al., 2000; Grunert et al., 2010), but higher as compared to the Latin American survey (Ares et al., 2008) or the study recently conducted among Spanish consumers (Carillo et al., 2012).

Using a cluster analysis, three clusters of the study participants were identified based on their nutrition knowledge level (Calinski-Harabasz pseudo F: 7.39). Cluster 1 is composed of 83 participants whose nutrition knowledge was classified as good, Cluster 2 encompassing 80 participants was classified as having a medium-level nutrition knowledge, and Cluster 3, comprising 37 participants whose nutrition knowledge turned out to be poor. The highly knowledgeable group has comprised a significantly higher number of middle-aged participants (46.99%, $P=0.002$) with a university degree (61.45%, $P=0.037$), while the group with poor knowledge consists of 64.86% of the 18–29 age group ($P<0.001$) and 75.68% of those who had no children ($P<0.001$). It could be assumed that respondents with children are more interested in seeking nutrition information with the aim to ensure that their children are eating healthy, what was confirmed also by Parmenter and co-workers (2000). Although, similar to us, several researchers have illustrated the need of young and especially lower educated people for more training in nutrition knowledge (Hendrie et al., 2008; De Vriendt et al., 2009). For middle-aged participants, concerns about health could encourage them to be more interested in nutrition (Ranilović & Colić Barić, 2013). Among our sample, no significant differences in gender distribution were found among clusters.

Generally, consumers showed the highest level of knowledge when it comes to the first group of questions ("Expert Recommendations"), with correct answers ranging from 81.23% (Cluster 3) to 92.24% (Cluster 1) (Table 2). Consumers constituting Cluster 1 showed the best knowledge when it comes to the recognition of sources of certain nutrients, their answers being 77.81% correct. However, some areas of knowledge were found to be poorly covered. For example, 42% of participants were not sure which food represents a rich fibre source, and only every third participant was able to name cholesterol sources. Consumers are generally not sure how to apply their nutrition knowledge; namely, all the respondents had the lowest score in the third Questionnaire section ("Food Choice"). For example, only every fifth participant knew which food should be chosen as an everyday low saturated fat source.

Table 2. Nutrition knowledge scores obtained in the identified clusters using the Questionnaire (mean ±SD)

Nutrition knowledge Questionnaire item (maximum score)	Whole sample (n=200)	Cluster 1 (n=83)	Cluster 2 (n=80)	Cluster 3 (n=37)
Expert recommendations (n=9)	7.82±1.11	8.28±0.80[a]	7.52±1.22[b]	7.32±1.08[c]
Nutrient knowledge (n=50)	34.54±0.62	38.90±2.22[a]	33.21±1.63[b]	27.62±2.02[c]
Food choice (n=10)	6.05±1.58	6.61 ±1.39[a]	5.78±1.62[b]	5.38±1.52[b]
Total (n=69)	48.39±5.89	53.79±3.09[a]	46.51±2.95[b]	40.32±3.02[c]

Means tagged with different superscripts within one row indicate that average scores are significantly different (established based on the Bonferroni test)

2.2. Labelled nutrition information use

The results of this survey suggest the existence of a significant relationship between nutrition knowledge and the importance of labelled nutrition information. About 46% of highly knowledgeable participants (Cluster 1) "often" or "always" read information provided on the nutrition label, in contrast, only 25% of consumers having poor nutrition knowledge (Cluster 3) tend to do so (Fig. 1). Carillo and co-workers (2012) also confirmed that group with low nutrition knowledge less frequently looked at food labels and considered this information too technical. The main reason of not reading nutrition labels among younger participants is lack of interest (Ranilović & Colić Barić, 2013). Participants belonging to Cluster 1 read nutrition information significantly more frequently on the whole (P=0.049), the information on fat content (P=0.041) (Fig. 2A), sugar content (P=0.043) (Fig. 2B), list of ingredients (P=0.009) and additives present in the foodstuff (P=0.006) (Fig. 2C). Consumers tend to look more closely at nutrients they wish to avoid (Shine et al., 1997), so that it is fair to assume that, despite the level of their nutrition knowledge, consumers under our study were not concerned enough about the intake of certain nutrients, sugar and fat thereby making an exception. These findings are similar to those obtained by Campos and co-workers (2011), who showed that the information on nutrients most commonly sought by modern consumers is that on fat,

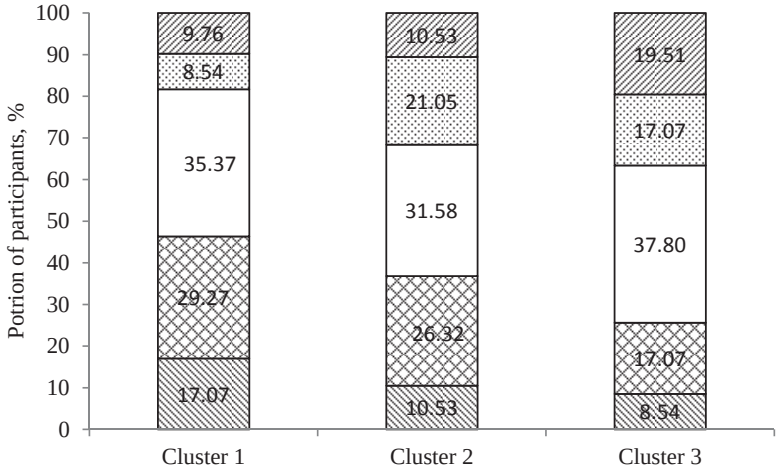

Fig. 1. The frequency of nutrition labels reading determined in the nutrition knowledge-based clusters (n=200)
▧: Always; ▨: Often; □: Sometimes, ▩: Rarely; ▨: Never

energy, and cholesterol content. A low awareness on the importance of salt content witnessed among our participants is of concern and could be explained by the fact that current nutrition labels provide information on sodium content is difficult to interpret, because many consumers do not understand the relationship between salt and sodium (GRIMES et al., 2009).

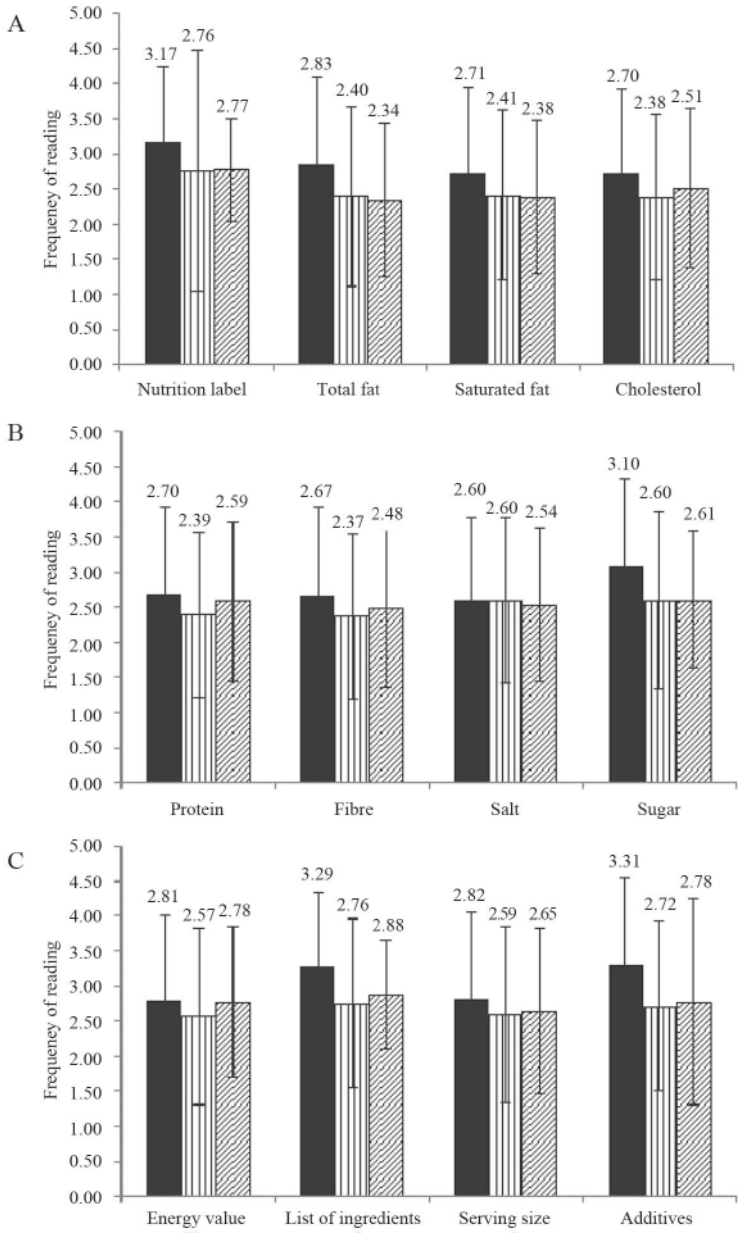

Fig. 2. The frequency of reading certain elements of nutrition labels established in the three nutrition knowledge-based clusters of consumers (n=200) ■: Cluster 1; ▥: Cluster 2; ▨: Cluster 3

It can be stated that Croatian consumers generally notice nutrition labels, but do not take much interest in its content. This is confirmed by the fact that about 80% of our respondents consider nutrition labelling policy useful for consumers (an average of 4.30 on a 1–5-point scale) (Table 3), what was also confirmed by Loureiro and co-workers (2006). As expected, the most knowledgeable consumer group largely tends to perceive a nutrition label as a tool that offers useful information about food products (P<0.001). Surprisingly, only 13% of consumers found nutrition labelling too technical, this proportion being significantly lower in a more knowledgeable consumer group (2.26 on a 1–5-point scale) (P<0.001) (Table 3).

Table 3. Answers (mean ±SD)* to questions related to attitudes toward nutrition labelling obtained in the three clusters

Attitudes towards nutrition labelling	Whole sample (n=200)	Cluster 1 (n=83)	Cluster 2 (n=80)	Cluster 3 (n=37)
The new nutritional labelling policy is positive for consumers	4.30±0.89	4.42±0.86^{a}	4.26±0.95^{b}	4.13±0.84^{c}
Nutrition label offers me a useful information about products	4.21±1.03	4.34±1.04^{a}	4.05±0.87^{b}	4.19±1.08^{b}
I do not understand the information provided	2.44±1.15	2.26±1.22^{b}	2.47±1.09^{a}	2.51±1.17^{a}
Nutrition label contains too much information	2.81±1.32	2.26±1.10^{b}	2.84±1.35^{a}	2.81±1.23^{a}

* Mean obtained on a 1-to-5 point scale. Means tagged with different superscripts within one row indicate that average scores are significantly different (established based on the Bonferroni test)

The multivariate logistic regression confirmed that labelled nutrition information use was significantly influenced both by the level of education (OR=0.45; 95% CI=0.23–0.86; P=0.016) and nutrition knowledge (OR=0.45; 95% CI=0.28–0.73; P=0.001) (Table 4). It can be assumed that higher education facilitates nutrition knowledge acquisition and motivate people to eat healthier, ultimately encouraging them to put even more effort to acquire more extensive nutrition knowledge.

Table 4. Predictors of nutrition label reading determined by a multivariate logistic regression with intercept

Predictor	Odds ratio	Standard error	95% Confidence interval	P-value
Gender	0.71	0.23	(0.37–1.33)	0.284
Age	0.88	0.24	(0.51–1.52)	0.651
Family status	0.91	0.40	(0.38–2.15)	0.825
Education level	0.45	0.15	(0.23–0.86)	0.016
Nutrition knowledge	0.45	0.11	(0.28–0.73)	0.001

3. Conclusions

Although nutrition knowledge and general education represent two significant predictors of labelled nutrition information use among Croatian consumers, they are not sure how to apply that knowledge and consequently do not pay close attention to the labelled content of certain nutrients. The highly knowledgeable group consisting of middle-aged participants with university degree are interested in nutrition labels per se, as well as in the content of fat and sugar, the list of ingredients, and the additives content. The same group of consumers consider nutrition labelling policy helpful and find the information provided on nutrition labels understandable and useful in conscious food choices. The understanding of differences in the level of consumers' nutrition knowledge as predictors of labelled nutrition information use will be helpful in shaping public policies and designing measures taken to increase the level of such knowledge and, even more important, consumers' ability to apply that knowledge. A target group for training in nutrition knowledge should be young and lower educated consumers. These groups could be easily educated to better understanding food-labelling information in schools. However, nutrition education in schools is limited due a lack of qualified teachers, insufficient focus on health, and lack of a discrete curriculum component what should be updated. Better co-ordination of nutrition education efforts in shopping places (i.e. with targeted campaigns in grocery shops) is also recommended. It must be noted that the study population was a sample of convenience and does not represent the general Croatian population, so it is suggested to conduct research on the general population after nutrition labelling becomes mandatory in Croatia.

References

Acheampong, I. & Haldeman, L. (2013): Are nutrition knowledge, attitudes and beliefs associated with obesity among low-income Hispanic and African American women caretakers. *J. Obesity, 2013*, Article ID 123901, 8 p.

Ahmadi, A., Torkmani, P., Sohrabi, Z. & Ghahremani, F. (2013): Nutrition knowledge: application and perception of food labels among women. *Pak. J. Biol. Sci., 16*, 2026–2030.

Ares, G., Giménez, A. & Gámbaro, A. (2008): Influence of nutritional knowledge on perceived healthiness and willingness to try functional food. *Appetite, 51*, 663–668.

Barreiro-Hurlé, J., Gracia, A. & De-Magistris, T. (2010): Does nutrition information on food products lead to healthier food choices? *Food Policy, 35*, 221–229.

Campos, S., Doxey, J. & Hammond, D. (2011): Nutrition labels on pre-packed foods: a systematic review. *Public Health Nutr., 14*, 1496–1506.

Carillo, E., Varela, P. & Fiszman, S. (2012): Influence of nutritional knowledge on the use and interpretation of Spanish nutritional food labels. *J. Food Sci., 71*, H1–H8.

De Vriendt, T., Matthys, C., Verbeke, W., Pynaert, I. & De Henauw, S. (2009): Determinants of nutrition knowledge in young and middle-aged Belgian women and the association with their dietary behaviour. *Appetite, 52*, 788–792.

European parliament and Council of the European Union (2011) Regulation (EU) No 1169/2011 on the provision of food information to consumers. *OJ. European Union, L 304*, 18–63.

Gravetter, F.J. & Forzano, L.A.B. (2012): *Research methods for the behavioural sciences*, 4th ed., USA: Cengage Learning EMEA, International Editions, Gardners Books, pp. 137–152.

Grimes, C.A., Riddell, L.J. & Nowson, C.A. (2009): Consumer knowledge and attitudes to salt intake and labelled salt information. *Appetite, 53*, 189–194.

Grunert, K.G., Wills, J.M. & 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.

Hendrie, G.A., Coveney, J. & Cox, D. (2008): Exploring nutrition knowledge and the demographic variation in knowledge levels in an Australian community sample. *Public Health Nutr., 12*, 1365–1371.

Kenđel Jovanović, G., Krešić, G., Pavičić Žeželj, S., Mićović, V. & Štefanac Nadarević, V. (2011): Cancer and cardiovascular diseases nutrition knowledge and dietary intake of medical students. *Collegium Antropol., 35*, 765–774.

Krešić, G., Kenđel Jovanović, G., Pavičić Žeželj, S., Cvijanović, O. & Ivezić, G. (2009): The effect of nutrition knowledge on dietary intake among Croatian university students. *Collegium Antropol., 33*, 1047–1056.

Lin, C.T., Lee, J.Y. & Yen, S.T. (2004): Do dietary intakes affect search for nutrient information on food labels? *Soc. Sci. Med., 59*, 1955–1967.

Loureiro, M.L., Gracia, A. & Nayga, R.M. (2006): Do consumers value nutritional labels? *Eur. Rev. Agric. Econ., 33*, 249–268.

Parmenter, K. & Wardle, J. (1999): Development of a general nutrition knowledge questionnaire for adults. *Eur. J. Clin. Nutr., 53*, 298–308.

Parmenter, K., Waller, J. & Wardle, J. (2000): Demographic variation in nutrition knowledge in England. *Health Educ. Res., 15*, 163–174.

Ranilović, J. & Colić Barić, I. (2013): Perceived barriers and motives to reading nutrition label among label 'non-users' in Croatia. *Croat. J. Food Technol., Biotechnol. Nutr., 8*, 52–57.

Shine, A., O´Reilly, S. & O'Sullivan, K. (1997): Consumer use of nutrition labels. *Brit. Food J., 99*, 290–296.

Staser, K.W., Zollinger, T.W., Saywell, R.M., Kunapareddy, S., Gibson, P.J. & Caine, V.A. (2011): Dietary behaviors associated with fruit and vegetable consumption, Marion County, Indiana, 2005. *Prev. Chronic. Dis., 8*, 1–9.

Temple, J.L., Johnson, K., Recupero, K. & Suders, H. (2010): Nutrition labels decrease energy intake in adults consuming lunch in the laboratory. *J. Am. Diet. Assoc., 110*, 1094–1097.

Temple, N.J. & Fraser, J. (2014): Food labels: A critical assessment. *Nutrition, 30*, 257–260.

Wardle, J., Parmenter, K. & Waller, J. (2000): Nutrition knowledge and food intake. *Appetite, 34*, 269–275.