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Evaluation of the impact of a hygiene warning label on the packaging of poultry

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ABSTRACT

Poultry meat is an important source of foodborne infections. Safe food-handling could lower the number of infections. Since 2001, a label containing safe food-handling instructions is required on the retail packages of raw poultry in the Netherlands. The aim was to determine the impact of this label on risk perception and food-handling behavior.

A random sample of 1235 adults from a representative Internet panel received an e-mail linking to the study questionnaire. Information was gathered about knowledge of safe food-handling regarding poultry, their current food-handling behavior and intention to change after reading the label, and influencing factors.

Median age of the 514 respondents was 51 years (18–87 years), and 53.9% was male. Seventy-nine respondents (15.4%) had never read the label. Respondents of households with person(s) aged 65 years or older, with safe food-handling practices, and who judge foodborne infections as severe were more prone to have read the label; respondents who find it a pity to throw away chicken after the expiration date were less likely to have read the label. After reading the label during the survey, the intention to change behavior did not differ between the readers and previous non-readers.

A label is a relatively easy and reasonable way of informing and educating consumers about safe food-handling. The majority of the respondents had read the label on poultry meat and scored it as important, usefull and reassuring. Therefore, investigating the feasibility and possible benefits of a similar label on other meat products could be worthwile.

1. Introduction

Each year, approximately 1 in 30 Americans (9 million people) suffer from a foodborne disease caused by one of 31 known pathogens (Scallan et al., 2011). In the Netherlands, roughly 650.000–700.000 people (1 in 24) suffer from a foodborne infection each year based upon 14 known pathogens (Bouwknegt, Mangen, Friesema, & Van Pelt, 2017; Havelaar et al., 2012). In most cases, the consequences of a foodborne infection are limited to acute gastroenteritis, in which spontaneous recovery sets in within several days to weeks. In some cases however, foodborne infections can have severe consequences such as Guillain-Barré syndrome, hemolytic-uremic syndrome, and even death (Gezondheidsraad, 2000; World Health Organization, 2013).

In the Netherlands, as is the case in most European countries, poultry meat is an important source of foodborne infections, with *Campylobacter* spp. being responsible for the highest disease burden followed by *Salmonella* spp. (Bouwknegt et al., 2017; Gabriel et al., 2010; Moore et al., 2005; World Health Organization, 2013; Zomer et al., 2015). The incidence of campylobacteriosis in the Netherlands varied between 47.4 and 50.9 per 100,000 inhabitants in the years 2010–2014. This is lower than the average rate in Europe, which shows an overall rate of 59.8 cases per 100.000 inhabitants (European Centre for Disease Prevention and Control,

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2016). The majority of cases is associated with domestic food preparation (Bearth, Cousin, & Siegrist, 2014; Fischer et al., 2007; Fulham & Mullan, 2011; Kennedy et al., 2005). In 2012–2014, Dutch citizens bought approximately 22 kilos of poultry per person per year (Terluin, Dagevos, Verhoog, & Wijsman, 2016), compared to approximately 21 and 44 kilos of poultry per person per year in the European Union (28 countries) and the United States, respectively (OECD/FAO, 2015).

Several target points in the food chain can be influenced to reduce the risk of a foodborne infection through contaminated poultry. First, it is important to ensure that poultry is not contaminated with harmful bacteria during breeding, and slaughter and retail procedures. In addition, improper food-handling behavior contributes to 40–60% of foodborne infections (de Jong, Verhoeff-Bakkenes, Nauta, & de Jonge, 2008; van Asselt, Fischer, de Jong, Nauta, & de Jonge, 2009). Several studies emphasize the importance of safe food-handling behavior in the prevention of foodborne infections (Doyle et al., 2000; Redmond & Griffith, 2003). Educating consumers about measures they can take may contribute to the decline in the incidence of foodborne infections (Osaili, Obeidat, Hajeer, & Al-Nabulsi, 2017; Ovca, Jevšnik, Kavčič, & Raspor, 2018; Yu, Gibson, Wright, Neal, & Sirsat, 2017). Measures consumers can take to reduce the risk of a foodborne infection due to poultry are proper hand-washing prior to food preparation, using separate cutting boards for raw poultry, keeping poultry in the fridge, and cooking poultry through and through (Rijksinstituut voor Volksgezondheid en Milieu, 2013). Since 2001, a label containing safe food-handling instructions is required on the retail packages of raw poultry, as was recommended by the Dutch Health Council (Gezondheidsraad, 2000). This is also the case in some other countries, such as the United States (Food Safety and Inspection Service & U.S. Department of Agriculture, 1994). The mandatory requirements for the Dutch label are the need to have a contrasting frame and it should be easily readable. The minimum text on the label is set. It should read: 'Attention, give harmful bacteria no chance. Make sure these bacteria do not end up in your food through packages, your hands, or kitchen utensils. Make sure this meat is cooked thoroughly to eliminate these bacteria' (Gezondheidsraad, 2000).

The purpose of this study was to assess the impact of a label (Fig. 1) on the packaging of poultry containing safe food-handling instructions on risk perception and food-handling behavior of adult Dutch consumers.

2. Material and methods

2.1. Study population and design

For this study, a representative Internet panel was used, named the Flycatcher panel (http://www.flycatcher.eu). This panel consists of members from the Dutch general public who volunteer to participate in online questionnaire surveys. The panel consists of 16.000 members with a representative distribution of demographic variables (gender, age, region, and level of education) for the Dutch population. The panel meets high quality requirements and is ISO-certified. A random sample of 1235 panel members aged 18 years an older was drawn. The sampled panel members were invited to participate in this study by sending an e-mail linking to an online questionnaire. Participation in the study consisted of completing this questionnaire. The survey remained online from 3 to 10 November 2014. To motivate enrollment, participants received credits for completion of the survey, which could be exchanged for gift vouchers. The nature of this general internet-based survey among healthy volunteers from the general population does not require formal medical ethical approval according to Dutch law.

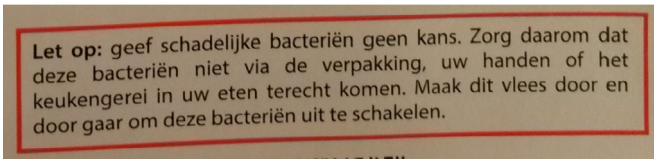

Fig. 1. The warning label on the packaging of poultry in the Netherlands.

2.2. Questionnaire

A questionnaire was developed to gain insight in knowledge of safe food-handling behavior regarding poultry among Dutch consumers and their current food-handling behavior. Furthermore, consumers' intention to change their food-handling behavior after the label was shown to them, was investigated. Finally, factors influencing knowledge, current food-handling behavior and intention to change food-handling behavior were investigated. The content of the questionnaire was based on (parts of) the Health Belief model (HBM) (Strecher, Champion, & Rosenstock, 1997). The HBM assumes human social behavior follows from attitudes and beliefs of individuals. It contains six different concepts which can be adapted based on the studied behavior: perceived susceptibility (a person's belief of chances of getting an illness), perceived severity (a person's belief of how serious an illness and its consequences are), perceived benefits (a person's belief of the efficacy of the advised action to reduce risk or seriousness), perceived barriers (a person's belief barriers to take the advised action), cues to action (strategies to activate 'readiness' to perform the behavior), and self-efficacy (confidence in a person's ability to take action) (Hanson & Benedict, 2002). The HBM has been used to study safe food-handling before (Hanson & Benedict, 2002).

Furthermore, relevant existing questionnaires and expert input was used (Bearth, Cousin, & Siegrist, 2013; Bearth et al., 2014; Gardner, Abraham, Lally, & de Bruijn, 2012; Meysenburg, Albrecht, Litchfield, & Ritter-Gooder, 2014). Questions regarding food-handling behavior were based on concepts that are used by the Netherlands Nutrition Centre in their educational materials regarding food safety. These are 'buying', 'washing', 'separating', 'heating', and 'cooling'. The content of the questionnaire was reviewed by a project team to make sure each question was understandable and the questions covered all determinants of the HBM. The online questionnaire was subdivided into six parts: 1. Food-handling of chicken; 2. Perceived severity of a foodborne infection and chance of contracting one; 3. Knowledge; 4. Barriers to carry out safe food-handling; 5. Warning label; 6. Demographic questions.

2.3. Statistical analyses

The questions about food-handling, perceived severity of foodborne infections, chance of contracting a foodborne infection, barriers to carry out safe food-handling and intention to change had to be answered on a five-point scale (e.g. never - rarely - sometimes - often - always or very little chance - little chance - neutral - high chance - very high chance). When a score was calculated, the categories were recoded to scores 1 to 5. Food-handling consists of 15 questions, which was summarized into safe food-handling (mean score 4.0 or higher) and unsafe food-handling (mean score lower than 4.0). Perceived severity of foodborne infections was measured with three questions and summarized into non-severe (mean score 3.0 or lower) and severe (mean score higher than 3.0). Seven questions formed an estimation of chance of contracting foodborne

infections and was summarized into low chance (mean score 3.0 or lower) and high chance (mean score higher than 3.0). Intention to change attitude and/or food handling behavior after reading the label was measured with three questions and summarized into no intention (mean score 3.0 or lower) and intention to change (mean score higher than 3.0). Finally, knowledge was tested with 12 correct-false questions, which were coded as 1 when the answer was correct or 0 when the answer was not correct, and summarized into good knowledge score (mean score above 0.67) and bad knowledge score (mean score 0.67 or lower). Statistical analysis was performed with SAS (version 9.3, 2011, SAS Institute Inc., Cary, NC, USA). Differences in evaluation of the label between respondents who had and who had not read the label before the study was tested using Chi square test. Logistic regression was used to test factors associated with safe food-handling behavior, having read the label before the study, and intention to change after reading the label as dependent variables, in three separate models. Factor tested in all three models were age, gender, educational level, household composition, perceived health status (own and of other members of the household), food allergies or intolerances within the household, pregnant household members, having had foodborne infections in the past, knowledge, perceived severity of a foodborne infection, chance of contracting a foodborne infection, and perceived barriers. Food-handling behavior was also tested as factor associated with having read the label, and intention to change. For all logistic regression analyses applies that factors with $P < 0.20$ in the univariate analysis were included in the multivariable model. A final model was determined by stepwise backward elimination of variables, eliminating the least significant variable per step.

3. Results

The online questionnaire was send to a sample of 1235 panel members. Of four members, the e-mail bounced. Twenty-five questionnaires were rejected due to poor quality of respons, incompleteness or drop-out. A total of 637 questionnaires were completed, leading to a respons of 51.6% (637/1231), of which 514 (80.7%) had prepared and eaten chicken in the past half year. Only the questionnaires of the latter group were used in the analyses.

Median age of the respondents was 51 years (range 18–87 years) with 64.0% being aged between 40 and 69 years, and 53.9% was male. Table 1 summarizes the characteristics of the respondents. About one-third of the respondents (32.1%) reported to have had one or more foodborne infections in the past. The majority of the respondents (86.0%) perceived foodborne infections as severe, but a minority (9.7%) thought they run a large risk of contracting foodborne infections. Knowledge about kitchen hygiene was good in 58.8% of the respondents. Two of the 12 knowledge questions were answered correctly by less than half of the respondents: 36.2% knew that if poultry smells normal, it does not mean it is safe to eat and only 32.9% was aware that eating at home is more riskfull than dining out. Correct food-handling behavior was reported by 69.5%. A total of 145 respondents (28.2%) reported experiencing one or more barriers of taking measures preventing foodborne infections, with having to throw away chicken after experiation date being the most reported barrier (15.2%).

Women (75.1%) showed more often safe food-handling than men (64.6%), as were people who considered foodborne infections severe (71.7%) compared to non-severe (55.6%) (Table 2). Also knowledge about safe food-handling and at least weekly preparing meals was associated with safe food-handling. Respondents living alone and respondents who thought taking measures is too much fuss less often carried out safe food-handling.

Seventy-nine respondents (15.4%) had never read the label, 191 (37.2%) had read it a few times and 244 respondents (47.4%) often or always read the label. Multivariable analysis of factors related to having read the label before the study, revealed that especially respondents of households with person(s) aged 65 years or older (OR 2.37; 95% CI 1.19–4.72), with safe food-handling practices (1.89; 1.13–3.16), who see foodborne infections as severe (3.23; 1.81–5.79) read the label and on the opposite was less read by respondents who find it a pity to throw away chicken after the expiration date (0.39; 0.22–0.69).

Before showing the label in the questionnaire, the respondents were asked whether they find it important that packaging of chicken contains a warning label. Of the respondents who had not read the label before the study, 40.5% found the presence of a warning label important compared to 87.1% of the readers of the label (Table 3). After having seen the label, 54.4% of the previous non-readers thought it was important compared to 92.2% of the readers. The previous non-readers also found the label less often useful (60.8%) and reassuring (44.3%) than the readers (91.5% and 75.4%, respectively). A total of 11.4% of the non-readers read some new information on the label compared to 24.1% of the readers. The overall intention to change food-handling practices after reading the label was 22.0%, and did not differ significantly between both groups.

The results of the multivariable analysis of factors associated with the intention to change food-handling practices after reading the label are given in Table 4. Respondents with a household consisting of people of 65 years or older (OR 2.72; 95% CI 1.68–4.43), respondents who consider the odds of contracting foodborne infections high (3.61; 1.87–6.97), respondents that find taking measures is time consuming (2.91; 1.38–6.13) or have inadequate facilities for washing the dishes (7.86; 1.45–42.63) had more often the intention to change behavior, whereas respondents with food allergies or intolerances within the household (0.37; 0.16–0.83) had less intention to change.

4. Discussion

About 13 years after the introduction of the mandatory warning label on poultry meat packages, 84.6% of the respondents in the present survey had read the label at least once before participating in the study. In the United States, awareness of safe food-handling labels was investigated in the first few years after introduction of those labels (Yang, Angulo, & Altekruse, 2000). About half of their respondents had seen the label and 79% of them had actually read the information. These results indicate that reading the label is not a standard practice when buying meat, which is quite understandable when someone buys a product regularly. However, reaching everyone is therefore difficult. Respondents of households with person(s) aged 65 years or older, reporting safe food-handling practices, and who see foodborne infections as severe were more prone to have read the label. The question remains whether the readers report more often safe food-handling practices because they have read the label or whether people reporting safe food-handling practices are more prone to read the label because they are interested in being on the safe side.

Unfortunately, no difference in overall intention to change food-handling practices after reading the label during the survey was seen between the readers and the previous non-readers. This could be caused by the difference in the time to reflect, as the non-readers read the label for the first time and only have minutes to make up their mind. Nevertheless, the non-readers appear to be less receptive to the label as even after reading it, only half of them think the presence of the label is important compared to almost all readers. They also find the label less often useful and reassuring than the readers.

Table 1
Characteristics of respondents.

Variable	Category	n	%
Characteristics of respondents			
Gender	male	277	53.9
Age	18-24 yrs	27	5.3
	25-39 yrs	104	20.2
	40-54 yrs	152	29.6
	55-69 yrs	177	34.4
	70 + yrs	54	10.5
Level of education	low	174	33.9
	medium	199	38.7
	high	141	27.4
Perceived health status	bad	27	5.3
Foodborne infections in the past	no	311	60.5
	yes	165	32.1
	unknown	38	7.4
Preparing of meals by respondent	several days per week	451	87.7
	weekly	35	6.8
	less than weekly	28	5.5
Preparing of chicken by respondent	once or more per week	288	56.0
	once or more per month	193	37.6
	once or more per year	33	6.4
Characteristics of respondents' households			
Composition of age in household	0-5 yrs	49	9.5
	6-17 yrs	92	17.9
	18-64 yrs	420	81.7
	65 + yrs	145	28.2
Pregnancy within household	yes	10	1.9
Food allergy or intolerance within household	yes	71	13.8
Perceived health status family members (N = 438)	bad	19	4.3
Food-handling and foodborne infections			
Perceived gravity of foodborne infections	severe	442	86.0
Chance of foodborne infections	large risk	50	9.7
Food-handling: knowledge	good	302	58.8
Food-handling: behavior	safe	357	69.5
Barriers of taking measures	*reporting 1 or more barriers*	145	28.2
	time consuming	37	7.2
	too much fuss	31	6.0
	a pity to throw chicken away after expiration date	78	15.2
	not enough kitchen requirements	47	9.1
	not enough money	16	3.1
	inadequate facilities for washing the dishes	8	1.6
	inadequate facilities for storing chicken refrigerated	6	1.2

Table 2
Factors associated with food-handling.

	% safe food-handling	multivariable
Gender		
male	64.6%	ref
female	75.1%	1.54 (1.02–2.31)
Living alone		
no	71.4%	ref
yes	56.1%	0.51 (0.29–0.90)
Knowledge food-handling		
bad	59.9%	ref
good	76.2%	2.19 (1.47–3.26)
Gravity of foodborne infections		
non-severe	55.6%	ref
severe	71.7%	1.83 (1.06–3.15)
Barriers of taking measures too much fuss		
no	71.6%	ref
yes	35.5%	0.24 (0.11–0.53)
Preparing of meals		
less than weekly	42.9%	ref
weekly	71.4%	3.37 (1.12–10.12)
several days per week	71.0%	3.02 (1.33–6.88)

Respondents with a household consisting of people of 65 years or older, respondents who consider the odds of contracting foodborne infections high, and respondents who experience barriers to change have more often the intention to change. However, intention to change is no garantuee for actual change in behaviour, especially when experiencing barriers, but also influenced by past behaviour and habits (Fulham & Mullan, 2011; Mullan & Wong, 2009). Respondents with food allergies or intolerances within the household showed less intention to change. A possible explanation is that if an allergy or intolerance is under control someone does not want to jeopardize the equilibrium by changing habits.

This study shows a majority of the respondents (69.5%) reporting proper food-handling behavior already. This is a high percentage, however, literature on self reporting behavior shows frequently a gap between reported behavior and actual behavior. Respondents are inclined to give socially desirable answers, possibly resulting in an overreporting of 'good behavior' (Mazengia, Fisk, Liao, Huang, & Meschke, 2015; Redmond & Griffith, 2003). Since respondents were asked to report their own behavior, this could have resulted in socially desirable answers, meaning the respondents answered in a way they thought the researchers were looking for. The knowledge scores of the respondents were in general high, as the majority answered nine out of twelve questions correctly. This means that they know what should be the correct behavior. Observational studies can, therefore, provide more reliable information on actual food-handling behavior (Redmond & Griffith, 2003). On the other hand, questionnaires can provide valuable data on knowledge and perception of respondents.

Table 3
Evaluation of the label, separate for respondents who had (readers) and had not read (non-readers) the label before the study.

	non-readers	readers	p-value
Warning label is (before)[a]			
not important	22.8%	0.9%	<0.0001
neutral	36.7%	10.6%	
important	40.5%	88.5%	
Warning label is			
not important	15.2%	0.9%	<0.0001
neutral	30.4%	6.9%	
important	54.4%	92.2%	
Warning label is			
not useful	15.2%	0.7%	<0.0001
neutral	24.1%	7.8%	
useful	60.8%	91.5%	
Warning label is			
not reassuring	12.7%	3.9%	<0.0001
neutral	43.0%	20.7%	
reassuring	44.3%	75.4%	
Reading of new information in label			
yes	11.4%	24.1%	0.02
keep bacteria from raw chicken away from food	2.5%	9.9%	0.03
chicken contains pathogens	2.5%	7.4%	0.11
store chicken below 4 degrees Celsius	8.9%	12.4%	0.37
heat chicken thoroughly	6.3%	7.6%	0.69
Intention to change food-handling practices			
yes	16.5%	23.0%	0.20

[a] Before = before reading the label in this survey.

Table 4
Factors associated with intention to change after reading the label.

	% intention to change	multivariable
Composition of household:		
65 + yrs		
no	18.1%	ref
yes	36.0%	2.72 (1.68–4.43)
Food allergy or intolerance within household		
no	23.7%	ref
yes	11.3%	0.37 (0.16–0.83)
Chance of foodborne infections		
small risk	19.6%	ref
large risk	44.0%	3.61 (1.87–6.97)
Barriers of taking measures		
time consuming		
no	20.1%	ref
yes	46.0%	2.91 (1.38–6.13)
inadequate facilities for washing the dishes		
no	21.2%	ref
yes	75.0%	7.86 (1.45–42.63)

Safe food-handling was more often reported by women, people who consider foodborne infections as severe, with good knowledge about food-handling and at least weekly preparing meals. These results are not unexpected, and similar associations with safe food-handling behavior have been described previously (Bearth et al., 2014; Meysenburg et al., 2014; Patil, Cates, & Morales, 2005). Women are more likely to be the main food preparer than men and thus more likely experienced as is also the case in respondents preparing meals at least weekly. Further, we can infer that implementation of safe food-handling is easier when having knowledge about food safety, whereas fear of severe consequences will promote behavior avoiding that risk. Living alone or experiencing barrieres was associated with less safe food-handling. This suggests that cooking for others is a trigger to be more careful in the kitchen.

Several factors make clear that additional food safety education is advised. First, only about a third of the respondents was aware that eating at home is more risky than dining out and still 30% reported unsafe food-handling within the current study. In an observational study in which chicken had to be prepared, food-handling activities which could result in cross-contamination were observed in all participants, with lack of proper hand washing being the main act (Mazengia et al., 2015). Source attribution analyses on Dutch data showed that 3.8% of the salmonellosis cases were related to broilers as reservoir and 66.2% of the campylobacteriosis cases originated from chickens (Mughini-Gras et al., 2014; Mughini-Gras et al., 2012). Especially since knowledge is no guarantuee for good practice, focus of food safety advices should be on reinforcing correct food-handling and implementing this behaviour into habits (Fulham & Mullan, 2011; Mullan & Wong, 2009).

In summary, a label is a relatively easy and reasonable way of informing and educating consumers about safe food-handling. The majority of the respondents had read the label. A difference in current reported food-handling was seen between the readers and non-readers of the label, whereas the knowledge did not differ. As, after reading the label during the survey, the intention to change did not differ between the readers and non-readers, the maximum range of effect of the current label appears to be reached. On the other hand, the readers scored the label as important, usefull and reassuring, demonstrating the value of the label. Design and location of the label might have a possitive effect on food-handling behavior. Therefore, possible effects of design and location of the label could be studied to see whether the visibility of the label can be improved. To reach the non-readers, other channels like education at schools and food-handling advices given in cooking programmes or magazines could also be used. Furthermore, the possible health risks of (handling) poultry are generally known, but that handling of pork and beef also needs safe food-handling is expected to be less known. Therefore, investigating the feasibility and possible benefits of the label on other meat products could be worthwile.

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Declarations of interest

None.

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