



RESEARCH/PRACTICE ARTICLE

Purchasing products with sustainable palm oil: designing and evaluating an online intervention for Australian consumers

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Abstract

Widespread tropical deforestation and biodiversity loss in Southeast Asia due to the oil palm industry can be addressed by encouraging consumers to purchase sustainable palm oil (SPO). An online experiment was conducted to assess whether addressing barriers relating to education, motivation and product availability would increase purchasing of SPO. Australian adults ($n = 628$) were randomly assigned to either: (1) a newly developed interactive educational website on palm oil and SPO; (2) an existing educational video on SPO; or (3) an interactive website on differentiating between real and fake news (an attentional control condition). All participants completed pre-intervention and immediate post-intervention measures. Most participants ($n = 403$) completed follow-up measures two weeks later. Multivariate analysis revealed that the interactive website and educational video increased both knowledge and the intention to purchase SPO (compared to the attentional control), but neither significantly impacted follow-up self-reported SPO purchasing behaviour. Low perceived product availability might help explain the intention–behaviour gap. Our results suggest that, in addition to increasing consumer knowledge and motivation, promoting sustainable consumption requires creating opportunities for people to engage in the desired behaviour.

Keywords: sustainable palm oil; online educational intervention; green purchasing; COM-B; interactive website

Introduction

Tropical rainforests and peatlands play important roles in mitigating the impacts of climate change by absorbing carbon dioxide from the atmosphere and storing carbon, while also maintaining water cycles and regulating global temperatures (Bonan, 2008; Humpenöder et al., 2020; Seymour & Busch, 2016; Wolosin & Harris, 2018). In fact, recent literature has emphasised that global net emissions can be significantly reduced if rainforest destruction and the draining of peatlands are stopped, and restoration efforts are made (Humpenöder et al., 2020; Seymour & Busch, 2016). Unfortunately, despite ‘no deforestation, peat, nor exploitation’ commitments made by companies and governments to decrease deforestation by 2020, the worldwide destruction of tropical rainforests continues to increase (Fountain, 2020).

Palm oil and climate change

Palm oil production is a chief reason for deforestation in Southeast Asia (Gaveau, 2017; Gilbert, 2012; Koh & Wilcove, 2008; Meijaard *et al.*, 2018; Meijaard & Sheil, 2013; Wright, Watson, Booth, & Jamaluddin, 2019). It is a popular and profitable vegetable oil, due to its high yield and relative inexpensiveness (Meijaard *et al.*, 2018). Over 40% of oil palm plantations are grown on small-holder family farms (Meijaard *et al.*, 2018; Parsons, Raikova, & Chuck, 2020) whose livelihoods rely on the oil (Lee, Ghazoul, Obidzinski, & Koh, 2013). The deforestation is linked to the increasing global demand for palm oil, requiring forested lands to be cleared on a large scale for new plantations (Gaveau, 2017; Gilbert, 2012; Koh & Wilcove, 2008; Meijaard *et al.*, 2018; Wright *et al.*, 2019). The dwindling biodiversity in these regions is reflective of this deforestation's ecological impact (Meijaard & Sheil, 2013; Sample, 2018; Wich *et al.*, 2008). Further, these rainforests and the peatlands upon which they grow release enormous amounts of greenhouse gases, such as carbon dioxide and methane, when cleared and burned (Basyuni, Sulistyono, Slamet, & Wati 2018; Carlson *et al.*, 2012; Sheil *et al.*, 2009).

Different solutions have been proposed, such as creating synthetic oils (Parsons *et al.*, 2020), promoting more 'sustainable' practices in the palm oil industry (Meijaard *et al.*, 2018; Parsons *et al.*, 2020; Sundaraja, Hine, & Lykins, 2020; Wilcove & Koh, 2010) and advocating a boycott of palm oil (<https://www.palmoilinvestigations.org>). However, experts agree that increasing consumer demand for sustainable palm oil (SPO) is one promising potential solution (Sundaraja *et al.*, 2020; Wilcove & Koh, 2010).

Interventions and pro-environmental behaviour

Knowledge and awareness about environmental concerns are necessary precursors to any pro-environmental behaviour (Hines, Hungerford, & Tomera, 1987; Hungerford & Volk, 1990; Joshi & Rahman, 2015). However, informational or educational interventions are often insufficient to create long-term behaviour change (Chen, Chen, Yang, Long, & Li, 2018), particularly when the desired behaviour is difficult and costly (Steg & Vlek, 2009). Therefore, it is prudent to design an intervention based on a framework that assesses specific barriers to a target behaviour. While there are various theoretical frameworks that have been used to understand factors that lead an individual to engage (or not engage) in pro-environmental behaviour, the most notable one being the *Theory of Planned Behaviour* (Ajzen, 1991), these tend to focus only on intrinsic factors. A more comprehensive framework, called the Capability-Opportunity-Motivation model of behaviour (COM-B), which is part of the behaviour change wheel (Michie, Van Stralen, & West, 2011; Figure 1) takes into consideration various internal *and external* factors that can influence successful performance of an intended action. According to COM-B, all behaviour can be influenced by factors associated with capability (e.g., physical skills, knowledge and affordability), opportunity (e.g., ease of access, social norms) and motivation (e.g., attitudes, empathy and self-efficacy), and hence understanding these could help design behaviour change interventions that target one or more of these factors (Michie *et al.*, 2011).

Designing interventions in line with the behaviour change wheel has become quite popular in the field of health (e.g., Carney, Bradshaw, & Yung, 2016; Fulton, Brown, Kwah, & Wild, 2016; Gould *et al.*, 2017), but this model has received comparatively less attention in the pro-environmental space. It has been applied in designing interventions for invasive animal management in Australia (McLeod, Hine, Please, & Driver, 2015), and one case study examined it in the context of recycling behaviour (Gainforth, Sheals, Atkins, Jackson, & Michie, 2016). The latter concluded that focussing on motivation alone is insufficient to overcome the barriers to behaviour change, and providing opportunities (e.g., access to trash bins) along with knowledge is also essential (Gainforth *et al.*, 2016). This highlights the importance of designing interventions that target both internal and external factors to promote behaviour change.

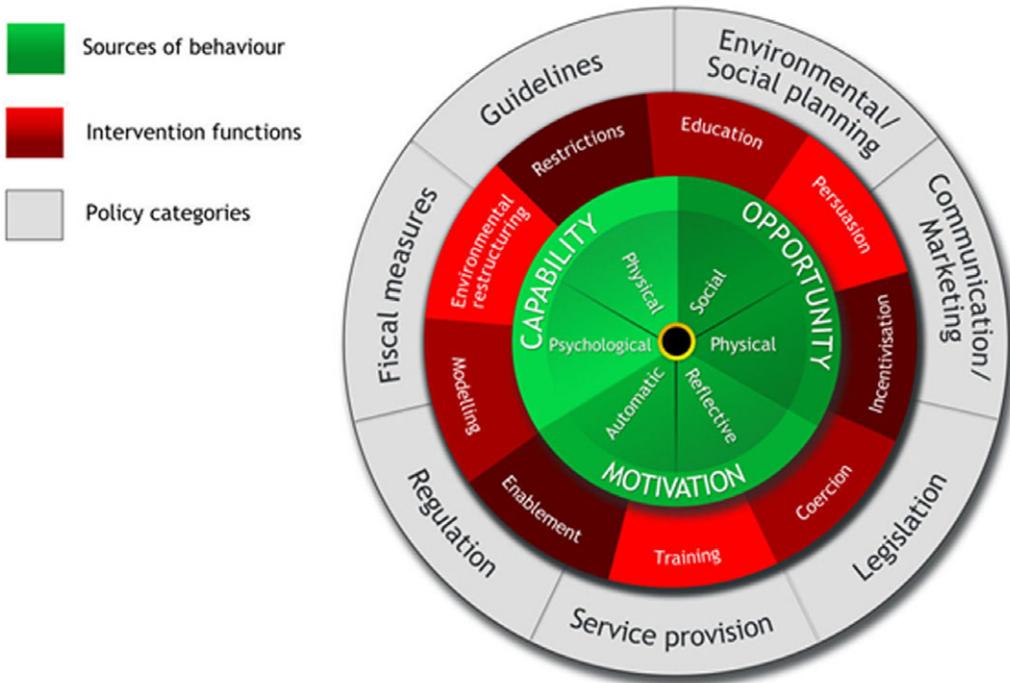


Figure 1. The behaviour change wheel. Reprinted from ‘The behaviour change wheel: A new method for characterising and designing behaviour change interventions’, by S. Michie, M. M. van Stralen and R. West, 2011, *Implementation Science*, 6(42), p. 7. Copyright [2011] by Michie et al., licensee BioMed Central Ltd. Used under Creative Commons Attribution License: <http://creativecommons.org/licenses/by/2.0>.

Green/sustainable consumerism

Increasing demand for SPO could be viewed under the lens of ‘green consumerism’, a topic that has attracted substantial attention (e.g., Bray, Johns, & Kilburn, 2011; Carrington, Neville, & Whitwell, 2010; Gleim, Smith, Andrews, & Cronin, 2013; Mainieri, Barnett, Valdero, Unipan, & Oskamp, 1997; Moser, 2015; Vermeir & Verbeke, 2006; Young, Hwang, McDonald, & Oates, 2010). In a systematic review, Joshi & Rahman (2015) concluded that both individual factors (e.g., knowledge, values, habits, perceived consumer efficacy) and situational factors (e.g., product price, availability, social norms) are important determinants of green purchasing intentions and behaviour. Several other studies in this area have focussed on a relatively narrow range of sustainable consumption predictors that relate to motivational factors like willingness to pay, personal norms (Moser, 2015) and self-efficacy (Hanss, Böhm, Doran, & Homburg, 2016), while few studies have gone beyond motivation-related factors (Barbarossa & Pastore, 2015, Isenhour, 2010, 2014; Sundaraja, Hine, Alex, Cosh, & Lykins, 2021).

Within the green consumerism literature, we were able to find only three studies focussed directly on palm oil purchasing behaviour (Hinkes & Christoph-Schulz, 2019; Isenhour, 2014; Sundaraja, Hine, Alex, et al., 2021), all qualitative in nature. One was a Swedish ethnographic study that highlighted situational barriers to SPO consumption (Isenhour, 2014), another had focus group discussions with German participants, exploring consumer attitudes towards palm oil (Hinkes & Christoph-Schulz, 2019), while the third was an Australian research study utilising framework analysis to understand consumers’ perceived barriers to the purchasing of SPO (Sundaraja, Hine, Alex, et al., 2021). The importance of the complexity of the palm oil issue, the lack of sufficient information on palm oil and potential alternatives, having limited personal resources of time and energy, unclear labelling on products, palm oil being an ingredient in a wide

variety of products and holding negative attitudes about palm oil in general, were stressed upon as barriers towards the sustainable consumption of palm oil (Hinkes & Christoph-Schulz, 2019; Isenhour, 2014; Sundaraja, Hine, Alex, et al., 2021).

In general, interventional research on promoting green consumption is scarce when compared to other pro-environmental behaviours like recycling or energy conservation (Osbaldiston & Schott, 2012), although there are many studies in a comparable area of promoting healthier food consumption. A systematic review of literature on healthy food consumption reviewed 89 interventions across real and simulated environments and concluded that interventions involving the manipulation of the product price or offering a financial reward appeared to be most influential (Hartmann-Boyce et al., 2018). While 'swap interventions' (i.e., where consumers can substitute their regular food with a healthier option) were also found to be useful, the effectiveness of educational interventions in simulated environments did not translate into real environments (Hartmann-Boyce et al., 2018). In terms of the behaviour change wheel, interventions that increase capability and opportunity were found to be more effective in getting people to make healthier food choices.

A Norwegian online grocery shopping experiment evaluated the effects of increasing knowledge and perceived consumer efficacy on sustainable purchasing (Hanss & Böhm, 2013). Across the course of six months, there was no significant difference between the intervention and control groups (Hanss & Böhm, 2013), highlighting once again that imparting knowledge (capability) and attempting to enhance perceived consumer efficacy (motivation) may be insufficient for long-term behaviour change.

Only one intervention has been conducted with palm oil among Australian university students (Pearson, Dorrian, & Litchfield, 2011). As part of the intervention, the researchers screened an emotive documentary, 'GREEN' (Rouxel, 2009) that focused on a dying orangutan's last days. The intervention also provided education on orangutans (their habitat, behaviour and intelligence) and how one could help conservation efforts. Results indicated that short-term behavioural effects (e.g., making donations, responsible purchasing) were observed in 84% of the sample who returned the behavioural diary (attributed to increased knowledge and attitude change), but only 18% of the original sample reported longer-term change after 10–12 weeks (Pearson et al., 2011). While this research proposed mechanisms of short-term behaviour change and attempted to examine barriers to longer-term change, it did not specify the pathways by which the intervention impacted behaviour. Further, yet again, this intervention targeted motivation (with the documentary) and capability (knowledge), without a clear understanding of the specific barriers that prevent people from engaging in palm oil-related pro-environmental behaviour and did not touch upon factors relating to opportunity.

The current study is one of the first to utilise the behaviour change wheel (Michie et al., 2011) in the field of green consumerism, specifically in encouraging the purchase of products containing SPO. It draws on previous research that identified specific COM-B factors significant in predicting engagement in SPO purchasing behaviour, including actively checking labels for SPO, purchasing products containing SPO and intentionally avoiding products because they contain unsustainably sourced palm oil (Sundaraja, Hine, & Lykins, 2021). *Knowledge/awareness* (about the impacts of the unsustainable palm oil industry and the existence of SPO), *perceived product availability* (of SPO products, including knowing how to identify and locate them) and *pro-green consumer attitudes* (such as having concern and empathy for plant and animal life, perceived consumer efficacy, responsibility, etc.) were found to significantly predict the frequency of SPO-related consumer action (Sundaraja, Hine, & Lykins, 2021). The present study therefore aimed to design and evaluate an online intervention that addressed the COM-B factors of capability (*knowledge/awareness*), opportunity (*perceived product availability*) and motivation (*pro-green consumer attitudes*) in increasing SPO purchasing behaviour among Australian consumers.

It was hypothesised that an intervention designed utilising interactive elements from the behaviour change wheel (Michie et al., 2011) would increase *knowledge/awareness*, *perceived product*

availability and pro-green consumer attitudes among Australian consumers compared to existing (passive) educational material and an (interactive) attentional control condition. It was further hypothesised that by reducing barriers associated with these COM-B factors, consumers would report greater SPO-related consumer intentions and would also engage in more SPO-related consumer behaviour 2 weeks following the intervention.

Materials and Method

Participants

The original sample consisted of 628 adult participants (330 women, 296 men and 2 gender non-specific) living in Australia, who self-reported as the primary grocery/supermarket shopper in their households. All participants were sourced using a survey panel from Qualtrics™, an online database and survey administrator (Qualtrics, Provo, UT, 2021). Qualtrics™ samples are generally sourced from double-opt-in market research panels and there are several ways in which recruitment can occur. Often, potential participants are sent email invitations (with information on the anticipated length of survey and incentives offered), while at other times, respondents who sign into a panel portal can view surveys that they might be eligible for. Other common invitation methods include in-app notifications and SMS notifications. To avoid self-selection bias, survey invitations are very general and do not include specific details about the nature of the survey.

The target sample size was determined by a power analysis. A small effect size of $f^2 = .02$ (Cohen, 1988; Henseler, Ringle, & Sinkovics, 2009) was predicted based on research into drivers and barriers associated with pro-environmental behaviour (e.g., adoption of low emission agricultural practices among farmers), which found small effect sizes (squared semi-partial correlations ranging from $<.01$ to $.10$; Morgan, Hine, Bhullar, & Loi, 2015). Assuming a target power of $.90$, 3 treatment groups, 7 measurements and an α level of $.01$, a power analysis using G*Power (Faul, Erdfelder, Buchner, & Lang, 2009) suggested a minimum sample size of 364 participants at follow-up. Anticipating an attrition rate of approximately 40% as seen in Western pro-environmental longitudinal research (47% over nine months; Steinhilber & Klöckner, 2018), with a short follow-up period of two weeks (Deutskens, de Ruyter, Wetzels, & Oosterveld, 2004), a sample size of above 600 was aimed for. Figure 2 shows that how the 628 participants were distributed across treatment groups. Participants had a mean age of 49 years ($SD = 15.50$, range = 19–85), and they reported having completed an average of 14 years of formal education. More than three-quarters of the participants (77%) stated that they lived in an urban area (big city or large town). The follow-up measures were completed by 403 participants after approximately 2 weeks, with no significant difference in attrition across the three groups ($M = 35.8\%$ attrition, range = 31.7–40.2%, $p = .60$). The mean age of participants at follow-up was also 49 years ($SD = 15.07$, range = 21 to 82).

Measures

Data were collected at three points in time – at pre-intervention, immediately post-intervention and at a follow-up 2 weeks following completion of the intervention.

Pre-intervention measures

These measures were initially administered to the participants prior to exposure to the intervention.

Basic socio-demographic details. Participants were asked relevant, non-identifying questions about age, sex, years of education and residence location (urban or rural/regional).

Frequency of SPO-related consumer behaviour. Three items on behaviour pertaining to the purchasing of products containing SPO were included ('At a supermarket/food store, how many

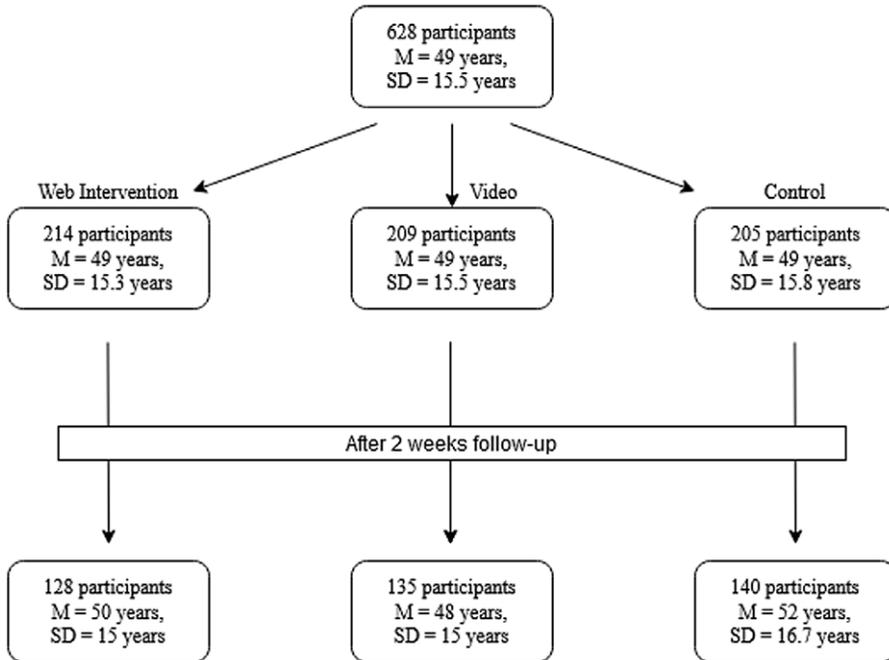


Figure 2. A flowchart indicating the number of participants and average age of participants across the three treatment groups at the initial phase of the research and at follow-up.

product labels (ingredients list) have you checked to see if they contain sustainable palm oil?, *'How many products have you intentionally purchased because they contained sustainable palm oil?'* and *'How many products have you avoided purchasing, because you realized that they contained palm oil that is not sustainable?'*). Participants were asked to indicate their frequency of each behaviour over the past 12 months, on an 11-point scale, where 0 = 'never' and 10 = '10 or more times'. These items had an internal consistency of $\alpha = .82$ and were summed to provide a total score that was used for subsequent analysis.

Connectedness with Nature Scale (CNS; Mayer & Frantz, 2004) Connectedness with nature has been shown to be an important predictor of eco-friendly behaviour (Mayer & Frantz, 2004). In this study, the CNS was used to determine if there were any significant difference between the intervention groups at baseline. Fourteen items consisting of statements written in the first person are each rated on a five-point scale, where 1 = 'strongly disagree' and 5 = 'strongly agree'. Previously, this scale has demonstrated high internal consistency (Cronbach's $\alpha = .84$), high test-retest reliability ($r = .78$, $p < .001$), and concurrent, convergent and discriminant validity (Mayer & Frantz, 2004). In the current study, the scale had high internal consistency (Cronbach's $\alpha = .86$).

Immediate post-intervention measures

These measures were administered to the participants immediately following exposure to the intervention.

Palm Oil COM-B Survey. This survey was designed for a previous research study that explored barriers and drivers of purchasing products with SPO (Sundaraja, Hine, & Lykins, 2021) based on COM-B (Michie *et al.*, 2011). The original survey was retained for the current study (in order to

confirm the factor structure from the previous study) and consisted of 53 items on capability, opportunity and motivation (Sundaraja, Hine, & Lykins, 2021; Appendix A). All items on knowledge were specific to SPO, while the other items were about 'green' or 'sustainable' products in general; this decision was made because pilot testing indicated that in the absence of awareness about the palm oil issue and the option of SPO, participants would have found it difficult to respond to the survey if all items were SPO-specific (Sundaraja, Hine, & Lykins, 2021). Items were rated on a five-point scale of 1 = 'not at all like me' to 5 = 'just like me'. Factor analysis confirmed the same factor structure as in the previous study (Sundaraja, Hine, & Lykins, 2021), with six items for the capability scale of knowledge/awareness ($\alpha = .90$), four items for the opportunity scale of perceived product availability ($\alpha = .84$), and for the two motivation scales – six items for pro-green consumer attitudes ($\alpha = .95$), and nine items for demotivating beliefs ($\alpha = .80$).

Intention to Engage in SPO-Related Consumer Behaviour. Participants were asked to indicate their likelihood of engaging in the three SPO-related consumer behaviours assessed pre-intervention over the following two weeks (i.e., the interval between first contact and follow-up) on a sliding scale from 0 – 100, where 0 = 'definitely will not engage in the behaviour', 50 = 'equally likely to engage or not engage in the behaviour' and 100 = 'definitely will engage in the behaviour'. The items were averaged to provide a measure of the intention to purchase SPO products ($\alpha = .82$).

Follow-up measures

At approximately two weeks after having participated in the intervention, participants were first asked to provide an indication of the frequency of grocery and/or supermarket shopping in the previous two weeks on a six-point scale from 0 to 5 or more times. Finally, the frequency of engaging SPO consumer behaviour over the interval between intervention participation and follow-up was assessed by administering the same three items that were administered pre-intervention. These items were summed to provide a total score that was used for data analysis. This total score had a high internal consistency of $\alpha = .87$.

Procedure

All participants were provided with an information sheet and then gave online consent to participate in the research and to being contacted for a follow-up study. Screening procedures excluded participants below 18 years of age and those who reported that someone else (i.e., not the participant) primarily did the grocery shopping for the household. Three separate survey links were randomly sent out via email to potential participants, one for each of the intervention groups (described below). All participants initially completed the pre-intervention measures, after which they were randomly assigned to one of three interventions: (1) interactive website intervention on palm oil; (2) existing educational video on SPO; or (3) interactive website intervention on differentiating between real news and 'fake' news, which was used as the attentional control group.

Interactive educational website intervention on palm oil

An interactive website was designed to educate participants about palm oil—its uses and benefits, as well as its impact on the environment, biodiversity, pollution, human health and social rights (https://unesurveys.au1.qualtrics.com/jfe/form/SV_cjgqxqolaE056wdL). Utilising active and interactive educational approaches in environmental education have been effective in interventions (Monroe, Plate, Oxarart, Bowers, & Chaves, 2019). The concept of SPO was then introduced as a potential solution, along with information on various behaviours individuals can perform to help promote the use of SPO (Sundaraja et al., 2020). These were intended to increase participants' knowledge and awareness about the issue. Further, the narration was from the perspective of a baby orangutan and a tiger cub and aimed to increase green attitudes by encouraging empathy

towards the animals in the Southeast Asian rainforests. Previous research has indicated that people experience greater environmental compassion and might be more willing to help single identified victims (human or animal), as versus an entire species (Kogut & Ritov, 2005; Markowitz, Slovic, Västfjäll, & Hodges, 2013). Finally, participants were presented with the symbol to help them identify which products had certified SPO in them, aimed at helping them identify SPO products in supermarkets (addressing perceived product availability). The website was 'interactive' in that participants were asked to participate in the intervention by making estimates (e.g., 'How many human lives has the Southeast Asian Haze claimed so far via respiratory illnesses?'), dragging and dropping statements into categories (e.g., 'Advantages of palm oil', 'Disadvantages of palm oil', or 'Not relevant to the issue'), and selecting areas on a flowchart where consumers can have an impact in the palm oil supply chain. The interaction element was included so that the participants were actively involved with the content provided and thus were not mere passive recipients of this information.

Video on SPO

The second group was exposed to an existing educational promotional video (<https://youtu.be/K6KQJjimVjA>) titled 'Sustainable Palm Oil Challenge — Supply and Demand', created by Chester Zoos (2019) to encourage people to purchase products containing SPO. The video (194 seconds) aims to raise awareness about the palm oil issue and supply chain, while encouraging viewers to read labels and use their consumer power to support SPO (Chester Zoos, 2019). The collected survey data included information on how long the participants stayed on this page after clicking 'play' to watch the video. A page timer was incorporated to prevent participants from moving to the next page until the 194 seconds had elapsed. Additionally, participants were asked three simple true or false questions about content in the video to ascertain if they were paying attention (e.g., *palm oil has an impact on crocodiles.*) and had to respond correctly to at least two out of the three to be included in the sample. This resulted in 11 participants being excluded.

Interactive website on real news and fake news

For the attentional control group, an interactive website was created to teach participants how to differentiate between real news and fake news, as narrated by 'Bottie' the robot (https://unesurveys.au1.qualtrics.com/jfe/form/SV_6FLs3j529k19WPH). Participants were helped to identify titles that indicated fake news and to evaluate if the news sources they relied on use evidence-based reporting. Brief articles were provided, and participants had to read each one and indicate if it was real news or fake news. The respondents exposed to this intervention served as the attentional control group, as they were exposed to an interactive website and obtained information in an active manner but received no information about palm oil nor its availability, and green attitudes were not targeted.

After exposure to their respective interventions, all participants completed the immediate post-intervention measures. They were also given an opportunity to download two shopping resources that would help them identify products with SPO. One was a list of brand names that source SPO (*Brand leaders for sustainable palm oil*, 2019) and the other was an Australian shopping guide to products that are either palm oil-free or use certified SPO (BOS Australia, *n.d.*).

Apart from the screening of age and being the primary grocery shopper for the household, participants were required to pass two attention checks incorporated into the COM-B survey. These were instructed-response items (e.g., 'In order to check for attention, please answer '3' for this question'), which have been known to be useful in screening out careless responders while still protecting the validity of the scale (Kung, Kwok, & Brown, 2018; Meade & Craig, 2012). Failing an attention check immediately resulted in participants being taken to the end of the survey, resulting in an incomplete response. Across all the three survey links, respondents

who provided partial responses were automatically screened out. Additionally, participants whose response times were below one-half of the average time taken for each of the three groups (less than or equal to 7 minutes 30 seconds, 7 minutes, and 6 minutes 30 seconds respectively for Groups One, Two and Three) were automatically screened out to ensure good data quality, as recommended by Qualtrics™. Three participants were screened out this way (two from Group One and one from Group Three). After the 11 participants screened out of Group Two were excluded for failing the fact-checking questions, no additional participants were screened out based on a below average time taken to complete the survey.

Two weeks after the initial survey launch, all participants were emailed with a request to complete a brief follow-up survey. Participants who clicked on the survey link were taken to another information sheet, after which they again provided consent to participate in the follow-up survey. After the follow-up measures were administered, participants were offered a chance to sign a petition requesting their respective state ministers in Australia to ensure that all palm oil on products is labelled — sustainable or otherwise (<https://www.zoo.org.au/dont-palm-us-off/>).

Data analysis

Multiple analyses of variance (ANOVA) and chi-square analyses were run using IBM SPSS Statistics version 26 (IBM corp., Armonk, NY, USA) to assess if the intervention groups differed from each other on the immediate and follow-up outcome measures. Further, a mediation analysis was run using the SPSS PROCESS (version 3.5) macro (Hayes, 2014), to help understand the pathways through which the interventions might have influenced the target outcome measures.

Ethics

The study was approved by the Human Research Ethics Committee of the University of New England (Approval No. HE20-107) and was conducted in compliance with the recommended research ethics procedure.

Results

The main aims of the study were to: (1) evaluate the impact of an interactive website intervention (relative to a video intervention and an attentional control) on consumer SPO purchasing intentions and behaviour and (2) determine whether these effects were mediated by COM-B factors of knowledge/awareness, perceived product availability and pro-green consumer attitudes. At pre-intervention, 52.7% of the total sample across the three intervention groups reported never having engaged in SPO purchasing behaviour over the past 12 months. Overall, the total sample had an average level of nature-connectedness that fell just above the midpoint on the five-point scale ($M = 3.45$, $SD = .61$). The three treatment groups did not differ significantly on nature-connectedness [$F(2, 625) = 2.02$, $p = .13$, partial $\eta^2 = .01$] nor their past SPO-purchasing behaviour [$F(2, 625) = 2.33$, $p = .10$, partial $\eta^2 = .01$], indicating that random assignment was effective in distributing pre-existing participant attributes evenly across treatment groups. Thus, we did not control for these factors in subsequent analyses. At follow-up, participants indicated that they visited their grocery store or supermarket an average of three times during the two-week interval.

Outcome measures

A MANOVA was conducted to determine if there was a statistically significant difference between the website, video and control groups on immediate post-intervention measures (i.e., the four COM-B factors and the intention to engage in SPO purchasing behaviour over the subsequent

Table 1. MANOVA and *post hoc* tests for outcome measures by intervention group

	<i>F</i>	Partial η^2	Intervention group		
			Interactive website	Video	Control
Pro-green consumer attitudes	0.23	0.00	3.49 ^a	3.44 ^a	3.44 ^a
Demotivating beliefs	0.02	0.00	2.75 ^a	2.75 ^a	2.76 ^a
Perceived product availability	2.54	0.01	2.56 ^a	2.56 ^a	2.73 ^a
Knowledge/awareness [#]	4.17**	0.03	3.23 ^a	3.01 ^{a/b}	2.80 ^b
SPO purchasing intentions	5.21**	0.02	61.75 ^a	61.04 ^a	54.55 ^b
SPO consumer behaviour (follow-up) [#]	3.02*	0.02	2.74 ^a	2.96 ^a	4.37 ^a

* $p \leq .05$; ** $p < .01$; [#]Bootstrapped with 5000 samples; Means with different superscripts are significantly different at $p < .05$, while means with the same alphabet superscript indicates no statistically significant difference between means; ^{a/b}There is no statistically significant difference with the website intervention group, nor the control group.

two weeks following the exposure to the intervention; $N = 628$) and the follow-up measure of SPO consumer behaviour ($n = 403$). Preliminary analysis revealed that knowledge/awareness and follow-up SPO consumer behaviour exhibited heterogeneity of variance across experimental conditions. Therefore, bootstrapping for 5000 samples was run to compute standard errors and probability values for these analyses and associated *post hoc* tests. Statistically significant effects of group membership were found with knowledge/awareness, SPO purchasing intention and SPO consumer behaviour at follow-up. A summary of analyses with *post hoc* tests, for each dependent variable is presented in Table 1.

The website intervention significantly increased knowledge/awareness and SPO purchasing intentions relative to the attention control group, but not relative to the SPO video group. SPO Consumer Behaviour at follow-up showed a trend of the control group reporting having engaged in more SPO consumer behaviour than the website intervention group (mean difference = -1.63 , $p = .07$; 5000 bootstrap samples 95% CI [-3.13 , $-.08$]). Although not statistically significant, this was an unexpected finding and was explored further using other analyses.

Chi-square tests of independence were also performed to examine the effect between the intervention group membership on participants' decisions to download the SPO shopping resources provided in the survey and/or follow a link to an Australia petition supporting improved palm oil labelling. Neither the effects of the interventions on downloading SPO shopping resources ($\chi^2(2, N = 628) = 1.65$, $p = .22$, $\phi = .05$) nor visiting the petition webpage ($\chi^2(2, N = 403) = .98$, $p = .61$, $\phi = .07$) approached significance.

Mediation analysis

Mediation analyses were run to explore the relationships amongst the intervention groups on SPO purchasing intentions, as well as SPO consumer behaviour at follow-up, to see if this was mediated by the four COM-B factors of knowledge/awareness, perceived product availability, pro-green consumer attitudes and demotivating beliefs. Figures 3 and 4 depict the pathways that were tested, with unbroken lines indicating those which were significant. All indirect effects were computed using 5000 bootstrapped samples.

Overall, the variables in Model 1 (Figure 3) together accounted for 49% of variability in SPO purchasing intentions, $F(6, 621) = 100.99$, $p < .001$, $R^2 = .49$. The SPO website intervention influenced SPO purchase intentions via the mediator knowledge/awareness (indirect effect = 2.49, $p < .001$, 95% CI [1.17 , 4.10]), as did the video intervention (indirect effect = 1.22, $p < .001$, 95% CI [$.01$, 2.64]), but not via the other mediators. Perceived product availability was the only mediator that did not significantly predict SPO purchasing intentions. After controlling for the

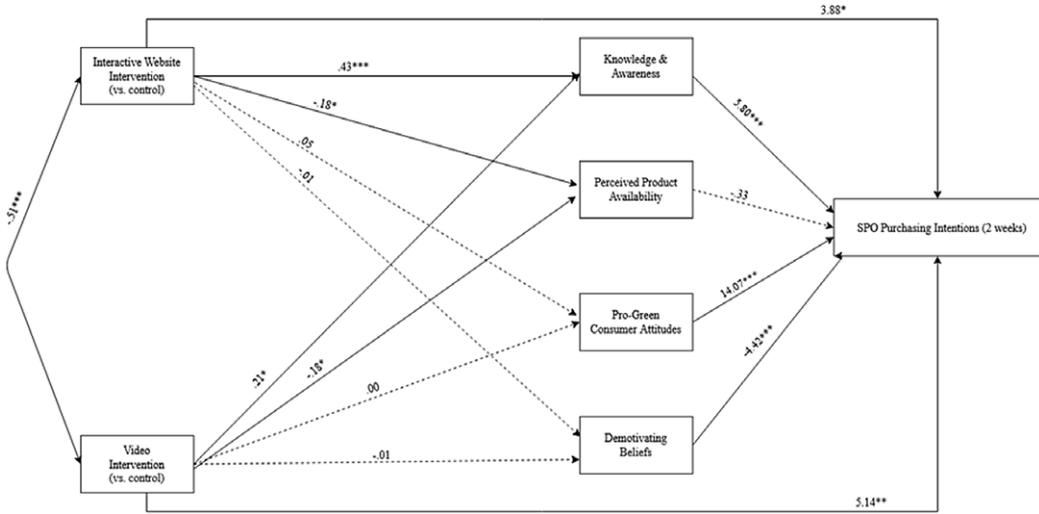


Figure 3. Model 1. COM-B as potential mediators of the relationship between the intervention groups and SPO purchasing intentions ($N = 628$). The model indicates that the relationship between the website intervention and SPO purchasing intentions is partially mediated by knowledge/awareness. All reported path coefficients are unstandardised; * $p < .05$, ** $p < .01$, *** $p < .001$.

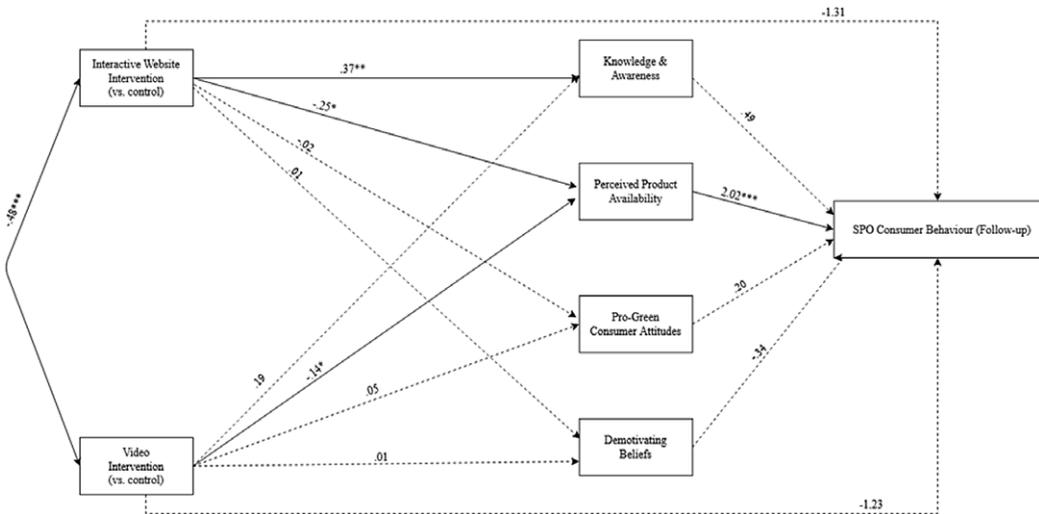


Figure 4. Model 2. COM-B as potential mediators of the relationship between the intervention groups and SPO consumer behaviour at follow-up ($n = 403$). The model indicates that the relationship between the website intervention and SPO consumer behaviour is mediated by perceived product availability. All reported path coefficients are unstandardised; * $p < .05$, ** $p < .01$, *** $p < .001$.

mediating variables, direct effects of both SPO website and video interventions on intentions remained statistically significant, indicating the effects were only partially mediated by the COM variables included in our study.

With respect to Model 2 (Figure 4), all the tested variables together accounted for 17% of variability in SPO consumer behaviour at follow-up, $F(6, 396) = 13.58, p < .001, R^2 = .17$. The SPO website intervention exerted a negative impact on consumer behaviour by decreasing perceived

product availability (indirect effect = -0.51 , $p < .001$, 95% CI $[-1.04, -0.05]$). A similar pattern was evident for the SPO video intervention (indirect effect = -0.28 , $p < .001$, 95% CI $[-1.04, -0.05]$). Therefore, while both the website and video interventions induced stronger SPO purchasing intentions by increasing knowledge/awareness, these interventions also weakened perceived product availability, a potentially important determinant of actual SPO consumer behaviour.

Overall, the results indicate partial support the hypothesis that the interactive SPO website intervention would address COM-B factors of knowledge/awareness, perceived product availability and pro-green consumer attitudes, that would in turn lead to increased SPO consumer behaviour. Instead, it was found that the interactive SPO website intervention did influence SPO purchasing intentions via increasing knowledge/awareness, but also reduced perceived product availability, the strongest predictor of actual purchasing behaviour.

Discussion

An interactive website intervention was designed to increase consumers' engagement in SPO purchasing behaviour by increasing their knowledge/awareness, perceived product availability and pro-green consumer attitudes. The results revealed that the SPO website intervention did significantly increase participants' knowledge/awareness about the palm oil issue, as well as SPO purchasing intentions. However, it did not have an impact on pro-green consumer attitudes and might have inadvertently reduced perceived product availability, which was a significant predictor of SPO consumer behaviour at follow-up. Further, the control group showed a trend towards engaging in more SPO consumer behaviour than both SPO intervention groups (website and video).

While increasing knowledge and awareness is an essential first step in the promotion of pro-environmental behaviour and green consumerism (Hines *et al.*, 1987; Hungerford & Volk, 1990; Joshi & Rahman, 2015), the present study supports previous findings that educational interventions alone are insufficient to promote consumer action, particularly in the face of external barriers surrounding opportunities and availability (Steg & Vlek, 2009). With respect to palm oil, there are several significant obstacles, including extensive research required on which products contain SPO prior to supermarket shopping, as well as obscure product labels making it difficult to identify SPO-containing products (Isenhour, 2014; Sundaraja, Hine, Alex, *et al.*, 2021). Education alone is unlikely to assist consumers in overcoming these barriers.

Next, pro-green consumer attitudes, addressed by utilising perspectives of endangered animals in the designed intervention, were not significantly increased by the interventions, nor did they significantly mediate the relationship between the interventions and outcome measures. Previous research on PEB and food consumption has indicated that interventions targeting motivation-related factors were less effective when compared to manipulating capability and opportunity-related factors (Hanss & Böhm, 2013; Hartmann-Boyce *et al.*, 2018; Pearson *et al.*, 2011; Vermeir & Verbeke, 2006).

Perceived product availability was targeted by specifically providing information on the alternative of SPO and then additionally making a shopping guide available, along with a list of brands one could purchase. However, palm oil (sustainable or otherwise) is often a hidden ingredient, frequently listed as 'vegetable oil', or by one of several technical terms (of which there are more than 200; Orangutan Foundation, 2019) that are unlikely to be recognised by most consumers. Additionally, the use of small letters on labels, an unfamiliar sustainability logo (Sundaraja, Hine, Alex, *et al.*, 2021) and manufacturers refraining from mentioning palm oil on the label due to negative public perceptions surrounding it (Bicknell, Slade, & Struebig, 2018; Hinkes & Christoph-Schulz, 2019) all reduce the perceived availability of SPO products.

Both the interactive website and promotional video, while increasing SPO purchasing intentions, did not produce significant behaviour change. The intention–behaviour gap in the context of green consumption has been previously studied (Barbarossa & Pastore, 2015, Carrington et al., 2010, 2014). In the present study, perceived product availability (opportunity in the COM-B model) was highlighted as a factor that was not necessary for SPO purchasing intentions, but was important in predicting actual SPO consumer behaviour. The control group appeared to trend towards greater perceived product availability and increased follow-up SPO consumer behaviour, which was surprising. As the issue of palm oil is complex (Isenhour, 2014; Wright et al., 2019), it is possible that by providing education on the multifaceted nature of this problem, and the lack of a perfect solution (highlighted in the interactive website group) might have highlighted the difficulties in making the right consumer decision. In their research, Lorenzoni, Nicholson-Cole, & Whitmarsh (2007) found that perceived information overload, and being provided with conflicting information could be barriers to pro-environmental action. It is possible that in the control group, completing the palm oil COM-B survey might have drawn participants' attention to the oil palm issue, but in the absence of detailed information, participants might not have perceived difficulty in finding these SPO products. However, although the SPO promotional video also did not highlight the complexity in finding an ideal solution, it still did not contribute to the desired behaviour change. Future research needs to explore whether simpler information from 'trustworthy' sources like academics or scientists (Lorenzoni et al., 2007), as versus a promotional video by a zoo, might better impact this pro-environmental behaviour.

It is hoped that these findings will strengthen the argument that the heavy responsibility of engaging in pro-environmental behaviour and thereby tackling larger issues like climate change are being placed almost exclusively on individuals or consumers (Moisander, 2007), which essentially ignores those factors that may be beyond a person's control (Isenhour, 2014; Rätzl & Uzzell, 2019). Interventions can potentially influence pro-environmental behaviour and green consumerism *if* they are able to address barriers related to capability and opportunity, which could require environmental restructuring and policy changes in order to be effective (Michie et al., 2011). It would appear that structural changes or strategies (Steg & Vlek, 2009) — for example, having a 'sustainable' aisle in the supermarket — are a necessary adjunct to educational interventions. Some informational strategies, like the development of a barcode-scanning mobile applications (<https://www.sustainabilityhackers.com/sustainable-food-apps/>) that detect the presence of palm oil (sustainable or otherwise), might also support consumers. Therefore, the current research adds to the literature advocating for additional government support and policy-level changes that would make this consumer behaviour easier — for example, having a national procurement policy in place that ensures the import of palm oil that is sustainable, and ensuring visible, legible and explicit product labels (Isenhour, 2014; Sundaraja et al., 2020), without which it may not be possible to influence global markets.

Implications

The current study is unique in that it is among the first to utilise the COM-B model in the field of green consumerism, to increase the sustainable purchasing of palm oil. Further, this research does not attempt to target motivation in isolation but situates it alongside capability (possessing relevant and accurate information) and opportunity (perceived availability of products). Therefore, it highlights the importance of having a thorough understanding of factors outside an individual's control that can serve as important barriers to the desired behaviour (Isenhour, 2010, 2014; Rätzl & Uzzell, 2019). It also suggests that providing consumers with a large amount of information may be counterproductive in promoting green consumption and other pro-environmental behaviour. Moreover, this research highlights the importance of considering structural

interventional strategies that target barriers around opportunity and lends empirical support to previous studies that have advocated for policy-level changes around procurement and labelling to increase the global demand for and purchasing of SPO (Isenhour, 2014; Sundaraja *et al.*, 2020).

Limitations

It is important to acknowledge that this intervention was conducted in June 2020, during the COVID-19 pandemic, which has drastically impacted grocery shopping behaviour (Grashuis, Skevas, & Segovia, 2020; Reiley, 2020). People were more likely to shop online (where reading labels can be harder), or if they were shopping in person, did so quickly and with haste to minimise exposure to crowded places (Reiley, 2020). Given these circumstances, it is possible that carefully checking labels and looking for SPO products was low on people's list of priorities. Further, there appears to be a dwindling of enthusiasm for sustainable products and a tendency to buy familiar brands when shopping online (Reiley, 2020). It would be interesting to conduct this study once again in a non-pandemic era and see if the results are any different, particularly with respect to perceived product availability and SPO-related consumer behaviour.

Finally, the two intervention conditions used in this study were not perfectly equivalent in terms of content (e.g., the social impact of oil palm farming nor the complexities in finding a solution were not covered in the video but were highlighted in the SPO website intervention), in addition to the primary difference of one requiring active participation (interactive website), while the other being more passive (video). However, it appears that these content differences were not critical as both these intervention conditions produced very similar results on the outcome measures.

Conclusions

In conclusion, this research tested an interactive website intervention aimed at increasing SPO consumer behaviour and concluded that while the intervention increased participants' knowledge about palm oil and boosted intentions to purchase SPO products, it had no impact on actual follow-up consumer behaviour. Perceived product availability (an opportunity-related factor) was lower in the SPO intervention groups and was an important predictor of the outcome behaviour. As such, these findings highlight the importance of opportunity-related factors in promoting green consumption. Addressing these factors would require environmental restructuring by policy-level changes that make the desired behaviour easier to perform. Future research could look at simulated experiments, where in addition to providing varying degrees of education, the environment could be restructured to test the importance of facilitating availability of sustainable products in contributing to behaviour change.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/aee.2022.27>

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