The influence of parental Dietary Behaviors, food literacy and chronotype on Children's eating habits and psychometric factors

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Abstract

The study aims to investigate the relationship between various psychometric characteristics, such as eating habits, food literacy, chronotype, chrono nutrition, and anthropometric variables, such as age, Body mass index (the range to value the normal or overweight or obesity status) and education, within family units consisting of parents and children. The goal is to analyse the drivers of children's BMI and eating habits, by investigating the interdependence between their dietary patterns and their families' environment. Total of 190 parents complete an online survey comprising validated questionnaires and anthropometric data concerning themselves and their children. The results show that the higher the food literacy was in parents the healthier was eating habit of children, although the better eating habits do not necessarily correspond to a lower child BMI. The chronotype of parents also influenced the children's chronotype, and parents with a morning chronotype reflect positive eating behaviours in their children. Results confirm the growing part of the literature focusing on the role of chrono nutrition and chronotype in weight-related issues. As obesity is a complex disease, these new prospective emphasise the role of psychometric variable to impact daily eating habits. We provide new cues to extend the current literature on social campaigns - which split children and adults - by suggesting the relevance to integrate the communication strategy to families as a target unit. In conclusion, the study sheds light on the complex relationship between psychometric characteristics, anthropometric variables, and familial environment in determining children's eating habits and BMI.

Framing of the research. *The World Health Organization has declared that in European countries childhood obesity is about to become a public health problem (World Health Organization. Regional Office for Europe n.d.). After Covid-19 the trend is getting higher (Pietrobelli et al. 2020) and the institutions need to face this trend mainly for two reasons, on one hand the presence of obesity in childhood represent an important risk to maintain obesity in adulthood and on the other hand obesity represent, in general, an important risk factor for several disorders (Simmonds et al. 2016). The overweight and obesity are complex diseases where internal and external variable matches (Jebeile et al. 2022). The internal variables are expressed by non-modifiable characteristics as sex, age, and genetic predispositions. The external ones refer to environment for example the eating habits, the society, the children care and school (Jebeile et al. 2022). These external ones represent the main working area of heath social campaign, that focuses to improve and to change the obesogenic environment to reduce and counterbalance the impact of internal risk factors. For example, in Australia a social campaign targeted on children was conducted at school to prevent childhood obesity using an informative campaign providing concept in a caching way (Colin Bell et al. 2013). In Italy the ViviSmart campaign, a social marketing-oriented campaign was conducted to improve nutritional skill of child through interactive lessons and ludic activity involving school and parents obtaining benefits for their eating lifestyle (Nosi et al. 2021).*

In the last decades, a little part of literature is providing interesting results on the relationship between BMI or metabolic risk and some psychometric variable, that are manifestation of internal characteristics; however, the interesting peculiarity is that we can partially modify them changing habits and iven if they can impact on external environment, social campaigns have never used these variable to impact habit's change. Psychometric variables refer to chrononutrition and chronotype; the first one, the chrononutrition, refers to the relationship between three element that are the circadian rhythm of the biological function of the body, the meals timing and the nutrients consumption

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(Johnston 2014; Oike, Oishi, and Kobori 2014). The chronotype is the attitude of a person to be more active during the day and emerging evidence suggest a relationship between chrononutrition and chronotype. (Almoosawi et al. 2019)

The review of Mazri and colleague assumes that adults more active during the evening (evening-chronotype) tend to have bad eating habits associated to obesity, contributing to obstacle the achievement of a healthy lifestyle (Mazri et al. 2020). Felső and colleague asses that a lack of sleep and a change in the circadian rhythm affect food metabolism functions, predisposing individuals to develop obesity and metabolic disorders (Felső R 2017). Consuming the meal at inappropriate times of day leads to an alteration of biological processes such as insulin secretion, lipid metabolism and blood pressure (Katsi et al. 2022). The chrononutrition appears relevant and really interconnected with lifestyle and dietary pattern. For instance, the evening chronotypes performed worse than intermediate and morning chronotypes in the food literacy score (Trieste et al. 2021) and this accentuates the need to better understand the relationship between these parameters considering a broader view. Regarding children, the morning chronotype predominates in childhood, shifting towards eveningness around puberty ((Jankowski 2015). Childhood and adolescence represent a vulnerable period and if they are not well directed, they risk establishing inadequate dietary patterns. The psychometric aspects are poorly taken in consideration even if they could impact on eating habits. They can represent a new prospective to ameliorate dietary pattern also in the social campaign along with other variables.

Purpose of the paper. *The aim of this paper is to investigate if and how the lifestyle of parents can impact their children's habits. Specifically, we are interested in comparing the daily mealtimes (chrono nutrition), the attitude to be more active in a certain part of the day (chronotype), the food knowledge (food literacy) and the anthropometric variables (age, sex. education) of the parents with the same variables of their children. These insights could provide relevant knowledge for developing effective social marketing strategy capable of improving positive behavioural changes.*

Given these premises the research hypotheses are:

H1. The food literacy is associated to a specific psychometric or anthropometric determinant such as BMI and chronotype in adults.

H2. Different chronotype in child can reflect differences between the child's anthropometric and eating habits.

H3. The parent's chronotype influence the child's chronotype and his eating habits.

Methodology

Participants

We enrolled a total of 190 parents in our study. To be eligible for inclusion, parents had to have child between 2 and 13 years old. They were recruited through school groups, sports associations, or social networks and we reached out respectively 179 (94,2) mothers and 11 (5.8) fathers. To collect data, we sked them to complete the questionnaire gathering information referred to themselves and to their child. We send them a link to fill the online questionnaire structured in Italian. The data collection lasted one month from 30/04/2021 to 25/05/2021. Participants live in Italy and most of them (89.5%) in Piemonte. Parents given the informed consent to participate.

Survey

Data were collected with an online survey and it lasts 20 minutes. Survey has validated questionnaires and anthropometric aspects concerning children's and parent's characteristics.

The validated questionnaire adopted for parents were:

- *the chronotype, that asses in which time of day the subject is most active with the Italian version of the reduced morning-evening questionnaire (rMEQ)(Natale et al. 2006);*
- *the chrononutrition that study the rhythm of the eating behaviour (Veronda et al. 2020)*
- *the Self Perceived Food Literacy (SPFL) to investigate 8 domains on food habits and food purchases (Poelman et al. 2018)*

The validated questionnaire adopted for children were:

- *Childrens Chronotype Questionnaire (CCTQ) Werner & C.*
- *The eating habits, using ten questions about the frequency consumption of several food, where each question could be rated 0 or 1, and the final score was the media of answers. The closer the score was to one the higher was the eating habits.*

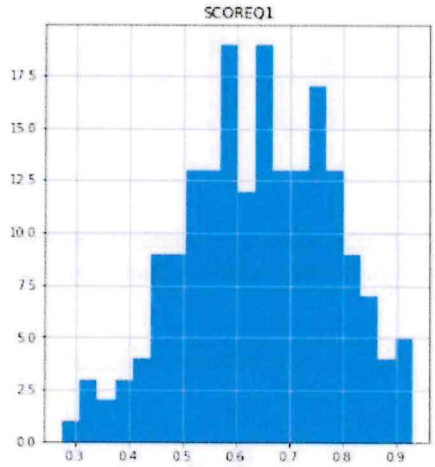
The anthropometric data collected were level of education, residence and BMI (weight/ height^2) considering different scoring for paediatric (Harrington et al. 2013) and for adult group (Ministero della salute Italiana 2021)

Results. *The sample of parents was characterized by a median age of 39,5 years and the majority of subjects were Italian (96.9%).Other participants came from Albania, Romania, Switzerland, France and Spain. Concerning the Italian participants, 149 were born in the north Italy (Piemonte, Lombardy, Liguria and Emilia-Romagna), 18 subjects were born in centre Italy and 17 in south. However, of all those participants the 89.5% lives in north-Italy. Slightly more than half of parents declared to have a university degree (52%), the 4.7% and 42.9% have a middle school licence and high school diploma respectively. Only one individual stated to possess a primary school licence. Of these subjects, 33%, 62 participants, had attended courses providing information on nutrition. We included these question in the survey to assess if participant had received any nutrition education because previous conducted study found that subjects with specific nutrition education reported higher levels of nutrition literacy, regardless of gender (Trieste et al. 2021). Furthermore 169 subjects (89%) stated to be employed, only 2.1% were unemployed, one individual retired and 8.4%, declared to be housewives. Then, we calculated parents' BMI based on weight and height. Results show that most of participant are within the range of normal weight, 5 subject are in the underweight category (BMI < 18.5). 52*

subjects (27%) are considered overweight, 11 subject are withing first degree obesity (30 < BMI < 40) and 4 are within second degree obesity (BMI > 40). BMI was calculated also for children but in a different way from adult. We have considered the BMI distribution according to the corresponding percentile of growing. 7.4% of child were overweight and 13.7% had obesity.

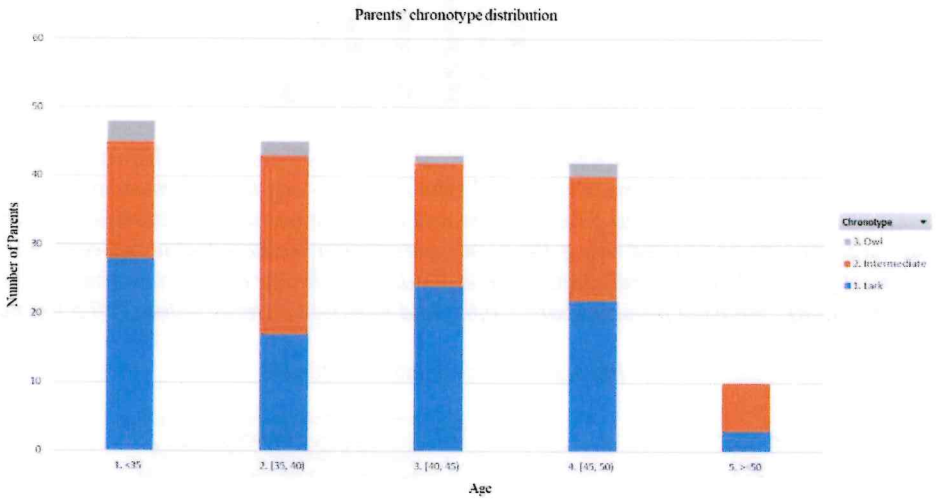
The level of food literacy was investigated for parents, and the scoring system range from zero to one, where zero represents the lowest value of food literacy and one the highest. The results, shown in Figure 1, depict a clear prevalence of parents with medium to high level of food literacy.

Fig. 1 Food Literacy Score



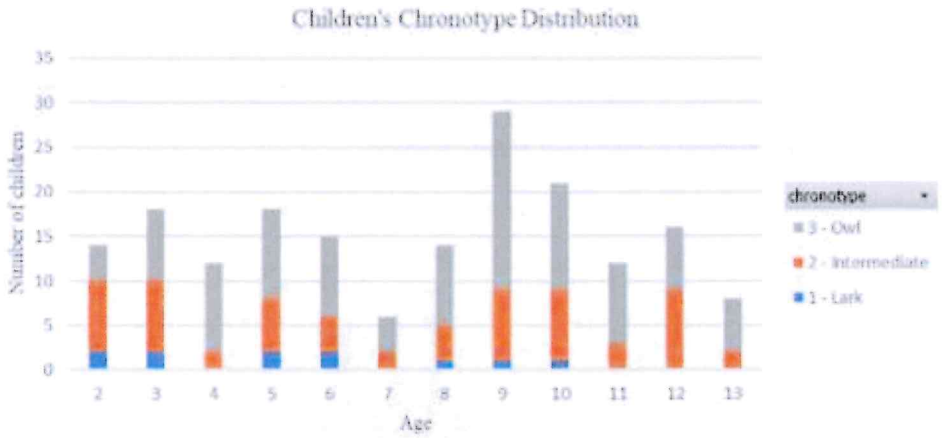
The chronotype of the adult sample is composed of 8 evening type, 69 morning type and 111 intermediates. Figure 2 summarised the results where the evening chronotype are indicated as "owls" and the morning type as "larks". The distributions don't reflect the general population distribution, usually characterized by 70% intermediate, 15% morning type and 15% evening type (Bazzani et al. 2022).

Fig. 2 Parent's chronotype



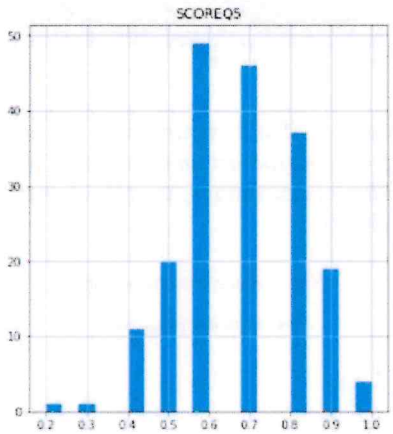
The chronotype distribution changes among children with a prevalence towards a serotonin chronotype, shown in Figure 3. Only 12 children have a morning chronotype and they are between 2 and 6 years old, accordingly with literature studies. The average age of the owls is about 8.5 years, while the larks are on average about 6 years old. Usually, in the first few years of life (0-5 years) the morning type predominant, whereas towards the age of 8 years old there increase the percentage of intermediates and evening type (Almoosawi et al. 2019).

Fig. 3 Children's chronotype



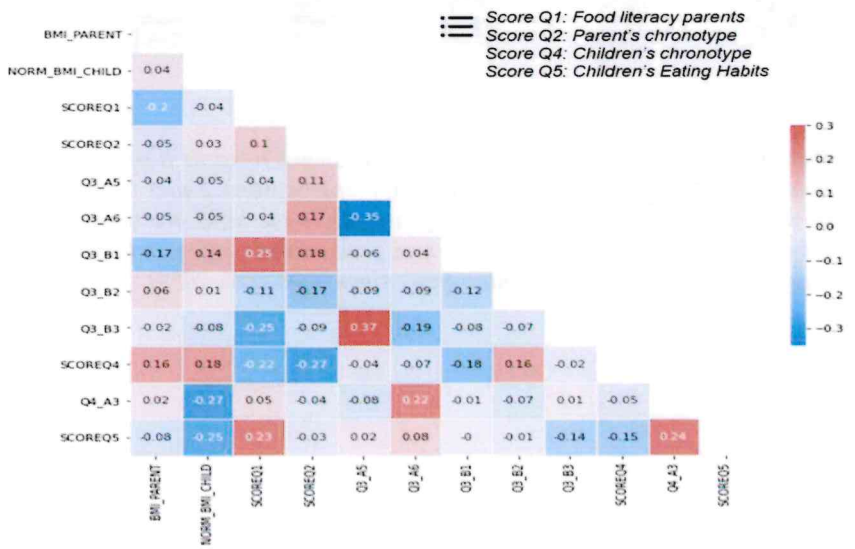
Moving toward children's eating habits (Figure 4), in our sample the majority of children have good eating habits. The scoring assume value from zero to one where lower score indicated poorer eating habits, and higher score closer to one indicate healthier eating habits.

Fig. 4 Score of children's eating habits,



We analysed the data from questionnaire using a statistical software (R program). We carried out linear regressions to highlight possible relations between variables studied. The first step was to perform a correlation analysis between scores to study the existing relationships for psychometric and anthropometric characteristics of participants as shown in Figure 5. The analysis was conducted using Pearson's correlation method (value between +1 and -1, where +1 corresponds to perfect positive linear correlation, 0 corresponds to no linear correlation and -1 corresponds to perfect negative linear correlation). We fixed p-value score ≤ 0,05, and homoscedasticity values > 0.5 to analyse variables.

Fig 5. Pearson correlation coefficient



The results show that the food literacy can predict the BMI value of parents assessing the first hypothesis. Food literacy and BMI are significantly related in an indirect way, when food literacy grows the BMI decrease (p-value < 0.047, homoscedasticity > 0.54). Figure 6 also shows some outliners in the linear relationship regression, and they correspond to subjects with BMI > 30. We decided to re-analyse data excluding the outliners and we obtain better results as shown in Figure 7. Obesity is a complex disease where internal and external factors play together, excluding these subjects we have the possibility to study the role of food literacy in the contents of normal weight. Food literacy is a powerful variable that can help the maintenance of weight. When obesity is present, the food knowledge does not be longer sufficient to determinate behavioural chance. Doesn't emerged other psychometric or anthropometric relationship with food literacy.

Fig. 6: Relationship food literacy and BMI parents

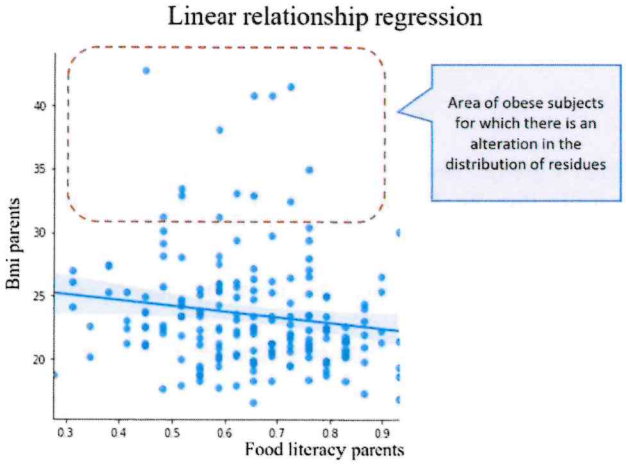
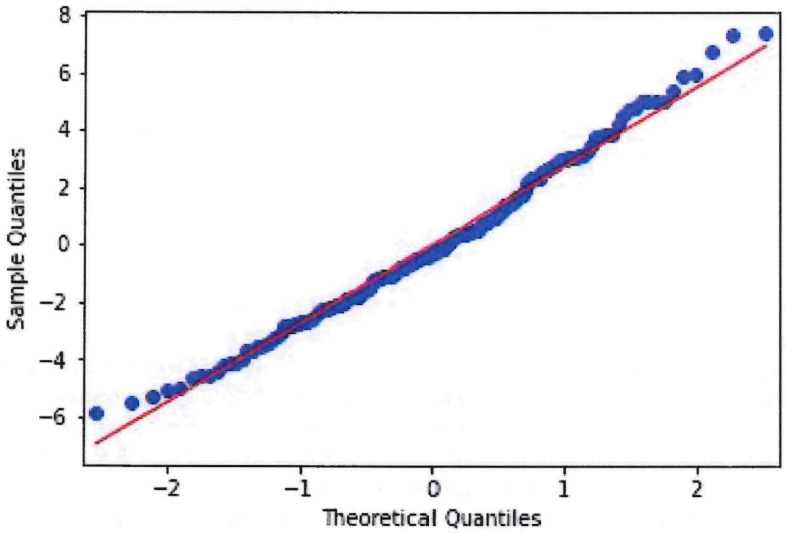


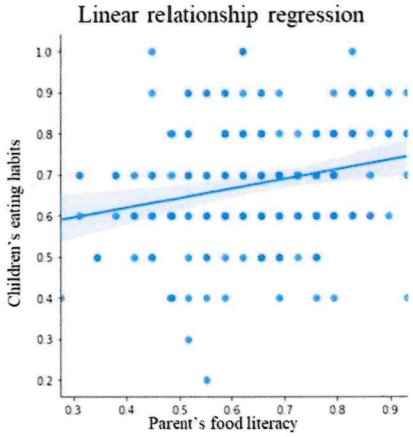
Fig.7 Q-Q Plot – Residue distribution eliminating BMI>30.



We can affirm that eating habits can influence BMI and chronotype's children. As the parent's case, the children's eating habits are statistically related to BMI in an indirect way (p-value < 0.009, homoscedasticity > 0.513, normal distribution of residues > 0.702). Also, chronotype is related to eating habits (p-value 0.02, homoscedasticity > 0.72, normal distribution of residues > 0.62).

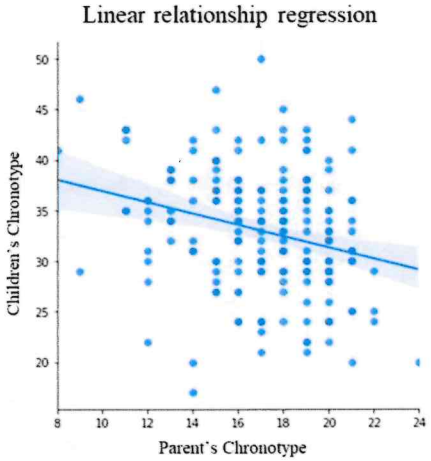
A strong relationship emerged between parent's food literacy and children's eating habits confirming the third hypothesis (p-value < 0.001, homoscedasticity > 0.44, normal distribution of residues > 0.73) (Fig. 8)

Fig. 8: Relationship parent's food literacy and children's eating habits.



For the children's and parent's groups resulted a significant relationship (p-value < 0.0002, homoscedasticity > 0.72, normality of residue > 0.81) (fig. 9). We tested the relationship also for BMI but it doesn't emerge values statistically significant.

Fig. 9: Relationship parent's chronotype and children's chronotype



Research limitations. *There are limitations to consider when interpreting the results of the study. The first one is the reduced sample size that reduce the generalizability of our finding to the Italian population. Additionally, we have to consider that the group is not really heterogeneous as the subject involved were recruited from common places for example the neighbouring residence, the same sport club or children's school. Again, these could imply that the taken sample does not reflect the diversity of the Italian population. Furthermore, we asked parents to answer questions on behalf of their children, which may have introduced the social desirability bias and it has an impact on the truthfulness of the answers. In that case the main risk is that the subject answers base on his own perception and memory. Although our study presents limitations, this research is fundamental in establishing a starting point for future research. In the future we plan to expand the sample and to make it more heterogeneous. Furthermore, we would like to investigate the psychometric variable adopting more accurate tools, for example to apply neuroscience technique as actigraphy to monitor sleep quality and to use food diary to collect eating habits. These instruments were not used for this study because this was an exploratory pilot study.*

Managerial implications. *Considering obesity one of the most impactful causes of a lot of disease as cardiovascular, cancerogenic, respiratory issues both for adulthood and childhood (Kumar and Kelly 2017; Pi-Sunyer 2002), the main goal of institution is to reinforce primary and secondary prevention approach. Most of the social campaign work on the environmental characteristics to induce a positive behavioural chance. For example, one of the most used approache is to increase the awareness and the knowledge of healthy lifestyle; these campaigns appear to be useful and consistent, however our results suggest an integrative prospective. Results also consider the relevance of the psychometric variable as the chronotype and chrono nutrition highlighting their impact on the daily lifestyle, even if they are variable related to internal characteristics. Using that variable to create a targeted communication to adult and children could be useful to impact on dietary change. We believe that our work would have an important contribution for social campaign programmes in establishing a more personalised communication towards their target group. Furthermore, we strongly believe the familiar content should be consider as a new target unit. It's important*

emphasise the parental role and improving the familiar environment to impact indirectly also the dietary. Change the familiar environment first, makes the best condition for apply the knowledge of good eating habits.

Originality of the paper. *Considering the literature, we chose to focus on determinants that influence dietary habits directly and indirectly within the family unit (parent/child). Few studies focus on the influences of the parent on the child and, there are no research studies that analyse dietary habits in a family unit by also taking the chronotype into account. Our novelty lies in having studied the impact of psychometric variables (chronotype and chrononutrition) in the family unit with the aim of being able to use these results in the future to better understand how to set up the communication of a behavioural change in eating habits campaign. Therefore, to the best of our knowledge no prior study correlated, anthropometric psychometric variable for example, the parent's food literacy with the child's chronotype or BMI. In improving diet quality and health of future generations, we suggest studying family's eating habits and to define areas of intervention. The way parents behave influences, even unintentionally, the upbringing and behaviour of children, creating a pattern of habits that they are likely to carry into the future. Therefore, society should contemplate this aspect considering also the parent's involvement in social campaign to encourage them to adopt virtuous behaviour to set up best conditions to behavioural change in their children.*

Keywords: *Parents, children, dietary behaviours, food literacy, chrono nutrition, psychometric profiling, nutrition education*

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