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Willingness to pay for personalised nutrition across Europe

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Abstract

Background: Personalised nutrition (PN) may promote public health. PN involves dietary advice based on individual characteristics of end users and can for example be based on lifestyle, blood and/or DNA profiling. Currently PN is not refunded by most health insurance or health care plans. Improved public health is contingent on individual consumers being willing to pay for the service.

Methods: A survey with a representative sample from the general population was conducted in eight European countries (N=8233). Participants reported their willingness to pay (WTP) for PN based on lifestyle information, lifestyle and blood information, and lifestyle and DNA information. WTP was elicited by contingent valuation with the price of a standard, non-personalised nutrition advice used as reference.

Results: About 30% of participants reported being willing to pay more for personalised nutrition than for non-personalised nutrition advice. They were on average prepared to pay about 150% of the reference price of a standard, non-personalised advice, with some differences related to socio-demographic factors.

Conclusion: There is a potential market for PN compared to non-PN advice, particularly among men on higher incomes. These findings raise questions to what extent personalized nutrition can be left to the market or should be incorporated into public health programs.

Keywords: Personalised nutrition, Willingness to pay, Nutrition services, Preventive medicine; Food4Me

Introduction

Balanced nutrition is of paramount importance to public health. Today's foods are abundant and generally safe and of high quality. Nutrition does however also have more long term public health effects that tend to differ between individuals and countries in Europe(1). Nutrition has different effects on individuals and food choices made in early life may impact health and quality of life decades from now(2). While such long term effects may contribute to healthy ageing the effect of nutrition may differ between individuals, and the public health improvement can only be achieved if individuals receive advice tailored to their personal nutritional needs. Current advances in nutrition science and more specifically in nutrigenomics indicate that more specific information about an individual could be used to develop personalised nutrition (PN) advice that is tailored to individual needs(3). Increased personalisation requires more information about an individual e.g. a blood sample to assess cholesterol levels, in order to suggest specific dietary recommendations. Genetic analysis can be applied to predict potential future nutritional needs, or to investigate how specific nutrients contribute to the healthiness of an individual's diet. PN advice is not necessarily aimed at people that are already unhealthy or overweight. Instead it aims at preventing health problems and can even improve health of individuals based on nutritional needs of these individuals. By large scale adoption of PN advice by individuals immediate and long term public health may be improved.

Nutrition advice aimed at curing nutrition related diseases is covered by most public health and health insurance systems. Currently, most health insurance companies or health service providers, such as the UK NHS, or health care insurances in the Netherlands or Germany do not refund the cost of PN advice. PN advice is considered a preventive or health improving advice which at this moment in time is generally placed outside health care systems. Community support to population at high risk are sometimes included, such as in diabetes

Fischer et al. (2016) Willingness to pay for Personalised Nutrition prevention programs in the US(4); but individuals who are not part of a vulnerable group and are non-patients are generally expected to organise nutrition advice themselves. Therefore, in the short term, adoption of PN depends on consumers' willingness to pay (WTP) for commercial PN advice. Various businesses across Europe have marketed PN as a viable opportunity, using a range of personalisation techniques and business models(5). The failure rate of these companies is however high, which may be in part because listed prices are more based on the incurred cost of more advanced personalisation methods than on a clear idea about *how much* consumers are willing to spend on PN advice at different levels of personalisation(6). Reasons why consumer may not be willing to pay more for PN advice requiring DNA or blood testing, may be that consumers see potential privacy risks, or do not believe these additional, costly analyses will provide better advice(6).

This paper presents results from a survey that assessed people's WTP for PN based on three different levels of personal information: i) lifestyle (food consumption and physical exercise pattern); ii) lifestyle and phenotype (from analysis of a blood sample); lifestyle and genotype (from DNA testing using a saliva sample). To identify potential groups most likely to adopt PN advice, comparisons regarding WTP were made between countries, gender, age groups, and income and education levels.

Methods

A survey was conducted in November and December 2012 with participants from eight EU countries¹. Samples were representative on gender, age, and education level for the general population in their country and were member of existing panels of consumer research agencies who consented in receiving survey invitations. Data collection was part of a larger study on PN where more details about the procedure can be found(7). Data reported here have not been published previously.

¹ Greece, Spain, Germany, Ireland, Netherlands, UK. Poland and Norway

WTP was measured as a two-step contingent valuation. Participants were first asked whether they would be willing to pay a price equal to that of standard, non-PN advice provided by a qualified dietitian. Those who reported a WTP of at least this reference price were provided with a continuous scale of which the lower-end represented the reference price, and the higher end being five times the reference price. Participants who reported to be not willing to pay the reference price were provided with a scale that ranged from 0 to the reference price.

Based on an internet survey on the price of general dietary advices consisting of one intake session and a three month follow up advice in the Netherlands the reference price for PN was estimated at about 100€, which was then translated to reference prices for all participating countries using the Eurostat Comparative Price Level index of 2011(8). To check whether the calculated reference prices resembled dietary advice prices of the participating countries, the reference price of each country was compared to the price of a national Weight Watchers² dietary service. To allow comparability across countries, the reported WTPs were expressed as percentages of the reference prices. Each participant scored WTP for nutrition advice based on three, increasingly personal, levels of personal information: lifestyle (about daily diets and exercise); lifestyle and phenotype (with additional information from blood chemistry information); and, lifestyle and genotype (with additional information from DNA testing using a saliva sample). The order of WTP scoring was randomized.

WTP data were coded into three classes: (1) Nothing: Participants reporting a WTP below 1% of the reference (2) Low: Participants reporting a WTP below reference, but more than 0; (3) High: Participants reporting WTP higher than the reference price. In addition, age,

² Weight Watchers is an international company that offers various products and services to assist weight loss and maintenance

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gender, income (compared to the modal income of country of residence³), education (Low: 12 or fewer years of schooling, including kindergarten; Medium: 12-16 years education; High: degree level) were recorded. Of the 8233 participants, 919 did not disclose income. These participants were omitted from analyses that included income as determinant. Distributions of participants across the WTP classes were cross-tabulated and tested using χ^2 . In addition, factorial ANOVAs were conducted testing the main effects of the sociodemographic on WTP, for the Lower and Higher WTP class⁴ and each level of personal information.

Results

Sample description

A total of 8233 participants from the representative survey completed the questionnaire. Gender distribution was about equal (50.6% male). Twenty-two percent of participants were aged between 18 and 29 years; 23% between 30 and 39 years; 35% between 40 and 54 years; and 20% between 55 and 65 years. Twenty-nine percent reported low education level; 39% had completed medium level education; and, 32% had completed higher education. Income distribution peaked (as expected) around the modal income of each country, with 49.3% (3605) of those willing to disclose income information, earning between 0.5 and 1.5 times modal income.

General Results

Average WTP as percentage of the reference price provided is reported in Table 1.

³ Modal incomes at the time of data collection were: Germany: 25,000€ ; Spain: 22,000€; Greece: 20,000€; Ireland: 24,000 €; Netherlands: 30,000€; United Kingdom: 22,000£; Poland: 50,000 Zloty; Norway: 322,000 kroner, Portuguese participants did not fill out this question.

⁴ For the Nothing WTP class, an ANOVA would be meaningless since all participants in this class scored a WTP equal to 0.

TABLE 1 ABOUT HERE

A minority of the participants (about 30% see Table 2) showed a high WTP for PN advice. About half showed a low WTP. The remaining participants (about 20%; Table 2) reported not being willing to pay anything for PN advice. These percentages differed between the three levels of information (Friedman $X^2(2)=106.98$, $N=8233$, $p<0.001$). For lifestyle-based nutrition advice, relatively fewer participants had a WTP above the reference price and more a WTP below the reference price. For lifestyle and phenotype information, more participants were willing to pay more, and fewer did not want to pay anything. For lifestyle and phenotype analysis and lifestyle and genotype analysis, relatively many participants were willing to pay nothing, while relatively few participants were willing to pay a lower than reference price (Table 2).

TABLE 2 ABOUT HERE

Demographic differences

The effects of gender, age, income, education level and country showed several statistically significant differences in WTP class and mean WTP within the WTP class (Table 3 shows statistical tests; Figure 1 shows distribution and means).

TABLE 3 ABOUT HERE

FIGURE 1 ABOUT HERE

Discussion

About a third of the participants reported WTP for PN higher than the reference price of standard, non-PN advice. Those participants were on average willing to pay a price of 40% and 50% of higher than the reference price. The additional price people were willing to pay for the more advanced forms (blood or DNA sample based) of personalisation (based on phenotype or genotype) was very small compared to what participants were willing to pay for lifestyle-only based PN advice. This aligns with previous research(9), where it was reported that people did not perceive additional benefits accruing from more medicalised personal data and suggests such advanced methods should be developed at little extra cost.

A sizable minority (20%) indicated that they are willing to pay nothing for PN, and about half of all participants indicated WTP for PN lower than for standard nutrition advice. While this may imply these participants reject the idea of PN altogether this is not necessarily the case. Current concerns about inadequate procedure to guarantee data privacy, lack of confidence in the efficacy of PN, or distrust in commercial service providers(9) may have reduced WTP regardless of perceived acceptance of PN per se. Another group may have consisted of people who were potentially interested in adopting a PN advice but were opposed to paying for healthcare from their private funds because this is seen as a responsibility of the state(11). There may have been a group of people for whom the personalized nutrition remained abstract and hypothetical and therefore indicated a low WTP, this may be particularly the case for a group of people not willing to pay for any

Fischer et al. (2016) Willingness to pay for Personalised Nutrition nutrition service which may have reduced WTP for PN services.⁵ This relates to another potential limitation to the current study that in the used contingent valuation method participants did not make any actual monetary sacrifice(13). Future research is needed to investigate the reasons why WTP is so low, and under what conditions these people would participate in a PN program.

Analysis of differences based on demographic variables gives some insights into what participants are most likely to adopt a PN advice. There were some differences in WTP between countries. Participants from the Netherlands and the UK most often reported they did not want to pay anything or at least less than the reference. Participants in these countries either wanted to pay the least, but those with WTP more than the reference price were among those with the highest WTP. This may have to do with the availability of relatively inexpensive basic healthcare (Netherlands), or free of direct charge basic healthcare (UK), while additional, non-standard care is something for which inhabitants of these countries are accustomed to pay when they use it.

There were more males than females reporting a WTP of nothing. Males with low WTP reported lower WTP than female participants, males with a WTP higher than the reference value had a higher WTP than females. This suggests that male participants, once committed to pay more or less for PN than conventional nutrition advice, are more extreme in their deviation from standard nutrition advice WTP than females.

Participants in the highest income classes reported the highest WTP for PN. This suggests that commercial introduction of personalized nutrition services would benefit higher socio-economic classes most, while it is generally accepted that these groups in the population already have better health(12). The higher WTP may in part be related to higher income classes having more awareness of health issues, but it may also relate to the

⁵ A much larger proportion (about 60%) of participants in a proof of principle trial in the same countries completed the same survey (7) and were willing to pay a higher price for a PN service than for a non-PN service (data not shown), indicating that motivation to engage with nutrition advice may be a central driver for adoption.

availability of resources (money) to purchase nutrition services. This suggests that if availability of PN advice is regulated by commercial markets, these may explicitly target the higher social classes and incomes to maximize profit; while PN advice to these population groups may have the least positive effect on public health. This raises important ethical questions to whether personalised nutrition should also be accessible to lower income classes that may need it more than those with high income. Considering the low WTP of these income classes alternatives to commercial businesses seem more promising ways to have these groups benefit from PN advice for example PN advice provided through employers or insurance companies. Alternatively, a hybrid form of commercial and public services could be considered, where basic PN services is covered by a national health program, while specific implementations such as comprehensive lifestyle advice and applications to monitor progress (6) may be left to the market. The answer to this issue is beyond the scope of the current paper, and should be taken up at the level of policy discussion.

That about one third of the population reports to be willing to pay more for PN than for a conventional nutrition services suggests that there may be a market for PN if it can be offered at no more than one and a half time the price of current nutrition advice services. While this suggests that PN may find a place in the European population if it is made available at limited additional cost compared to non-PN services, it might be more likely to be adopted by those who need it most if it is offered through existing health care systems.

Key points:

- There is a potential market for personalised-nutrition advice in the EU
- The majority of people is not willing to pay for personalised- nutrition advice
- Willingness to pay for personalisation based on DNA sampling is not higher than for personalisation based on lifestyle or blood data.
- Large scale adoption of personalised nutrition is likely to require inclusion in national health services

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Conflict of interest: Authors know of no conflict of interest. All procedures were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards). Informed consent was obtained from all individual participants for being included in the study

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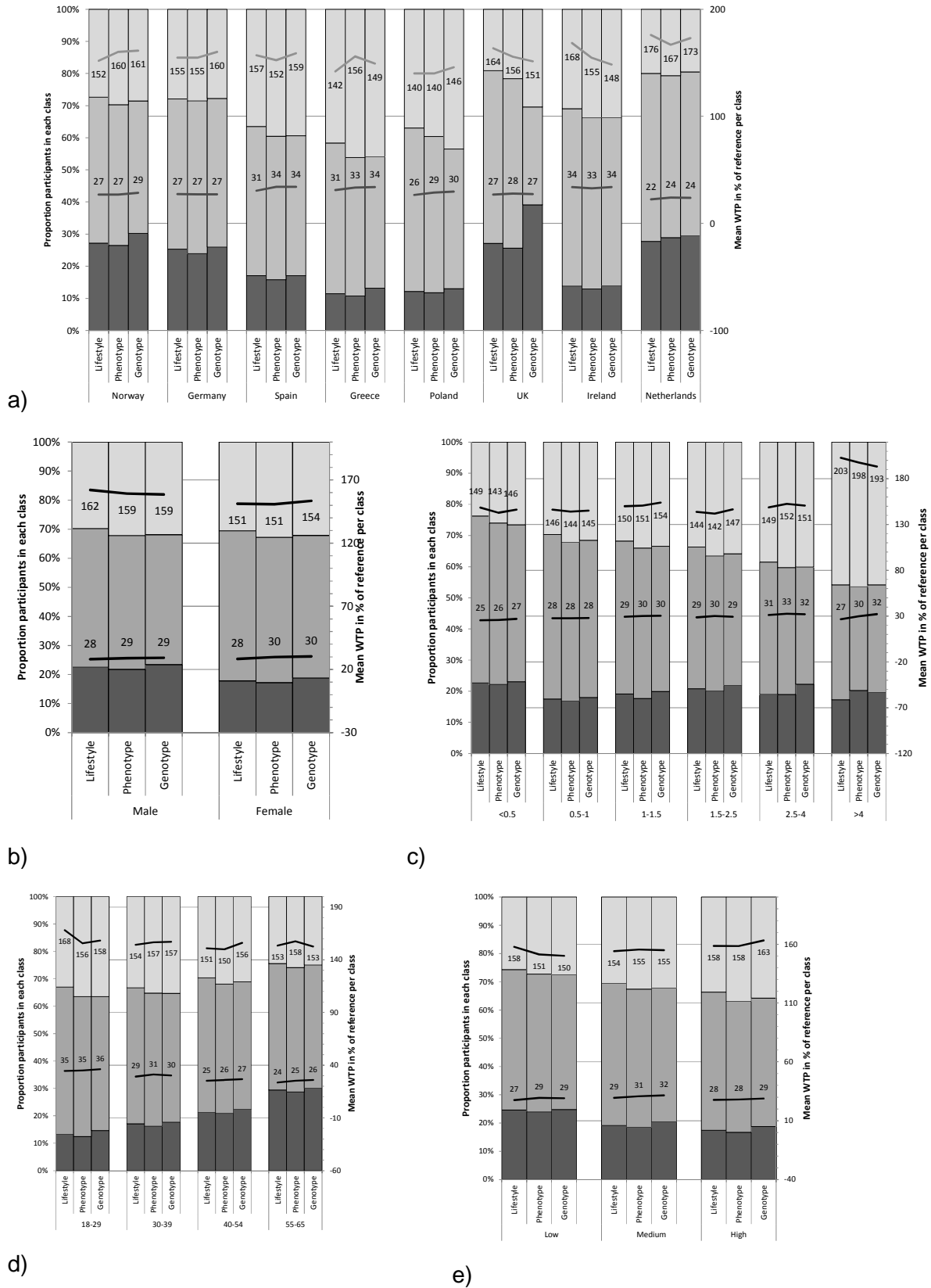


Figure 1: WTP for different levels of PN by (a) Country (b) Gender (c) Income (d) Age and (e) Education. Bars indicate proportion of participants willing to pay: Nothing (dark grey), Lower than reference (mid grey) and Higher than reference (light grey). Lines and numbers indicate mean WTP in percentage of the reference.

Table 1: Average WTP per country per type of required personal information

| Country | N | Reference price (local currency) | Average in % reference | | |
|-------------|------|-------------------------------------|------------------------|-----------------------|----------------------|
| | | | Lifestyle | Lifestyle + Phenotype | Lifestyle + Genotype |
| Greece | 1020 | 90€ | 70.24 | 75.81 | 76.64 |
| Spain | 1025 | 90€ | 65.84 | 68.77 | 71.21 |
| Germany | 1020 | 100€ | 53.38 | 54.32 | 54.62 |
| Ireland | 1020 | 110€ | 68.42 | 69.64 | 68.44 |
| Netherlands | 1020 | 100€ | 42.35 | 41.70 | 41.26 |
| UK | 1061 | £80 | 44.24 | 47.53 | 46.65 |
| Poland | 1045 | 230 Złoty | 64.50 | 68.67 | 70.99 |
| Norway | 1022 | 1100 Norse kroner | 52.15 | 57.23 | 54.90 |

Table 2: Distribution of WTP (as percentage of reference price) per personalisation level

| | Lifestyle | Lifestyle + Phenotype | Lifestyle + Genotype |
|-----------|----------------|-----------------------|----------------------|
| N | 8233 | 8233 | 8233 |
| Nothing | 19.6% | 19.1% | 20.8% |
| Lower | 51.5% | 49.9% | 48.4 % |
| Mean (SD) | 30.10 (21.40) | 30.44 (21.66) | 30.68 (21.83) |
| Median | 25.56 | 26.10 | 27.27 |
| Higher | 29.0% | 31.0% | 30.7% |
| Mean (SD) | 143.84 (62.53) | 143.27 (61.14) | 146.73 (63.64) |
| Median | 120.00 | 119.00 | 122.23 |

Table 3: Test statistics for effect of sociodemographics on WTP-class membership and mean WTP within the Low and the High WTP class. Bold font indicates significant outcomes at p<.05).

| N=8233 ¹ | Lifestyle | | | Lifestyle and Blood | | | Lifestyle and DNA | | |
|--|---|--------------------------------------|---------------------------------------|---|--------------------------------------|---------------------------------------|---|--------------------------------------|---------------------------------------|
| | Class (nothing, low, high) | Low (n=3609) (df _e =3590) | High (n=2269) (df _e =2250) | Class (nothing, low, high) | Low (n=3485) (df _e =3466) | High (n=2443) (df _e =2424) | Class (nothing, low, high) | Low (n=3393) (df _e =3374) | High (n=2415) (df _e =2396) |
| Country (df _{χ²} =14; df _F =7) | χ²=358.82, p<.001, V=.15 | F=14.02; p<.01 | F=5.86; p<.01 | χ²=408.11, p<.001, V=.16 | F=11.32; p<.01 | F=3.92; p<.01 | χ²=439.02, p<.001, V=.16 | F=2.46; p=.02 | F=1.56; p=.14 |
| Gender (df _{χ²} =2; df _F =1) | χ²=29.23, p<.001, V=.06 | F=6.95; p<.01 | F=25.03; p<.01 | χ²=29.18, p<.001, V=.06 | F=9.97; p<.01 | F=15.78; p<.01 | χ²=28.31, p<.001, V=.06 | F=4.68; p=.03 | F=25.85; p<.01 |
| Age class (df _{χ²} =6; df _F =3) | χ²=163.34, p<.001, V=.10 | F=36.54; p<.01 | F=1.01; p=.35 | χ²=173.65, p<.001, V=.10 | F=41.41; p<.01 | F=1.80; p=.12 | χ²=159.35, p<.001, V=.10 | F=34.07; p<.01 | F=0.77; p=.51 |
| Education level (df _{χ²} =4; df _F =2) | χ²=61.81, p<.001, V=.06 | F=0.63; p=.53 | F=0.17; p=.84 | χ²=75.02, p<.001, V=.07 | F=0.55; p=.58 | F=0.33; p=.72 | χ²=51.54, p<.001, V=.06 | F=0.16; p=.86 | F=1.81; p=.17 |
| Income level (df _{χ²} =10; df _F =5) | χ²=90.00, p<.001, V=.08 | F=5.97; p<.01 | F=5.77; p<.01 | χ²=88.96, p<.001, V=.08 | F=5.94; p<.01 | F=7.04; p<.01 | χ²=86.65, p<.001, V=.08 | F=4.66; p<.01 | F=7.66; p<.01 |