Attached to meat? (Un)Willingness and intentions to adopt a more plant-based diet.

9   **Abstract**

10   In response to calls to expand knowledge on consumer willingness to reduce

11   meat consumption and to adopt a more plant-based diet, this work advances the

12   construct of meat attachment and the Meat Attachment Questionnaire (MAQ). The

13   MAQ is a new measure referring to a positive bond towards meat consumption. It was

14   developed and validated through three sequential studies following from an in-depth

15   approach to consumer representations of meat. The construct and initial pool of items

16   were firstly developed drawing on qualitative data from 410 participants in a previous

17   work on consumers' valuation of meat. Afterwards, 1023 participants completed these

18   items and other measures, providing data to assess item selection, factor structure,

19   reliability, convergent and concurrent validity, and predictive ability. Finally, a sample

20   of 318 participants from a different cultural background completed the final version of

21   the MAQ along with other measures to assess measurement invariance, reliability and

22   predictive ability. Across samples, a four-factor solution (i.e., hedonism, affinity,

23   entitlement, and dependence) with 16 items and a second-order global dimension of

24   meat attachment fully met criteria for good model fit. The MAQ subscales and global

25   scale were associated with attitudes towards meat, subjective norm, human supremacy

26   beliefs, eating habits, and dietary identity. They also provided additional explanatory

27   variance above and beyond the core TPB variables (i.e. attitudes, subjective norm and

28   perceived behavioral control) in willingness and intentions concerning meat

29   substitution. Overall, the findings point towards the relevance of the MAQ for the study

30   of meat consumption and meat substitution, and lend support to the idea that holding a

31   pattern of attachment towards meat may hinder a shift towards a more plant-based diet.

32

33   *Keywords: Meat; Meat Attachment; Attitudes; Plant-based diets; Meat*

34   *substitution.*

35

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1 INTRODUCTION

For several millennia human beings have been drawing on meat as a means to satisfy nutritional needs, a practice that is believed to have shaped our evolutionary history (Leroy & Praet, 2015). Historically a scarce but cherished food, during the last century there was a massive and global shift towards an increased consumption of meat and animal-based products in general, and a decreased consumption of grain and plant-based foods (Chopra, Galbraith, & Darnton-Hill, 2002; Delgado, Rosegrant, Steinfeld, Ehui, & Curbois, 1999; Pokpin, 2011). Three main issues are identified as having played a key role in triggering this shift, namely economic growth, changes in the food industry, and urbanization (e.g., Delgado, 2003; Stabler, 2011). In many western countries meat has become a symbol of food itself, an item taken as granted to which most consumers feel they are naturally entitled to (Fiddes, 1991). However, meat's central place in the menu is being increasingly challenged on the grounds of environmental sustainability, health and safety concerns, and animal rights/welfare arguments (Pluhar, 2010; Ruby, 2012; Tilman & Clarke, 2014; Westhoek et al., 2014). For instance, animal based products tend to have higher impacts in terms of greenhouse gas (GHG) emissions, water footprint, biomass use and reactive nitrogen mobilization than most nutritionally equivalent plant-based foods (e.g., Ercin, Aldaya, & Hoekstra, 2012; González, Frostell, & Carlsson-Kanyama, 2011; Mekonnen & Hoekstra, 2012; Stehfest et al., 2009). Drawing on estimates of future production and consumption, scholars have voiced concerns that the impacts of the livestock sector alone may bring irreversible environmental changes regardless of any technological methods of addressing climate change (Raphaely & Marinova, 2014). A major transformation of

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61 agrifood systems has thus been called for to meet the regulatory capacity of the earth,

62 along with a global transition towards a more plant-based diet (i.e., diets which have the

63 bulk of calories from plant sources while limiting or avoiding animal sources) (e.g.,

64 Kahiluoto, Kuisma, Kuokkanen, Mikkilä, & Linnanen, 2014; Stehfest et al., 2009). Such

65 transition can also contribute to improve health due to decreased exposure to health-

66 hazardous components (e.g., excessive ingestion of saturated fat and cholesterol) and

67 increased exposure to protective items (e.g., higher amounts of fibre, folate,

68 antioxidants, carotenoids and phytochemicals) (e.g., Sabaté, 2003; Scarborough,

69 Allender, & Clarke, 2012). Likewise, decreasing consumer demand for meat might also

70 allow for minimizing harm, suffering and death to sentient animals used in the livestock

71 industry (e.g., Foer, 2010; Singer & Mason, 2007).

72   Earlier relevant research on the topic of meat eating has applied the Theory of

73 Planned Behavior (TPB; Ajzen, 1991) to understand consumer behavior. This

74 theoretical model highlights the role of intentions as proximal determinants of food

75 choice, which in turn are affected by attitudes (i.e. an overall evaluation of the

76 behavior), subjective norm (i.e. beliefs about whether others think you should or should

77 not perform the behavior), and perceived behavioral control (i.e. the extent to which the

78 behavior is perceived as controllable). Intentions to eat meat have indeed been shown to

79 predict actual consumption (Berndsen & van der Pligt, 2005; Saba & Di Natale, 1998),

80 and all three TPB variables were observed to successfully predict intentions to eat meat,

81 although subjective norm emerged as the weakest predictor (Povey, Wellens, & Conner,

82 2001). Habit was also found to play an important role in the context of food choice,

83 including meat consumption, increasing the power of the TPB model to predict actual

84 consumption (Saba & Di Natale, 1998).

85   More recently, drawing from concerns surrounding current and projected meat

86   production and consumption patterns, there have been calls to expand knowledge on

87   consumer willingness to reduce meat consumption and to adopt a more plant-based diet

88   (e.g., Dagevos & Voordow, 2013; Stehfest et al., 2009). Evidence on this matter

89   indicates that while plant-based diets and alternatives to meat are increasingly

90   associated with several benefits, a high consumption of meat, a low regard for meat

91   substitutes, and a lack of willingness to adopt a more plant-based diet are still the

92   dominant cultural pattern in most western societies (e.g., Latvala et al., 2012; Lea,

93   Crawford, & Worsley, 2006a, 2006b; Schösler, de Boer, & Boersema, 2012; Schösler,

94   de Boer, Boersema, & Aiking, 2015). Recent findings exploring the ideological

95   underpinnings of meat consumption suggest that human-animal dominance ideologies

96   may play a role in hindering consumer behavior and willingness to change habits

97   (Dhont & Hodson, 2014), and many studies consistently show that men tend to be

98   particularly more reluctant than women to endorse meat avoidance and reduced meat

99   consumption (e.g., Kubberød, Ueland, Rødbotten, Westad, & Risvik, 2002; Prättälä et

100   al., 2007; Rothgerber, 2013; Ruby & Heine, 2011; Schösler et al., 2015).

101   Importantly, it has also been argued that meat's special status as a food item is

102   not to be neglected in this regard, as it seems to be invested with a socially constructed

103   meaning that goes beyond its biological role and nutritional properties (e.g., Fiddes,

104   1991; Holm & Møhl, 2000; Schösler et al., 2012; Twigg, 1984). In line with this

105   argument, recent findings have reinforced the idea that some consumers have an

106   affective connection towards meat that may play a role in their willingness to change

107   consumption habits (Graça, Oliveira, & Calheiros, 2015). More specifically, it has been

108   suggested that affective connection towards meat may be a continuum in which one end

109   refers to disgust (i.e., negative affect and repulsion, related with moral internalization),

while the other shows a pattern of attachment (i.e., high positive affect and dependence

towards meat, and feelings of sadness and deprivation when considering abstaining

from meat consumption) that may hinder a change in consumption habits (Graça et al.,

2015). This pattern mirrors the main characteristic of the general concept of attachment,

which is the presence of a positive bond and desire to maintain closeness to the object

of attachment (Hidalgo & Hernández, 2001).

The existence of an affective connection towards meat is well established

concerning a pattern of disgust (Rozin, Markwith, & Stroess, 1997), as is the relevance

of negative affective reactions towards meat (e.g. feeling guilty about meat

consumption) in variables such as attitudes, ambivalence, intentions, and reported meat

consumption (Berndsen & van der Pligt, 2004, 2005). It is also well known that in

addition to meeting basic needs for energy and nutrition, food choices and preferences

are often anchored in values, meanings and shared conventions that go beyond the

biological function they ensure (Beardsworth & Keil, 2002). However, the role meat

plays beyond nutrition has only recently started to receive attention, and the merit of

meat attachment as a construct and measure to help increasing knowledge on the

psychology of meat consumption and meat substitution is yet to be determined.

In response to calls to expand knowledge on consumer willingness to reduce

meat consumption and to adopt a more plant-based diet, this work advances the

construct of meat attachment by describing the validation of the Meat Attachment

Questionnaire (MAQ). Developed following an in-depth approach to consumer

representations of meat, the MAQ is a new instrument measuring a positive bond

towards meat consumption. Such measure may be useful for research advancing on the

theoretical understanding of consumer willingness to adopt a more plant-based diet, but

ultimately also as a tool for the assessment, design and evaluation of tailored initiatives

135 encouraging meat substitution. This work aims to: (1) propose a tentative structure for

136 the MAQ, (2) test the resulting structure in samples from different settings, (3) observe

137 evidence for the validation of the questionnaire, and (4) explore the relevance of the

138 MAQ for the study of meat consumption and meat substitution.

139

140 *1.1 Overview of the MAQ Development and Validation*

141 The MAQ was developed and validated through three sequential studies. In this

142 process we followed a mixed approach that combined a social constructionist

143 framework in generating data-driven propositions (i.e. the construct of meat attachment

144 framed in consumers' representations of meat), with a more positivistic framework

145 addressing researcher-defined variables (i.e. operationalizing the construct and testing

146 hypotheses about the validity and reliability of the questionnaire). Specifically, the

147 construct and initial pool of items were firstly developed drawing on qualitative data

148 from 410 participants in a previous work on consumers' valuation of meat (Graça et al.,

149 2015). Afterwards, in study one of the present work, 1023 participants answered these

150 items and other measures. These data provided information on item selection, factor

151 structure (principal axis factoring and confirmatory factor analysis), reliability

152 (Cronbach's alpha), and several types of validity: convergent (associations with

153 attitudes towards meat, subjective norm, gender, and human supremacy beliefs),

154 concurrent (associations with eating habits and dietary identity), and predictive ability

155 (additional explanatory variance above and beyond the effects of attitudes towards meat

156 and current consumption habits in willingness to reduce meat consumption and to

157 follow a plant-based diet). In study two, a new sample of 318 participants from a

158 different cultural background completed the final version of the MAQ along with other

159 measures. These data allowed for replicating and strengthening evidence concerning the

160 MAQ's measurement invariance (confirmatory factor analysis), reliability (Cronbach's

161 alpha), and predictive ability (additional explanatory variance above and beyond the

162 effects of TPB variables in willingness and intentions towards meat substitution).

163

164 2 STUDY ONE

165 *2.1 Methods*

166 2.1.1 Participants and procedure

167   This study was conducted through an internet platform and advertised on social

168 media. The survey was hosted online by Qualtrics.com and advertised through

169 Facebook ads to Portuguese users. A short recruitment notice presented the study as

170 "exploring people's opinions on several issues related with society and different social

171 practices, lifestyles and eating habits". Participants were rewarded with the option of

172 registering in a draw to win a 7.9" 16 GB tablet. To minimize self-selection biases, no

173 references were made in the advertisement and cover page to the specific goals of the

174 study. After data collection participants were thanked and debriefed.

175   The survey was accessible in Portuguese for nearly four months between July 3rd

176 and November 5th 2014. During this period, 1278 people clicked on the cover page to

177 participate in the study, and 1023 (aged between 18 and 69 years, M = 26.5, SD = 9.7;

178 57.8% women) completed all the measures. For the purposes of this study, participants

179 were randomly split in two samples (Table 1). Sample 1 consisted of 558 participants

180 and was used for the exploratory factor analysis. Sample 2 consisted of 516 participants

181 and was used for the confirmatory factor analysis and gathering of further evidence

182 concerning the validity of the questionnaire. Almost all respondents reported eating

183 meat at least once in a regular week (93.2%). The observed bias in terms of age (i.e.

184 skewed towards younger participants) was in line with a trend found in previous online

185 studies, and might be consequence of having chosen an online recruitment platform

186 and/or providing a tablet in a draw as the incentive for participation (e.g., Geeroms,

187 Verbeke, & Van Kenhove, 2008). Completion rate was quite high (i.e. around 80%) and

188 there was no observable particular stage in which participants dropped out after

189 beginning to fill the survey.

190

191   [INSERT TABLE 1]

192

193 2.1.2 Development of initial item pool

194   To ensure a mixed approach combining a social constructionist and a positivist

195 framework in generating items relevant to the study of meat attachment, several steps

196 were made. First, we drew on data from a previous study in which participants provided

197 responses on their representations of meat (Graça et al., 2015). These were retrieved by

198 means of two word association tasks ("Meat makes me think, feel or imagine…"; "If I

199 was forced to stop eating meat I would feel…"). Data retrieved in these tasks were

200 sequentially cleared, converged, and subjected to Multiple Correspondence Analysis

201 (MCA) along with other variables to detect and represent underlying structures in the

202 dataset (for details see Graça et al., 2015). Afterwards, several sentences were drafted

203 using three criteria: the propositions advanced in the study concerning a pattern of meat

204 attachment; the salience and semantic significance of the resulting categories taken

205 together; and the interpretation of the topological configuration observed in the MCA.

206 To favor parsimony, we then followed an iterative process in which blatant

207 redundancies were identified and reduced (although not entirely eliminated) by

208 combining/deleting draft sentences, which resulted in an initial pool of 20 items (Table

209 2) to be subjected to initial exploratory analyses.

210

212

213   2.1.3 Measurement

214   *Meat Attachment Questionnaire*. The initial item pool included 20 questions

215   addressing a positive bond towards meat consumption (e.g., "If I was forced to stop

216   eating meat I would feel sad"). Participants indicated the extent in which they agreed or

217   disagreed with each statement on a 5-point Likert-type scale ranging from 1 (strongly

218   disagree) to 5 (strongly agree).

219

220   *Attitudes*. Five semantic differential scales with 5-point each measured

221   respondents' attitudes towards meat (Berndsen & van der Pligt, 2004). The five items

222   were "bad–good", "unpleasant–pleasant", "against–for", "unfavorable–favorable",

223   "negative–positive". In this sample internal consistency was high ($\alpha = .93$).

224

225   *Subjective Norm*. Subjective norm was assessed by two items (Berndsen & van

226   der Pligt, 2004). The first item referred to perceived social pressure ("People who are

227   important for me think that I should eat meat"), and the second measured motivation to

228   comply ('How much do you want to do what these important people think you

229   should?") ($r = .38$). Both were measured using a 5-point scale, and subjective norm was

230   computed by multiplying both scores.

231

232   *Human supremacy*. Beliefs about human supremacy as a dominance ideology

233   relevant to meat consumption and substitution were measured with a six-item scale

234   (e.g., "Animals are inferior to humans") taken from Dhont & Hodson (2014). In this

235   sample internal consistency was high (α = .87).

236

237   *Eating habits*. Participant's usual consumption of meat was measured with a

238   single item borrowed from (Hoek et al. 2011) using the following answering categories

239   for the frequency of meat consumption in a regular week: never, less than once per

240   week, once or twice per week, three or four times per week, five times or more per

241   week.

242

243   *Dietary Identity*. Participants were asked to indicate the extent in which they

244   personally identified themselves as: (a) meat eater, (b) omnivore, (c) vegetarian, and (d)

245   vegan, using a scale ranging from 1 (not at all) to 5 (very much) for each item.

246

247   *Willingness to follow a more plant-based diet*. Participants were presented a

248   short passage on meat ("In recent times, meat consumption is being increasingly

249   debated on the grounds of environmental sustainability, health and safety concerns, and

250   animal rights/welfare arguments") and reported their willingness to reduce meat

251   consumption and to follow a plant-based diet with a single item each ("Please indicate

252   your willingness to: (1) reduce meat consumption, (2) follow a plant-based diet"), using

253   a Likert-type scale ranging from 1 (not willing at all) to 5 (very willing).

254

255   2.1.4 Data Analysis

256   Prior to the analysis the sample was randomly split in two. Following this split,

257   two phases of analyses were conducted (DeVellis, 1991). First, Exploratory Factor

258   Analysis (EFA) was conducted with one group (Sample 1, N = 558) on the original set

259   of 20 items, using IBM SPSS Statistics for Windows (IBM Corp. Released, 2010). We

260   used principal axis factoring as the estimation method for its usefulness in identifying

261   underlying dimensions and advantage of accounting for measurement error in the

262   solution (Gorsuch, 1983). An oblique rotation (oblimin) was performed to allow for the

263   derived factors to be intercorrelated, as would be expected (Abdi, 2003). In determining

264   the model (i.e. number of factors) that provided the best solution, we used parallel

265   analysis to compare obtained eigenvalues with those generated from random data sets,

266   and provide a ceiling for the number of factors to consider (Horn, 1965; O'Connor,

267   2000). The scree test, variance, interpretability and item loadings were also accounted

268   for (DeVellis, 1991). In determining item selection, an iterative process was used

269   combining several criteria: first, eliminating items with a factor loading <.40;

270   afterwards, dropping items with <.50 and cross-loadings >.25 until we reached a

271   solution in which all items retained had a factor loading >.5 and no significant cross-

272   loadings (Bryman & Cramer, 2011; Matsunaga, 2010). Reliability was estimated using

273   the Cronbach's Alpha.

274   In the second phase, using the other group of participants (Sample 2; N=574) to

275   provide evidence for the initial validation of the questionnaire, we assessed indicators

276   for internal structure, construct validity, predictive ability, and reliability. Specifically,

277   for internal structure we tested the solution obtained in the EFA (Sample 1) using a

278   Confirmatory Factor Analysis (CFA) with maximum likelihood method in AMOS 20

279   (Arbuckle, 2011). The analysis of the model fit from the CFA considered a range of

280   criteria based on different measures. The ratio x^2/df was used to evaluate the

281   appropriateness of the model (with good to acceptable values referring to ≤5), since the

282   model chi-square test is sensitive to sample size (Schermelleh-Engel, Moosbrugger, &

283   Muller, 2003). Comparative fit index (CFI), Tucker Lewis index (TLI) and root-mean-

284   square error of approximation (RMSEA) were also used as model fit indices. Criteria

285   for good to acceptable model fit were CFI $\geq$ .90, TLI $\geq$ .90, and RMSEA $\leq$ .08, with

286   higher values in CFI and TLI and lower in RMSEA referring to better-quality fit indices

287   (Hu & Bentler, 1999; Marsh, Hau, & Wen, 2004; Vandenberg & Lance, 2000).

288   Concerning construct validity, we assessed the relationship between the derived

289   subscales and the extent in which they related to external measures and indicators

290   relevant to the study of meat consumption and meat substitution (i.e. associations with

291   attitudes towards meat, subjective norm, gender, and human supremacy beliefs were to

292   be taken as indicative of convergent validity; associations with eating habits and dietary

293   identity were to be taken as indicative of concurrent validity). Regarding predictive

294   ability, we explored whether the MAQ provided additional explanatory variance above

295   and beyond the effects of attitudes towards meat and current consumption habits in

296   willingness to reduce meat consumption and to follow a plant-based diet. Finally, to test

297   reliability we used the Cronbach's alpha.

298

299   *2.2 Results*

300   2.2.1 Sample 1: Exploratory Factor Analysis and Reliability

301   An initial assessment to verify the adequacy of the data for exploratory factor

302   analysis was performed for the set of 20 items. The percentage of missing data was

303   0.4% and cases were deleted listwise. Absolute values of skewness ranged from to -1.43

304   to .380, showing no problems of severe departure from a normal distribution. The

305   Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy yielded a value of .95 and

306   Bartlett's test of sphericity was highly significant: $x^2(190) = 6990.25$, p < .001.

307   Parallel analysis revealed that four factors had eigenvalues greater than chance

308   (using a 95% confidence interval). Scree test, variance accounted for, interpretability

309 and item loadings also pointed towards a break at four factors. We thus initially

310 considered a solution of four factors explaining 68% of the variance for the 20 items.

311 During the process of determining item selection, four items were dropped based on low

312 factor loadings and high cross-loadings. Analyses confirmed the four-factor solution for

313 the 16 items with 72.3% of the variance accounted for (see Table 3). The labels given to

314 the four factors were Hedonism (four items; higher scores referring to meat represented

315 as a source of pleasure; e.g., "A good steak is without comparison"), Affinity (four

316 items; higher scores indicative of affinity towards meat consumption, measured in

317 opposition to feelings of repulsion; "I feel bad when I think of eating meat", reversed

318 score), Entitlement (three items; higher scores referring to feelings of entitlement

319 towards meat consumption; "To eat meat is an unquestionable right of every person"),

320 and Dependence (five items; higher scores indicating feelings of dependence on meat;

321 e.g., "If I was forced to stop eating meat I would feel sad"). Cronbach's Alpha

322 suggested good consistency levels in these three-to-five item tentative subscales, which

323 were subject to further validation in the second phase of analysis.

324

325   [INSERT TABLE 3]

326

327 2.2.2 Sample 2: Confirmatory Factor Analysis and further evidence for initial validation

328 *Confirmatory Factor Analysis*

329   An assessment to verify the adequacy of the data for confirmatory factor

330 analysis was performed for the set of 16 items in the holdout sample, again showing no

331 problems of severe departure from a normal distribution (i.e. absolute values of

332 skewness ranged from to -1.14 to .191). The percentage of missing data was 0.4% and

333 cases were deleted listwise. Confirmatory factor analysis was then conducted testing the

334   four factor solution obtained in the EFA, with a second order global dimension of meat

335   attachment (Figure 1). The model fully met criteria for good fit ($x^2/df = 2.7$; TLI = .96;

336   CFI = .97; RMSEA = .05 [.05, .06]). In subsequent analysis we thus gathered further

337   evidence for the initial validation of the MAQ using the four subscales and also the

338   global measure of meat attachment. All subscales showed moderate to strong

339   correlations with each other and strong correlations with the global scale (Table 4).

340

341   [INSERT FIGURE 1]

342

343   *Reliability*

344   Reliability analyses for the MAQ global and subscales showed strong values of

345   internal consistency (Table 4). The MAQ global scale had a Cronbach alpha of .92 and

346   the subscales showed values ranging from .77 to .90.

347

348   *Convergent and Concurrent Validity*

349   We expected that scores on all the measures from the MAQ would: (1) show

350   positive correlations with a measure of attitudes towards meat, subjective norm

351   concerning meat consumption, meat eating habits and human supremacy beliefs; (2)

352   show an association with dietary identity (i.e., positive correlations with self-

353   identification as omnivore and as meat consumer, and negative correlations with self-

354   identification as vegetarian and as vegan); and (3) yield significantly higher scores for

355   men than for women. As predicted, all measures from the MAQ showed moderate to

356   strong positive correlations with attitudes towards meat, and positive associations with

357   subjective norm concerning meat consumption and human supremacy beliefs (Table 5).

358   They also showed positive correlations with eating habits and yielded the anticipated

359　pattern of associations with dietary identity, showing moderate to strong relationships

360　with persons identifying as meat consumers, weaker but still positive associations as

361　omnivores, and negative correlations with self-identification scores as vegetarian and as

362　vegan (Table 5). Concerning gender differences, one-way ANOVAs revealed that men

363　tended to score systematically higher than women on all four subscales and global scale

364　(Table 6).

365

366　　　　　　　　　　　　　[INSERT TABLES 4, 5 & 6]

367

368　*Predictive Ability*

369　　　　　Concerning predictive ability, we explored whether the MAQ provides

370　additional explanatory variance above and beyond the effects of attitudes towards meat

371　and current habits in willingness to change meat consumption and to follow a plant-

372　based diet. Five hierarchical regressions were performed to examine the predictive

373　ability of the MAC global scale and subscales' scores using willingness to reduce meat

374　consumption as the criterion variable. Five additional hierarchical regressions were

375　performed with willingness to follow a plant-based diet as the criterion variable. For

376　each separate regression analysis, in Step 1 we entered the related study variables (i.e.

377　attitudes towards meat and current habits), and in Step 2 the MAQ global or subscale

378　scores. Incremental variances of MAQ global and subscale scores in predicting

379　willingness to reduce meat consumption above and beyond related variables were all

380　significant (Table 7), ranging from 3% (MAQ Hedonism) to 14% (MAQ Global Scale).

381　The same trend was observed concerning willingness to follow a plant-based diet (Table

382　7), with all the MAQ measures adding 3% (MAQ Hedonism) to 11% (MAQ Global

383　Scale) in the amount of variance explained. All the regression models were checked for

384　indications of multicollinearity by examining the variance inflation factor (VIF) and

385 tolerance values (VIF values > 10 and tolerance < .10 are typically considered

386 problematic; Cohen, Cohen, West, & Aiken, 2003). No violations of limits were found

387 (VIF range: 1.15–2.52; tolerance between .40 and .87).

388

389 [INSERT TABLE 7]

390

391 *2.3 Conclusion*

392   A four-factor solution with 16 items for the MAQ scale was obtained and

393 evaluated in study one: hedonism, affinity, entitlement, and dependence. Results

394 suggested that a four factor model with a second-order global dimension of the

395 construct of meat attachment fully met criteria for good model fit. Reliability analyses

396 for the MAQ global and subscales showed strong values of internal consistency. All

397 predictions concerning the assessment of convergent and concurrent validity found

398 support. Results for predictive ability suggested that meat attachment is a different

399 construct from previous related measures and adds explanatory capacity in

400 understanding consumer willingness to reduce meat consumption and adopt a more

401 plant-based diet.

402

403 3 STUDY TWO

404 *3.1 Methods*

405 3.1.1 Participants and procedure

406   Participants for the second study were recruited through Amazon Mechanical

407 Turk (MTurk-http://www.mturk.com/mturk/), a crowdsourcing internet marketplace

408 where requesters post task opportunities and workers choose which tasks to do for a

409 monetary payment set by the requester. To strengthen evidence for the validation of the

410   MAQ, MTurk was chosen in light of evidence that participants tend to be more

411   demographically diverse than standard internet samples, realistic compensation rates do

412   not affect data quality, and the data obtained are at least as reliable as those obtained via

413   traditional methods (Buhrmester, Kwang, & Gosling, 2011). A short recruitment notice

414   was advertised to U.S. based participants and presented the study as exploring "people's

415   opinions about food and different eating habits", along with a link to the Qualtrics

416   website hosting the survey. Participants were paid $.75 for their participation. Before

417   beginning the survey, participants were informed about the study's procedures and

418   anonymity was ensured. The survey was accessible in English in March 2nd 2015. Three

419   hundred and eighteen persons (aged between 18 and 72 years, M = 36.3, SD = 11.2)

420   participated in the study. One hundred and eighty five were male (58,2%) and 133 were

421   female (41,8%). Most participants had completed higher education (204; 64,4%),

422   followed by secondary (89; 28,1%) and primary (24; 7.6%). As regards their

423   employment status, around two thirds were employed (227; 71,4%), 37 were

424   unemployed (11,6%), 23 were students (7,2%) and 31 were retired or held a different

425   status (9,1%).

426

427   3.1.2 Measurement

428   *Meat Attachment Questionnaire, Attitudes and Subjective Norm.* The same

429   instruments as in study one were used to measure meat attachment (final version

430   comprising of 16 items), attitudes (Berndsen & van der Pligt, 2004; α = .97 in the

431   current sample) and subjective norm (Berndsen & van der Pligt, 2004; r = .38 in the

432   current sample).

433

434   *Perceived Behavioral Control.* A measure of Perceived Behavioral Control

435   (PBC) concerning changing meat consumption was built based on theory of planned

436   behavior questionnaire development guidelines (Francis et al., 2004). The measure

437   consisted of three items ("Concerning meat consumption: I am confident that I could

438   change my habits if I wanted to; Whether I change my habits or not is entirely up to me;

439   Changing my habits or not is something that is under my control") with a 5-point

440   Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Internal

441   consistency was adequate ($\alpha = .69$).

442

443   *Willingness and intentions towards meat substitution.* Participants were

444   presented a short passage on meat ("In recent times, meat consumption is being

445   increasingly debated on the grounds of environmental sustainability, health and safety

446   concerns, and animal rights/welfare arguments") and reported their willingness ("Please

447   tell us about your willingness to…") and intentions ("Specifically, in the next six

448   months, do you intent to…") to (i) reduce meat consumption, (ii) avoid eating meat, and

449   (iii) follow a plant-based diet, using a 5-point Likert-type scale (ranging from 1 – Very

450   unwilling to 5 – Very willing and 1 – Surely not to 5 – Surely yes, respectively).

451   Responses were averaged to form a general measure of willingness ($\alpha = .91$) and

452   intentions ($\alpha = .90$) concerning meat substitution.

453

454   3.1.3 Data Analysis

455   A replication of the MAQ's structure and extension of its predictive ability were

456   assessed with a different sample to provide further support for its validity and relevance

457   in the study of meat consumption and substitution. While new variables were included

458   (i.e. PBC and two composites of focal behaviors) to extend findings from study one and

459   others were excluded (e.g., dietary identity) to keep the survey short, the analytical

460   procedures and criteria for model fit were the same as in study one.

461

462   *3.2 Results*

463   *Internal Structure*

464   An initial assessment to verify the adequacy of the data for confirmatory factor

465   analysis was performed for the 16 items. No missing data was observed. Absolute

466   values of skewness ranged from to -1.6 to .34. Confirmatory factor analysis was then

467   conducted testing the model consisting of a four-factor structure with a second-order

468   dimension of the construct of meat attachment (Figure 2). The model fully met criteria

469   for good fit (x^2/df = 2.3; TLI = .97; CFI = .97; RMSEA = .06 [.05, .08]). All subscales

470   showed moderate to strong correlations with each other and strong correlations with the

471   global scale (Table 8).

472

473   [INSERT TABLE 8]

474   [INSERT FIGURE 2]

475

476   *Predictive Ability*

477   Concerning predictive ability, we explored whether the MAQ provided

478   additional explanatory variance above and beyond the effects of the core TPB variables

479   in willingness and intentions concerning meat substitution. Five hierarchical regressions

480   were performed to examine the predictive ability of the MAC global scale and

481   subscales' scores using willingness as the criterion variable. Five additional hierarchical

482   regressions were performed with intentions as the criterion variable. For each separate

483   regression analysis, in Step 1 we entered the TPB variables (i.e. attitudes, subjective

484   norm, perceived behavioral control), and in Step 2 the MAQ global or subscale scores.

485   Incremental variances of MAQ global and subscale scores in predicting willingness

486   concerning meat substitution were all significant (Table 9), ranging from 3% (MAQ

487   Hedonism) to 15% (MAQ Global Scale).The same trend was observed concerning

488   intentions (Table 9), with all the MAQ measures adding 2% (MAQ Entitlement) to 8%

489   (MAQ Global Scale) in the amount of variance explained. No problems of

490   multicollinearity were detected in these analyses (VIF range: 1.04–3.84; tolerance

491   between 0.26 and .96).

492

493   [INSERT TABLE 9]

494

495   *3.3 Conclusion*

496   Evidence gathered in study one concerning the structure and predictive ability of

497   the questionnaire were replicated and extended using a sample from a different setting

498   in study two. As in the first study, a four-factor solution with a global second-order

499   dimension of meat attachment fully met criteria for good model fit, providing evidence

500   for measurement invariance. Likewise, reliability analyses showed strong values of

501   internal consistency. Results for predictive ability reinforced the evidence that meat

502   attachment is a different construct from previous measures relevant to the study of meat

503   consumption and adds explanatory capacity to understand consumer willingness and

504   intentions towards meat substitution.

505

506   3 GENERAL DISCUSSION

507   In response to calls to expand knowledge on consumer willingness to reduce

508   meat consumption and to adopt a more plant-based diet (e.g., Dagevos & Voordow,

509   2013; Stehfest et al., 2009), this work advances the construct of meat attachment by

510   describing the validation of the Meat Attachment Questionnaire (MAQ). Overall, our

511   findings indicate that a four-dimensional model of meat attachment comprising of

512   hedonism, affinity, entitlement, and dependence, along with a global score of meat

513   attachment, is a valid and reliable measure of consumers' positive bond towards meat

514   consumption. This measure may help advancing in the psychology of meat consumption

515   and substitution in three different ways: building theory, improving methodology, and

516   informing practice and policy.

517

518   3.1. Building Theory

519   Concerning theory development, the topic of meat consumption and substitution

520   is still rich in abstract and intangible notions that are often viewed as if requiring no

521   additional understanding and explanation, such as the general representation of meat as

522   a cherished and dominant food among the majority of consumers in most western

523   societies (Fiddes, 1991; Holm & Møhl, 2000; Latvala et al., 2012; Schösler et al., 2012;

524   Twigg, 1984). As put forward by Fiddes (1991), moving beyond these abstract notions,

525   it is the core of these appraisals that must be investigated: the issue is not why we eat

526   meat at all, but rather why we do so consistently and in such quantities, and often with

527   such ceremony and strong emotional responses. Specifying and refining the construct of

528   meat attachment, which can be broadly defined as a positive bond towards meat

529   consumption, offers a helpful advance in this regard. In the current work, exploratory

530   and confirmatory factor analysis revealed four dimensions within the construct, namely

531   hedonism (i.e. higher scores referring to meat represented as a source of pleasure),

532   affinity (i.e. higher scores indicative of affinity towards meat consumption), entitlement

533   (i.e. higher scores referring to feelings of entitlement towards meat consumption) and

534   dependence (i.e. higher scores indicating feelings of dependence on meat consumption).

535   All dimensions were interrelated with each other and strongly correlated with a global

536   measure of meat attachment. Thus, as with the general concept of attachment, which is

537   portrayed as multifaceted in shaping the bond between individuals and the object of

538   attachment (e.g., Hidalgo & Hernández, 2001; Scannell & Gifford, 2010), meat

539   attachment seems to comprise an interplay of cognitive and affective elements acting

540   together to shape consumer's positive bond with meat consumption. Across samples, a

541   four-factor model with 16 items and a second-order global dimension of meat

542   attachment fully met criteria for good model fit. Analysis for convergent and concurrent

543   validity showed that the MAQ yielded the anticipated pattern of associations to other

544   constructs and variables previously shown to be relevant to the study of meat

545   consumption and meat substitution, such as attitudes towards meat (e.g., Saba & Di

546   Natale, 1999), subjective norm (e.g., Povey et al., 2001), gender (e.g., Prättälä et al.,

547   2007), human supremacy belief as a dominance ideology in the field of animal-human

548   relations (Dhont & Hodson, 2014), eating habits (e.g., Berndsen & van der Pligt, 2004),

549   and dietary identity (Fox & Ward, 2008). Specifically, associations with attitudes

550   towards meat, subjective norm, gender, and human supremacy beliefs were taken as

551   indicative of convergent validity. In turn, associations with eating habits and dietary

552   identity were taken as indicative of concurrent validity. Regarding predictive ability, in

553   study one the MAQ provided additional explanatory variance above and beyond the

554   effects of attitudes towards meat and current consumption habits in willingness to

555   reduce meat consumption and to follow a plant-based diet, while showing no problems

556   of multicollinearity. In study two these results were replicated and extended in a sample

557   from a different cultural background, providing additional explanatory variance above

558   and beyond the core TPB variables (i.e. attitudes, subjective norm and perceived

behavioral control; Ajzen, 1991) in willingness and intentions towards meat

substitution. Taken as a whole, these findings suggest that meat attachment is a

separate, self-standing and relevant psychological construct in what respects meat

consumption and meat substitution. They also lend support to the idea that holding a

pattern of attachment towards meat consumption may hinder personal willingness and

intentions to adopt a more plant-based diet (Graça et al., 2015).

3.2. Improving Methodology

As for improving methodology, the design and test of new measures addressing

consumer valuation of meat provide the necessary tools for researchers to meet the

pressing demand to understand consumer willingness to shift towards a more plant-

based diet. In tandem with developing and testing theory, operationalizing and making

constructs measurable is necessary to observe associations, establish causalities and test

propositions. In other words, given the still young but increasing scholarly attention to

meat reduction and substitution, more instruments are needed for research in this topic

to keep advancing. For example, studies exploring acceptance of meat substitutes in a

meal context (e.g. Hoek et al., 2011; Elzerman, Hoek, van Boekel, & Luning, 2011)

may benefit from measures to control for individual differences in consumer valuation

of meat, and explore different solutions for different segments of consumers. Such

measures may also assist for instance in studies exploring consumer acceptance of lab-

grown meat (e.g. Laestadius & Caldwell, 2015; Verbeke, Sans, & Van Loo, 2015;

Werbeke et al., 2015). Methodologically, given its psychometric properties, favorable

initial evidence concerning its validity, parsimony, and versatility (i.e. can be used to

assess each dimension in separate or as a global measure of meat attachment), the MAQ

is a candidate to be used in such research.

584

3.3. Informing Practice and Policy

As for informing practice and policy, in the longer term, familiarization with the construct of meat attachment, the dimensions that comprise it and learning how it relates with willingness and intentions concerning meat substitution, may empower practitioners and policy makers to design, deliver and evaluate tailored interventions and initiatives facilitating a shift towards a more plant-based diet. For instance, providing targeted information and campaigns for reducing meat consumption, particularly in high-risk groups or populations vulnerable to misinformation, is advanced as a policy suggestion to encourage people to eat less meat and more plant-based protein sources (Raphaely & Marinova, 2014). On this note, it has been proposed that consumers already with lower levels of meat attachment are more open to information on the impacts of meat and the benefits of changing habits, whereas for consumers more attached to meat, some initiatives to encourage reducing meat-eating may actually trigger defense or loss-aversion mechanisms, thus increasing entrenchment in meat-eating justifications (Graça et al., 2015; Rothgerber, 2014). It can even be expected that consumers higher in meat attachment will be especially prone to rationalize meat consumption, which in turn is shown to be associated with commitment to eat meat (Piazza et al., 2015). While these hypotheses will require experimental testing in the near future, there are indeed concerns that campaigns seeking to encourage reduced meat consumption may be at risk of being accused of questioning consumers individual right to consume what they want, which is arguably reinforced by the cultural significance of meat consumption in the West (e.g., Doyle, 2011; Laestadius et al., 2014; de Boer, Schösler, & Boersema, 2013). Looking forward, empowering practitioners and policy makers on the issue of meat attachment may allow for

609   expanding knowledge on how to work with these dimensions (i.e. hedonism, affinity,

610   entitlement, and dependence on meat) at the individual and societal levels (e.g., which

611   tools to provide; what contents to deliver, and to who; how to frame communication), to

612   encourage willingness and intentions to change habits. While more research is still

613   needed before this is feasible, it may be a promising path to pursue, integrating evidence

614   also on other drivers and barriers either already found (e.g., Pohjolainen, Vinnari, &

615   Jokinen, 2015; Zur & Klöckner, 2014) or yet to be discovered. Of course, encouraging

616   consumers to choose to eat less meat is just the 'tip of the iceberg' (Spurling,

617   McMeekin, Shove, Southerton, & Welch, 2013). To elicit and support personal

618   willingness and intentions to adopt a more plant-based diet, solid endeavors are likely to

619   have to bypass meat attachment and other barriers at the individual level, but probably

620   also ensure that plant-based meals are embedded and easily available in the surrounding

621   environments' routines, conventions, resources and institutions (Spurling et al., 2013;

622   Vinnari & Vinnari, 2014).

623

624   3.4. Limitations and Other Future Directions

625   In spite of the possibilities advanced, the present work is not without limitations.

626   One concern was that the sample in study one was slightly biased in terms of age (i.e.

627   skewed towards younger participants). Given the large sample size, older participants

628   were nonetheless represented by fairly high absolute numbers. In addition, evidence

629   obtained with the sample from study two, which was more balanced in terms of

630   participants' characteristics and recruited in a different setting and cultural background,

631   suggests that the findings from the first study were valid, not influenced by this bias

632   and, to some extent, generalizable. Another noteworthy issue is that the MAQ's

633   subscales and global scale seem to share a considerable amount of variance, judging

634 from the moderate to strong associations with each other. There were differences in the

635 strength of the associations between the subscales, global scale, and the network of

636 variables assessed in the different types of validity, which imply the existence of

637 discriminatory value in the subscales even if the global scale seemed to hold more

638 promise in terms of adding explanatory capacity. Thus, while the global scale is a

639 particularly good candidate to be included in future research, it is expected that the

640 different subscales may also add value for more fine grained analyses and

641 interpretations. For instance, when assessing predictive ability, across both studies the

642 predictive power of dependence subscale greatly overshadowed that of the other three

643 and added almost as much predictive power as the entire MAQ. This may suggest that

644 feelings of dependence towards meat consumption, as framed in the construct of meat

645 attachment, are a core issue in hindering a shift towards a more plant-based diet, which

646 ought to be explored in the future. On a different note, another matter worth noticing is

647 that in spite of showing weak but significant associations with the MAQ in study one,

648 the variable referring to subjective norm yielded no predictive capacity in willingness

649 and intentions concerning meat substitution in study two, when coupled with the other

650 core TPB variables (i.e., attitudes and perceived behavioral control). This finding was

651 not entirely unexpected since subjective norm did emerge in previous research on meat

652 consumption as the weakest predictor in the TPB model (e.g., Povey et al., 2001). We

653 echo previous interpretations suggesting that the influence of normative pressure from

654 specific referent groups on intentions may only be evident for high identifiers with the

655 specific group, and reiterate the suggestion that in future studies a measure of group

656 identification is also taken in addition to the standard measures of subjective norm

657 (Povey et al., 2001; Terry & Hogg, 1996). Finally, the present work is narrowed by its

658 scope and cross-sectional nature. One important caveat is the downside of one of its

659 major strengths, which is departing from data-driven propositions to improve

660 understanding on the psychology of meat consumption and substitution. While

661 providing a contribution to this topic and helping to build new theory in various ways,

662 as discussed above, we are still far from being able to sketch what may become a proper

663 theory of meat attachment. Such a theory will clarify the psychological nature of the

664 construct as a whole and its dimensions in particular, and illuminate its position with

665 reference to other well established theoretical frameworks that seek to explain consumer

666 behavior. For instance, when testing the instrument's predictive ability, inclusion of

667 meat attachment alongside TPB elements reduced greatly their direct effect on

668 willingness and intentions towards meat substitution, suggesting a mediation

669 mechanism that ought to be clarified in the future and holds promising research

670 possibilities. Likewise, future research towards building a theory of meat attachment

671 will need to shed light on the process of becoming attached to meat (e.g., how meat

672 attachment develops during childhood and adolescence until one becomes a more self-

673 determined consumer), and explore possible moderators that strengthen or weaken this

674 process. This is important because much of our relationship with food and food choice

675 occurs at a non-conscious level within deep-rooted patterns of habit and behavior

676 (Köster, 2009), so it may be particularly challenging to bring the issue of meat

677 consumption to higher levels of reasoning without triggering personal defense or loss-

678 aversion mechanisms when a pattern of meat attachment is already established (Graça et

679 al., 2015).

680

681   3.5 Main Conclusions

682   Meat attachment refers to a positive bond towards meat consumption and

683 comprises four dimensions, namely hedonism, affinity, entitlement, and dependence. Its

684 measure yielded favorable initial evidence concerning validity indicators, measurement

685 invariance and psychometric properties. Meat attachment showed negative associations

686 with willingness and intentions to reduce meat consumption and to follow a more plant-

687 based diet. That is, consumers that were more attached to meat consumption were also

688 less inclined to consider changing their eating habits. They were also more likely to eat

689 meat more often, hold more positive attitudes towards meat, perceive more social

690 pressure to eat meat, endorse values of human dominance over animals, and identify

691 more strongly as meat eaters and omnivores, and less as vegetarians or vegans. Men

692 tended to score higher than women in all dimensions of meat attachment. Overall, the

693 results obtained and propositions advanced in the current work, suggest that the

694 construct of meat attachment and proposed questionnaire is a relevant first step for a

695 variety of present and future applications and research questions on the psychology of

696 meat consumption and meat substitution.

697

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703

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907   Table 1. *Study one: Samples' characteristics*

Variable	Category	Sample 1		Sample 2	
		N	**%**	**N**	**%**
Gender	Male	225	45	223	43.4
	Female	275	55	291	56.6
Age	< 23	246	50.3	240	48
	23-40	198	40.5	212	42.4
	> 40	45	9.2	48	9.6
Education	Basic	16	3.2	11	2.2
	Secondary	211	42.3	227	44.2
	Higher	272	54.5	275	53.6
Employment Status	Employed	156	31.2	170	33
	Unemployed	31	6.2	40	7.8
	Student	308	61.6	296	57.5
	Other	5	1	9	1.9

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911   Table 2. *Initial pool of items referring to the meanings that consumers*

912   *associate with meat*

To eat meat is one of the good pleasures in life.
Meat is irreplaceable in my diet.
According to our position in the food chain, we have the right to eat meat.
I feel bad when I think of eating meat.
I love meals with meat.
To eat meat is disrespectful towards life and the environment.
To eat meat is an unquestionable right of every person.
Meat consumption is crucial to my balance.
A full meal is a meal with meat.
I'm a big fan of meat.
If I couldn't eat meat I would feel weak.
If I was forced to stop eating meat I would feel sad.
Meat reminds me of diseases.
By eating meat I'm reminded of the death and suffering of animals.
Eating meat is a natural and undisputable practice.
I don't picture myself without eating meat regularly.
Meat sickens me.
I would feel fine with a meatless diet.
Meat consumption is a natural act of one's affirmation as a human being.
A good steak is without comparison.

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Table 3. *Study one - Item and Scale Information from the Exploratory Factor Analysis*

916 *for the Meat Attachment Questionnaire*

Item	Factor loadings				M	SD	h^2
	1	2	3	4			
Hedonism							
1. To eat meat is one of the good pleasures in life.	**.79**	.08	.01	.01	3.55	1.06	.72
6. I love meals with meat.	**.69**	.14	.02	.10	3.69	1.03	.73
13. I'm a big fan of meat.	**.67**	.05	.05	.23	3.46	1.01	.80
9. A good steak is without comparison.	**.60**	-.02	.20	.09	3.39	1.16	.61
Affinity							
17. By eating meat I'm reminded of the death and suffering of animals.*	.06	**.82**	-.01	.02	3.65	1.16	.74
7. To eat meat is disrespectful towards life and the environment.*	-.14	**.77**	.13	.13	3.67	1.07	.67
5. I feel bad when I think of eating meat.*	.12	**.70**	.13	-.07	4.00	1.09	.67
16. Meat reminds me of diseases.*	.21	**.60**	-.04	-.02	4.00	1.05	.50
Entitlement							
8. To eat meat is an unquestionable right of every person.	.03	.04	**.77**	-.09	3.30	1.06	.57
4. According to our position in the food chain, we have the right to eat meat.	.03	.03	**.69**	.03	3.15	1.04	.55
18. Eating meat is a natural and undisputable practice.	-.01	.06	**.55**	.24	3.18	1.04	.53
Dependence							
20. I don't picture myself without eating meat regularly.	.14	.02	.02	**.72**	3.09	1.23	.69
14. If I couldn't eat meat I would feel weak.	.05	-.17	.11	**.71**	2.60	1.07	.57
10. I would feel fine with a meatless diet.*	-.07	.19	-.03	**.69**	2.85	1.20	.52
15. If I was forced to stop eating meat I would feel sad.	.17	.04	-.01	**.62**	2.92	1.24	.57
2. Meat is irreplaceable in my diet.	.26	.07	.09	**.52**	3.06	1.22	.64
Eigenvalue	7.91	1.69	1.14	.83			
Percentage of variance	49.4	10.5	7.1	5.2			
Cronbach's alpha	.89	.86	.76	.86			

917 *Notes.* h^2 = Item communalities. Factor loadings >|.50| are presented in bold.

918 * = Reverse-scored items.

919

920   Table 4. *Study one - Subscale and global scale reliabilities, means, standard deviations,*

921   *and correlations*

MAQ Scale and subscales	α	M	SD	1	2	3	4	5
1. Hedonism	.90	3.56	.94	-				
2. Affinity	.86	3.91	.87	.61*	-			
3. Entitlement	.77	3.19	.87	.57*	.51*	-		
4. Dependence	.86	2.88	.94	.72*	.49*	.57*	-	
5. Global scale	.93	3.40	.75	.88*	.80*	.75*	.86*	-

922   * $p < .01$

923

924 Table 5. *Study one - Correlations with other measures and indicators relevant to the*

925 *study of meat consumption and meat substitution*

MAQ Scale and subscales	Attitudes	Subjective Norm	Human Supremacy	Habits	Dietary identity			
					Meat eater	Omnivore	Vegetarian	Vegan
1. Hedonism	.67*	.35*	.31*	.67*	.70*	.36*	-.48*	-.43*
2. Affinity	.61*	.21*	.42*	.51*	.51*	.30*	-.49*	-.45*
3. Entitlement	.50*	.21*	.45*	.41*	.44*	.26*	-.37*	-.31*
4. Dependence	.61*	.32*	.36*	.56*	.60*	.24*	-.47*	-.33*
5. Global scale	.73*	.33*	.45*	.66*	.68*	.35*	-.55*	-.46*

926 * $p < .01$

927

928   Table 6. *Study one - Mean differences between men (N = 223) and women (N = 291) on*

929   *the Meat Attachment Questionnaire (MAQ) scale and subscales*

MAQ Scale and subscales	Men		Women		F(1,512)	Cohen's *d*
	M	SD	M	SD		
1. Hedonism	3.78	.84	3.40	1	20.50**	.41
2. Affinity	4.10	.83	3.84	.88	7.83*	.30
3. Entitlement	3.33	.88	3.03	.88	14.91**	.34
4. Dependence	3.08	.90	2.71	.96	20.07**	.40
5. Global scale	3.57	.70	3.26	.78	22.15**	.42

930   * $p < .01$ ** $p < .001$

931

932 Table 7. *Study one - Hierarchical regressions for predictive ability in willingness to reduce meat consumption and to follow a*
933 *plant-based diet above and beyond related variables*

	Reduce meat consumption						Follow a plant-based diet					
Variable	B	SE	β	ΔR^2	ΔF	dfs	B	SE	β	ΔR^2	ΔF	dfs
Step 1				.22***	67.89	2, 493				.39***	168.31	2, 517
Attitudes	-.44	.05	-.37***				-.51	.06	-.41***			
Current habits	-.21	.06	-.16***				-.35	.06	-.28***			
Step 2 - Hedonism				.03***	21.17	1, 492				.03***	25.13	1, 516
Attitudes	-.32	.06	-.27***				-.37	.06	-.30***			
Current habits	-.12	.06	-.09*				-.23	.06	-.18***			
MAQ Hedonism	-.29	.06	-.23***				-.34	.07	-.25***			
Step 2 - Affinity				.05***	35.24	1, 492				.06***	60.13	1, 516
Attitudes	-.30	.06	-.25***				-.31	.06	-.25***			
Current habits	-.17	.06	-.13**				-.26	.05	-.21**			
MAQ Affinity	-.38	.06	-.27***				-.48	.06	-.33***			
Step 2 - Entitlement				.06***	40.08	1,492				.04***	33.16	1, 516
Attitudes	-.34	.05	-.28***				-.40	.06	-.32***			
Current habits	-.20	.06	-.15**				-.31	.05	-.25***			
MAQ Entitlement	-.33	.05	-.26***				-.32	.06	-.22***			
Step 2 - Dependence				.12***	90.54	1,492				.09***	87.89	1, 516
Attitudes	-.24	.05	-.20***				-.30	.06	-.24***			
Current habits	-.09	.06	-.07				-.21	.05	-.18***			
MAQ Dependence	-.49	.05	-.42***				-.52	.06	-.39***			
Step 2 - Global Scale				.14***	103.91	1, 492				.11***	118.91	1, 516
Attitudes	-.13	.06	-.11*				-.15	.06	-.12*			
Current habits	-.07	.06	-.05				-.14	.05	-.12**			
MAQ Global Scale	-.79	.08	-.49***				-.88	.08	-.54***			

934   * *p* < .05   ** *p* < .01   *** *p* < .001

935   Table 8. *Study two - Subscale and global scale reliabilities, means, standard deviations,*

936   *and correlations*

| MAQ Scale and subscales	α	M	SD	1	2	3	4	5
1. Hedonism	.92	3.78	1.06	-				
2. Affinity	.88	4	1.03	.63*	-			
3. Entitlement	.86	3.6	1.06	.68*	.66*	-		
4. Dependence	.91	3.21	1.16	.78*	.58*	.66*	-	
5. Global scale	.95	3.62	.94	.90*	.81*	.84*	.90*	-

937   * *p* < .01

938   Table 9. *Study two - Hierarchical regressions for predictive ability in willingness and intentions towards meat substitution above and*

939 *beyond core TPB variables*

| Variable	Willingness						Intentions					
	B	SE	β	ΔR^2	ΔF	*df*s	B	SE	β	ΔR^2	ΔF	*df*s
Step 1				.49***	98.8	3, 314				.61***	165	3, 314
Attitudes	-.77	.05	-.63***				-.90	.05	-.77***			
Subjective norm	.00	.00	-.04				.00	.00	.03			
PBC	..27	.07	.17***				..21	.07	.13***			
Step 2 - Hedonism				.03***	21.02	1, 313				.03***	23.24	1, 313
Attitudes	-.46	.09	-.38***				-.62	.07	-.53***			
Subjective norm	.00	.00	-.03				.00	.00	.04			
PBC	.27	.07	.16***				.20	.06	.13***			
MAQ Hedonism	-.38	.08	-.32***				-.34	.07	-.29***			
Step 2 - Affinity				.06***	37.62	1, 313				.03***	28.53	1, 313
Attitudes	-.46	.07	-.38***				-.67	.06	-.57***			
Subjective norm	.00	.00	-.06				.00	.00	-.01			
PBC	.30	.06	.18***				.23	.06	.14***			
MAQ Affinity	-.43	.07	-.34***				-.32	.06	-.26***			
Step 2 - Entitlement				.06***	41.09	1, 313				.02***	14.63	1, 313
Attitudes	-.50	.07	-.41***				-.76	.06	-.65***			
Subjective norm	.00	.00	-.05				.00	.00	.03			
PBC	.27	.06	.16***				.21	.06	.13***			
MAQ Entitlement	-.40	.06	-.33***				-.21	.06	-.18***			
Step 2 - Dependence				.13***	101.50	1, 313				.06***	57.63	1, 313
Attitudes	-.33	.07	-.27***				-.60	.07	-.51***			
Subjective norm	.00	.00	-.03				.00	.00	.07*			
PBC	.12	.06	.08*				.11	.05	.07*			
MAQ Dependence	-.61	.06	-.55***				-.41	.05	-.38***			
Step 2 - Global Scale				.15***	128.31	1, 313				.08***	75.67	1, 313
Attitudes	-.01	.08	-.01				-.38	.07	-.32***			
Subjective norm	.00	.00	-.02				.00	.00	-.05			
PBC	.20	.06	.12**				.16	.05	.10**			
MAQ Global Scale	-1.03	.09	-.75***				-.71	.08	-.53***			

940   * $p < .05$ ** $p < .01$ *** $p < .001$

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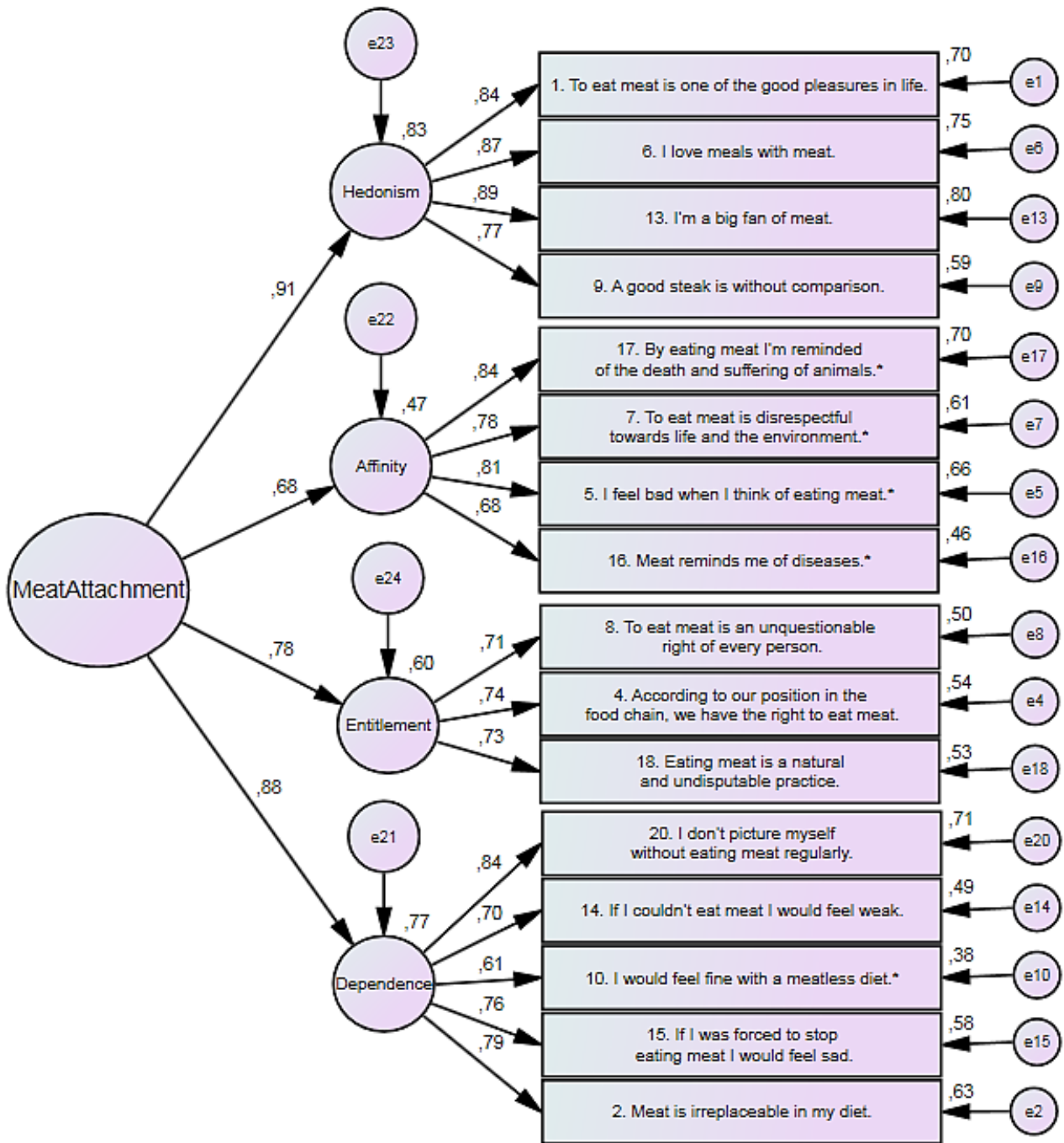
941

942　Figure 1. *Study one - Confirmatory factor analysis of the Meat Attachment Questionnaire, four-*

943　*factor structure with a second-order dimension. Standardized coefficients are presented.*

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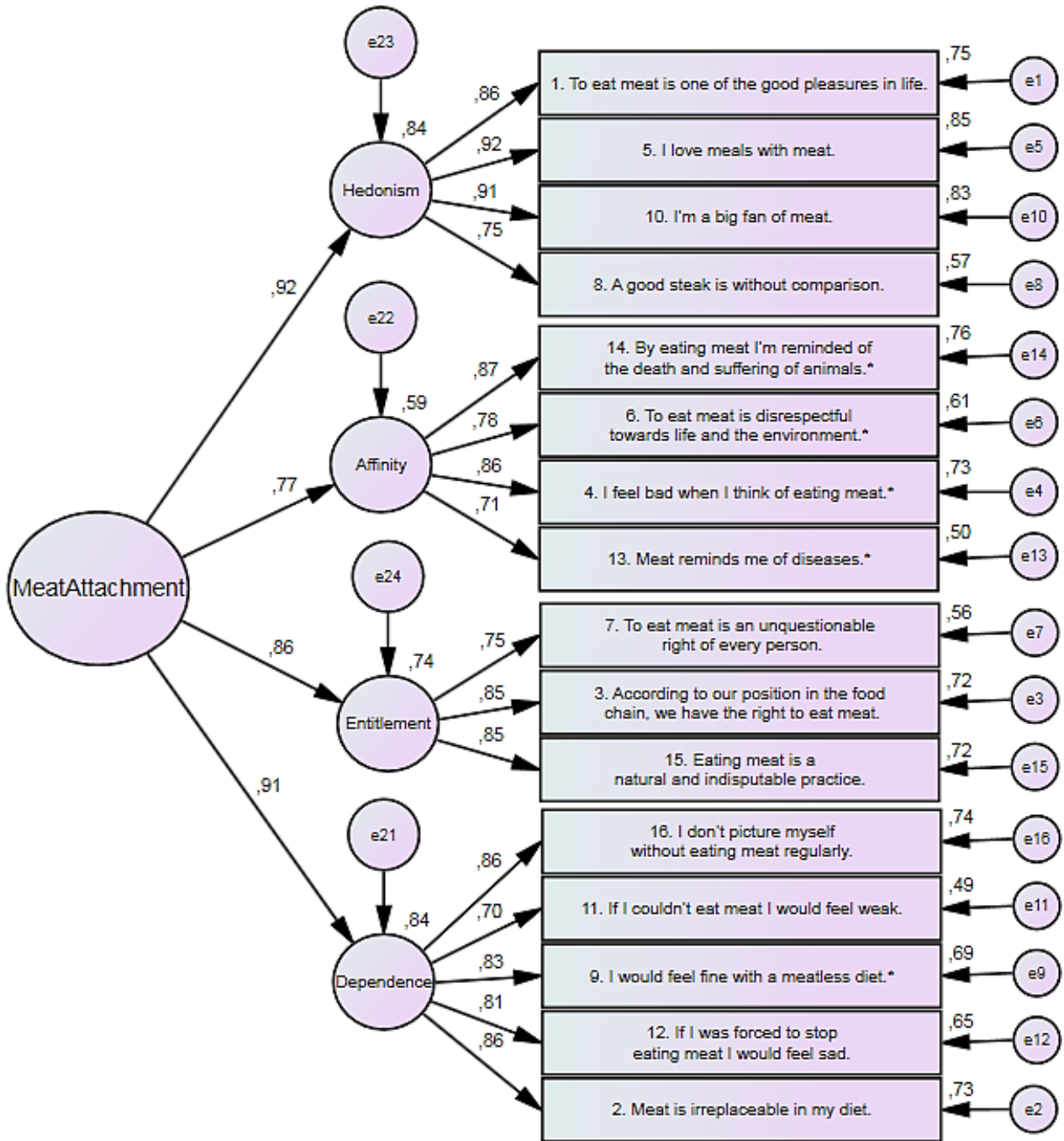
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946   Figure 2. *Study two - Confirmatory factor analysis of the Meat Attachment Questionnaire, four-*

947   *factor structure with a second-order dimension. Standardized coefficients are presented.*

948