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Grand challenges: companies and universities working for a better society

Extended Abstracts

University of Pisa - Sant'Anna School of Advanced Studies, Pisa

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Electronic Conference Proceedings

Extended Abstracts

a cura di

Sandro Castaldo, Elisa Giuliani, Marco Frey e Marta Ugolini

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Al Lettore,

questo volume accoglie gli extended abstract del Convegno Sinergie-SIMA 2020, dal titolo *Grand challenges: Companies and Universities working for a better society*, Università di Pisa, Scuola Superiore Sant'Anna, Pisa, 7-8 settembre 2020.

Le società contemporanee si trovano di fronte a un bivio: da un lato i governi sono sotto pressione per raggiungere obiettivi ambiziosi di crescita economica, dall'altro tale crescita alimenta complesse sfide ambientali e sociali, parte degli obiettivi di sviluppo sostenibile, o Agenda 2030, delle Nazioni Unite. Ciò spinge verso un ripensamento del capitalismo così come tradizionalmente inteso.

Lo scopo del Convegno è di discutere del ruolo delle imprese e dell'università per affrontare queste sfide. Per quanto riguarda le imprese, un focus particolare è rivolto agli impatti positivi che esse possono esercitare sulla società e sull'ambiente attraverso varie iniziative: dagli investimenti responsabili al coinvolgimento degli stakeholder per affrontare rilevanti problematiche sociali. Altrettanto articolato è il contributo che le università possono offrire attraverso le proprie attività di ricerca, formazione e terza missione.

Gli Extended Abstract racconti in questo volume affrontano la tematica con una varietà di argomenti, punti di vista, prospettive.
Vengono altresì proposti studi e ricerche sul più ampio e generale capo del management, cui spetta un ruolo da protagonista anche al di fuori delle imprese.

Sandro Castaldo, Elisa Giuliani, Marco Frey e Marta Ugolini

Cari Lettori e Convegnisti,

il *call for paper* del Convegno Sinergie-SIMA 2020 Conference dal titolo *Grand challenges: companies and universities working for a better society* ha previsto la possibilità di presentare *extended abstract* oppure *full paper*. In totale sono pervenuti in redazione 113 *extended abstract* e 35 *full paper*.

Per gli *extended abstract*, la valutazione dei contributi ricevuti è stata operata dai Chair e dal coordinamento scientifico in base alla coerenza con il tema del Convegno e/o con gli studi di management secondo l'articolazione dei Gruppi Tematici SIMA. Sono state altresì valutate la chiarezza e la rilevanza (anche potenziale) dei contenuti proposti.

Per i *full paper*, la procedura di valutazione dei contributi è stata condotta secondo il meccanismo della *peer review* da parte di due referee anonimi, docenti universitari ed esperti dell'argomento, scelti all'interno dei soci SIMA e della comunità di Sinergie.

In particolare, nella valutazione dei contributi i referee hanno seguito i seguenti criteri:

- chiarezza degli obiettivi di ricerca,
- correttezza dell'impostazione metodologica,
- coerenza dei contenuti proposti con il tema/track del convegno e/o con gli studi di management,
- contributo di originalità/innovatività,
- rilevanza in relazione al tema/track del convegno e/o agli studi di management,
- chiarezza espositiva,
- significatività della base bibliografica.

L'esito del referaggio ha portato a situazioni di accettazione integrale, accettazione con suggerimenti e non accettazione. In caso di giudizio discordante la decisione è stata affidata ai Chair. Ogni lavoro è stato poi rinviato agli Autori completo delle schede di referaggio per la attuazione delle modifiche suggerite dai referee.

A seguito del processo di valutazione sono stati accettati 23 *full paper* e 111 *extended abstract*, pubblicati in due distinti volumi.

Tutti gli *extended abstract* di questo volume sono stati presentati e discussi durante il Convegno e pubblicati *online* sul portale della rivista Sinergie (***www.sijm.it***). Quest'anno sono anche disponibili on line i video con le presentazioni registrate dagli Autori.

Nel ringraziare tutti gli Autori per la collaborazione ci auguriamo che questo volume contribuisca a fornire un avanzamento di conoscenze sul ruolo che le imprese e l'università possono svolgere per conciliare la crescita economica e la necessità di affrontare le complesse sfide globali ambientali e sociali.

I Chair e il Coordinamento Scientifico

Marco Frey, Elisa Giuliani, Marta Ugolini, Sandro Castaldo,
Arabella Mocciaro Li Destri, Angelo Bonfanti

INDICE

Biology and entrepreneurship: how they can meet?

MARIACARMELA PASSARELLI[*] VALENTINA CUCINO[•] ERIKA CIONE[♠] ALBERTO DI MININ[**]
ALFIO CARIOLA[••] ROBERTO CANNATARO[♠♠]

Objectives. *Macro (entrepreneurial environment and socio-economic macrosystem) and micro (personal turbulence) environments, provide several stimuli (Tang, 2008) to entrepreneurs. They are always under pressure (Imran et al., 2016) and often find themselves reacting to external stimuli in a complex macrosystem. In a complex macrosystem, especially when catastrophic event happen, entrepreneurship is required to be involved in a process of opportunity identification, evaluation, and exploitation (Shane and Venkataraman, 2000), in order to keep the competitive advantage.*

Entrepreneurial opportunities bring into existence new goods, services, raw materials, and organizing methods that allow outputs to be sold at more than their cost of production (Casson, 1982). These opportunities are concrete realities in the environment waiting to be noticed, discovered, or observed by entrepreneurs (Kirzner, 1979; Shane, 2000). They are objective phenomena that are always not known to all parties (Shane and Venkataraman, 2000). Therefore, by definition, opportunity is unknown until discovered; and one cannot search for something that one does not know exists (Kaish and Gilad, 1991). Entrepreneurs do not discover entrepreneurial opportunities through search, but through recognition of the value of new information that they happen to receive through other means (Kirzner, 1979).

The focus of the current paper is to understand why some people identify entrepreneurial opportunities and others do not, especially in a turbulent context, where unexpected exogenous events happen. Studies have shown that one or more factors influence an individual's ability to recognize opportunities (Cliff et al. 2006; Cooper and Park 2008). Thus, studying these factors explicitly provides a deeper understanding of the reasons underlying the entrepreneurial recognition process and more thoroughly explains why some individuals can recognize opportunities and others cannot (Shane 2000; Baron 2006). Studies have shown that one or more factors influence an individual's ability to recognize opportunities (Cliff et al. 2006; Cooper and Park 2008). Thus, studying these factors explicitly provides a deeper understanding of the reasons underlying the entrepreneurial recognition process and more thoroughly explains why some individuals can recognize opportunities and others cannot (Shane 2000; Baron 2006) especially in a turbulent context. A recent turbulent environment has been generated by the COVID-19 health emergency. Indeed, the lockdown has created a unique context for studying the reaction of entrepreneurs.

In the literature, six factors influence opportunity recognition (George et al., 2016): prior knowledge, social capital, cognition/personality traits, environmental conditions, alertness and systematic search. In this paper we focus on alertness because it best represents the concept of "readiness" opportunity recognition. The present work focuses on Alertness. It is defined as "the ability to notice, without search, opportunities that have hitherto been overlooked" (Kirzner, 1979, p.48), endeavor to discover and exploit opportunities. Kirzner (1997) distinguishes discovery from successful search of opportunities and suggests that alert individuals discover opportunities by surprise. However, Kirzner's alertness by no means implies pure accident either. Rather, the notion of opportunity discovery is midway between that of deliberate search and that of sheer windfall gain generated by pure luck (Kirzner, 1997). From this perspective, entrepreneurs do not discover entrepreneurial opportunities through search, but through recognition of the value of new information that they happen to receive through other means. A concept that well expresses the meaning of alertness is "Flashes of superior insight"(Alvarez and Busenitz, 2001)."Flashes of superior insight" refer to entrepreneurial alertness, which assists an individual in opportunity recognition when it presents itself or even if it does not exist (Alvarez and Busenitz, 2001).

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Alertness has been studied in several ways. Miao and Liu (2010) study the individual psychological factors (entrepreneurial alertness and prior knowledge) which influence alertness. Garcia-Cabrera and Garcia-Soto (2009) study the individual's cognitive capabilities which influence the Alertness. Sambasivan et al. (2009) study alertness as mediator of the relationship between personal qualities and venture performance. Entrepreneurial alertness is still loosely defined both conceptually and empirically in the extant literature, even if different studies put effort in analyzing the concept. While psychological variables are frequently investigated, physiological variables have played a peripheral role in the study of management (Zhang and Zyphur, 2015). No one in literature considers the biological approach. We define the biological perspective on management as the set of studies that examine the genetic influences (Arvey et al, 2016; Lindquist et al., 2015;2016). These studies form the basis for a new school of thought that incorporates human biology, dosing blood biochemical molecules, into explanations of management behavior (Shane, 2009; Shane et al., 2010, Shane and Nicolau, 2015, Nofal et al., 2018).

As mentioned above, entrepreneurs are always under pressure and they must continuously react, to recognize and exploit opportunities. This mood has a connection with a well-known concept in biology "The fight-or-flight response". The fight-or-flight response, also known as the acute stress response, refers to a physiological reaction that occurs in the presence of something that is alarming, either mentally or physically (Goldstein, 2008;2010). The fight-or-flight response can be activated due to both real and imaginary stimuli (Goldstein, 2010). The fight-or-flight response plays a critical role in how people deal with stress in the environment. The flight or fight response can be activated instantly when needed and the reaction is very rapid and happens unconsciously. The sympathetic nervous system triggers the fight-or-flight response before people consciously make any decision on how to act. When the perceived stimulus passes, the parasympathetic nervous systems begins to return the body back to balance. Then, an opportunity has been felt, identified and recognized; then, a new equilibrium is reached. Form a physiological point of view, the hormones testosterone, and cortisol affect how organisms react to stress (Klein, 2013). Adrenaline, cortisol, norepinephrine are the three major stress hormones, explained. Both testosterone and cortisol bind to steroid-responsive centres in the amygdala (Wood, 1996), a brain structure centrally involved in emotional processing (LeDoux, 2000), where approaching (e.g. fight) (testosterone) or avoidant (e.g. flight) (cortisol) behavior is facilitated (Schulkin, 2003). It has been widely demonstrated that the brain area known as amygdala that belongs to the sympathetic nervous system (SNS), is susceptible to testosterone (Sar et al., 1990, Johnson et al., 2005) as well as to cortisol. It is already well-known that the fight-or-flight reactions are induced by the SNS (Johnson et al., 1992). Approaching (fight) or avoidant (flight) behaviors are facilitated in the amygdala by testosterone and cortisol, respectively (Sherman et al., 2012; Sellers et al., 2007). Taken together, this suggests that, the testosterone: cortisol ratio involved in the SNS-amygdala relationship, regulates the response to (micro and micro) environmental stimuli (Hermans et al, 2008) . In other words, the testosterone:cortisol ratio can be used as a biomarker for human fight-or-flight reactions (Montoya, Estrella R et al., 2012). In addition, the activation of the amygdala by angry faces vs. happy faces is positively correlated with the resting testosterone:cortisol ratio (Hermans et al, 2008). The dual-hormone hypothesis posits that testosterone's role in status-relevant behavior should depend on concentrations of cortisol, a hormone released in response to physical and psychological stress. Thus, high testosterone/low cortisol ratios seem to predict approach motivation or reward sensitivity. In these motivational stances, individuals are more likely to confront threat (Terburg et al., 2009).

Thus, in this explorative study, we attempt to propose a physiological measure of entrepreneurial alertness. We use Testosterone:cortisol ratio as a biomarker for human fight-or-flight reactions (Montoya, et al., 2012), to measure the "alertness " of entrepreneurs in the process of opportunity recognition and exploitation. Our assumption is that the Testosterone:cortisol ratio is not considered as a proxy of life stress-full, instead entrepreneurs live they life as a challenge.

There are studies on testosterone:cortisol ratio in the management literature. Some authors have investigated the relationship between testosterone:cortisolo ratio and sleep (Van Cauter et al., 2008). Others invested the testosterone:cortisolo ratio with taking the risk (Barel et al., 2017). Other studies have highlighted (with a non-invasive prenatal exposure of testosterone with a retrospective marker) the relationship with testosterone:cortisolo ratio and the taking of domain-specific risks related to financial investments and professional career (Bonte et al., 2016). There are also studies on testosterone:cortisolo ratio in the Entrepreneurial literature. Several studies have found that the interaction of testosterone and cortisol in predicting status-relevant behaviors, such as risk-taking and desire to compete after a loss, is not moderated by gender (Mehta and Josephs, 2010; Mehta et al., 2015; Mehta et al., in press).

One study of women found that testosterone and cortisol interacted in predicting reactive aggression, with greater testosterone associated with more reactive aggression but only for women with high cortisol (Denson et al., 2013). Nevertheless, women's testosterone levels tend to be lower and less variable (across women) than men's levels (Dabbs, 1991; Harris, et al., 1996). Thus, for women there is less variation in testosterone to potentially relate to behavior, a problem that may be compounded if women show similarly limited variation in the outcomes typically measured in dual hormone studies (e.g., antisocial behaviors, dominance). Most of the physiological analyses of alertness use salive (Sherman et al., 2015.

There are studies investigating the testosterone:cortisol ratio with the entrepreneurial opportunity (White et al., 2006) and entrepreneurial recognition (Nicolau and Shane 2009; 2014), however, we identified some gaps: (1) none research in management has examined the association between alertness and testosterone:cortisol ratio as well as the neuroendocrine axis strictly associated with. (2) no studies performed physiological analyses of alertness with blood samples (most of them use saliva); (3) no study has associated testosterone: cortisol relationship with entrepreneurial alertness as a gender issue.

In this study, we aim to investigate the role of this ratio as a factor that could influence the individual in entrepreneurial alertness to recognize opportunities to create new firms and/or to generate firms' growth (Fini et al., 2009).

Our research question is the following: "How entrepreneurial alertness is influenced by biological factors?".

Methodology. *The methodology of this study is based on two steps. First, the authors administered an explorative questionnaire to verify the entrepreneurial alertness (Tang et al., 2012) and entrepreneurial intent (in January 2020). The questionnaire was divided into three parts: the first part collects general information (age, gender, profession), the second part aims to collect information on the respondent's business intent and the third part measures entrepreneurial alertness. The questionnaire is still active and to date has a total of 180 responses. The questionnaire was administered online on the main professional networks (LinkedIn and Facebook). In the last part of the questionnaire we asked for the availability to participate an exploratory study based on a clinical routine hormones blood analysis.*

Among 180 people, 8 people gave their willingness to supply their blood sample. According to Cooke et al., (2020) for this first study, we selected only women (they were 4). Since this study is going to consider the testosterone: cortisol ratio, the exclusion of men was essential to ensure reliability of the result. Indeed, this can be influenced in men by sexual behavior, therefore in this preliminary study, we did not consider them. We choose businesswomen instead of men to have a category of subjects in which testosterone levels are tightly controlled by estrogens (of course this cannot be possible for men). The main characteristics of the 4 female entrepreneurs involved in the explorative analysis, are described below (although in our case series, one case is in menopausal she is under estrogens therapy, the influence could be related to the management of their business):

Case 1: *she is an entrepreneur who lives between Italy, Switzerland and the United States. He is 53 years old. She is divorced but is currently engaged and has no children. She has managerial skills. She operates in the financial sector.*

Case 2: *she is an entrepreneur who lives in Italy. She is 42 years old. She is not busy and has no children. In addition, she has managerial skills. She operates in the wellness sector.*

Case 3: *she is an entrepreneur who lives in Italy. She is 36 years old. She is not busy and has no children. She has no managerial skills. She operates in the wellbeing sector.*

Case 4: *she is an academic entrepreneur who lives in Italy and a biomedical scientist who travels all over the world. She is 46 years old, married and has two children. She has no managerial skills. She operates in the health sector and in the medical devices sector.*

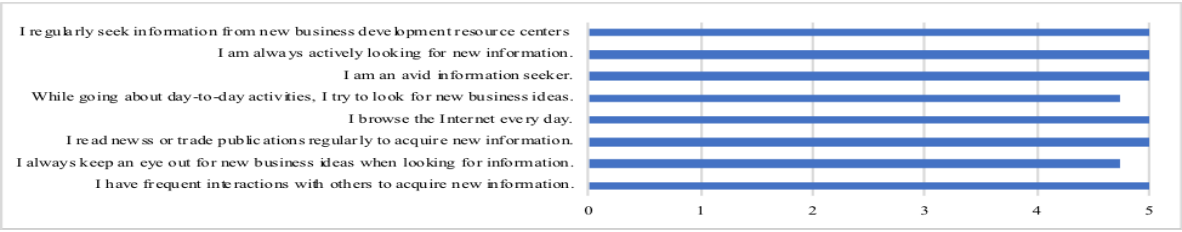
The second step is an exploratory qualitative study that aims to provide a first evidence on the phenomenon from a physiological point of view. Exploratory studies are known in management. Indeed, there are studies on the relevance of leadership in organizational life that use for example, the functional magnetic resonance imaging (Boyatzis et al., 2012). In this step, all participants were volunteers and underwent clinical routine hormones blood analysis (at the end of February 2020, just some days before the COVID-19 lockdown). The trials were deemed not to constitute clinical trials and were not registered as such. All participants were tested also for metabolic disease (such as diabetes), renal diseases, and liver dysfunction. No one of the participants was on drug therapy. About the clinical biochemistry parameters, blood samples were collected for clinical biochemistry markers were determined as following: glucose, total cholesterol, HDL, LDL, TG, γGT, as well as AST, ALT and creatinine with ADVIA 1800. Neuroendocrine axis hormones profile, TSH, T3, ACTH, Cortisol, Testosterone (free and conjugated) by ELISA with CENTAUR XP. Efficiency of glomerular filtration rate (eGFR) was calculated by the abbreviated MDRD equation as following: 186 x (Creatinine/88,4)$^{-1,154}$ x (Age)$^{-0,203}$ x (0,742 for female). Testosterone: cortisol ratio was calculated after conversion of testosterone from pictograms/deciliter into micrograms/deciliter.

Findings. *This exploratory study provides some preliminary results. First, we get the results from the explorative questionnaires. Information was collected on the lifestyle and nutrition of the volunteers for analysis. The entrepreneur women interviewed do not conduct special diets. However, they said they preferred healthy food and had moderate sports. In all cases, women entrepreneurs consider themselves as* innovative *people, even if with different risk attitudes.*

The first evidences of the questionnaires show an alignment towards the three dimensions of the entrepreneurial alertness, suggested by the literature.

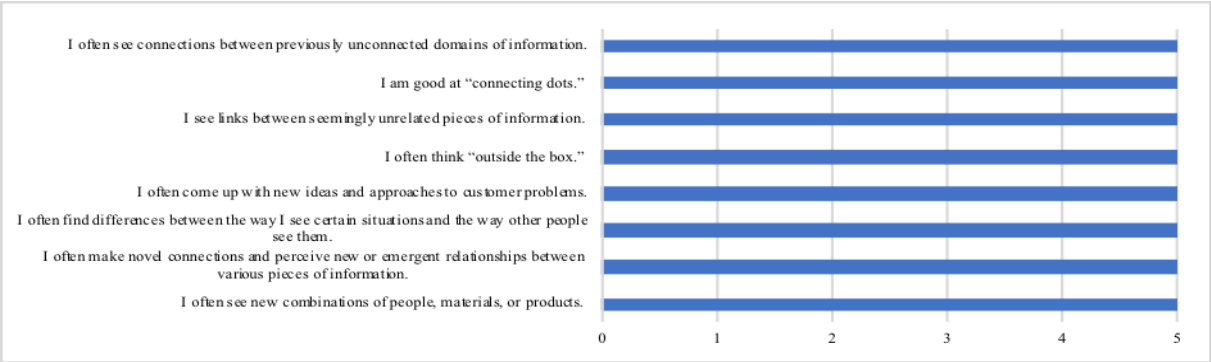
The data show the average values of the respondents. On average, respondents frequently search for information from different sources (Figure 1) and easily manage to associate this information with others (Figure 2). Finally, they perceive that they can sense potential opportunities and make decisions accordingly (Figure 3).

Fig. 1: Scanning and search



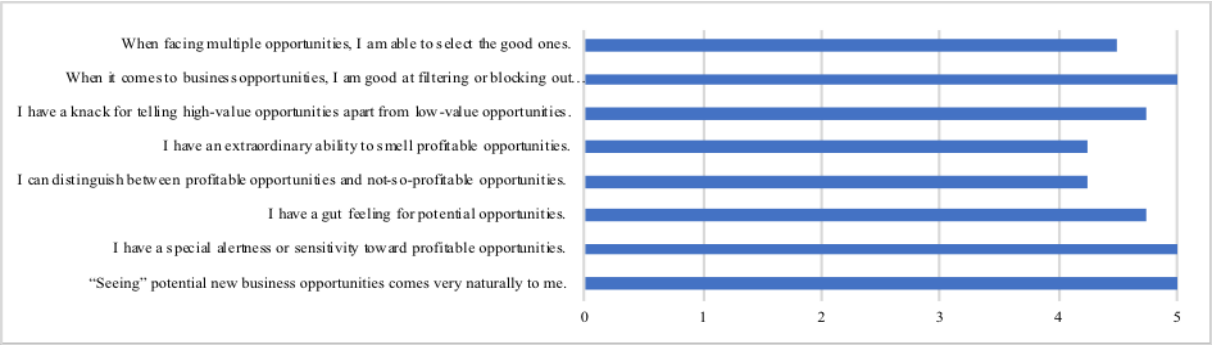
Source: authors elaboration

Fig. 2: Association and connection



Source: authors elaboration

Fig. 3: Evaluation and judgment

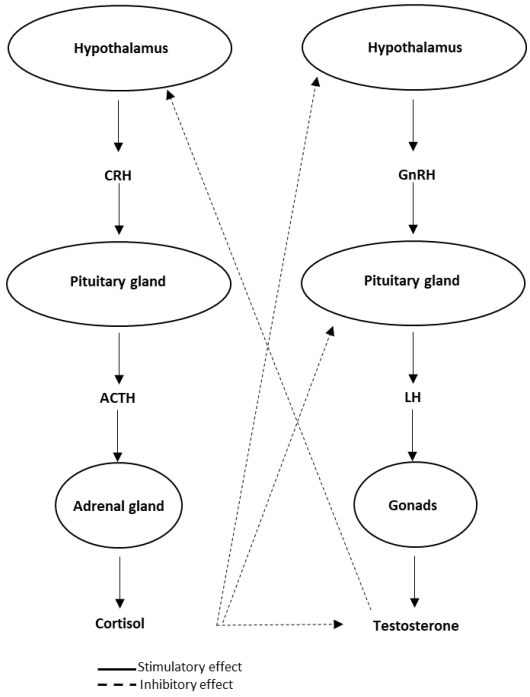


Source: authors elaboration

We get some results also from the exploratory study on blood samples, to analyses "alertness" from a physiological point of view.

In this part, the case series, four women (described above) were enrolled in order to evaluate the neuroendocrine axis linked to the testosterone:cortisol ratio (figure 4). This latter two hormone can be influenced in men by sexual behavior (therefore in this preliminary study, we did not consider them).

Fig. 4: Neuroendocrine axis hormones involved in the synthesis of cortisol and testosterone.



Source: authors elaboration

The subjects were tested for glucose, total cholesterol, HDL, LDL, TG (table 1), to prove no presence of metabolic disease (such as diabetes), as well as AST, ALT, γGT, creatinine and, eGFR to prove no presence of liver dysfunction, and renal diseases, respectively (table 2). The hypothalamus and pituitary hormones involved in the neuroendocrine axis control was also assessed (table 3). The testosterone and cortisol levels are shown in figure 5A and B. The testosterone:cortisol ratio is shown in figure C.

Tab 1: Circulating levels of metabolic substrates

	Glucose (mg/dL)	*Total cholesterol (mg/dL)*	*HDL (mg/dL)*	*LDL (mg/dL)*	*TG (mg/dL)*
Case 1	*94*	*237*	*79*	*138*	*100*
Case 2	*86*	*257*	*78*	*-*	*67*
Case 3	*68*	*255*	*87*	*138*	*-*
Case 4	*85*	*212*	*118*	*89*	*62*

Source: authors elaboration

Tab 2: Circulating levels of liver enzymes and renal biomarkers.

	AST (IU/L)	*ALT (IU/L)*	*γGT (IU/L)*	*Creatinine (mg/dL)*	*eGFR (mL/min/1,73m²)*
Case 1	*18*	*28*	*11*	*0,77*	*72*
Case 2	*20*	*18*	*16*	*0,80*	*75*
Case 3	*14*	*19*	*13*	*0,93*	*71*
Case 4	*13*	*15*	*11*	*0,71*	*83*

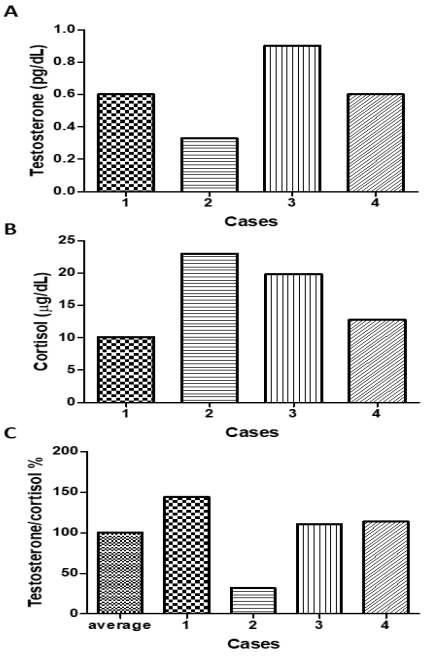
Source: authors elaboration

Tab 3: Circulating levels of neuroendocrine axis hormone.

	Prolactin (ng/mL)	*ACTH (pg/dL)*	*TSH (μUI/mL)*	*T3 (pg/mL)*	*T4 (mg/dL)*
Case 1	*8,55*	*8,37*	*2*	*3,53*	*-*
Case 2	*15,90*	*21,7*	*1,22*	*5*	*17,1*
Case 3	*12,33*	*14,8*	*0,9*	*2,01*	*-*
Case 4	*13,26*	*16,9*	*1,44*	*3,6*	*14,2*

Source: authors elaboration

Fig 5: A) testosterone; B) cortisol levels in four entrepreneurships. C) average and single data of the testosterone and cortisol ratio



Source: authors elaboration

The clinical biochemical parameters showed a healthy state of the subjects. The neuroendocrine axis was in the physiological range. Therefore, the testosterone: cortisol ratio was calculated, probably significantly associated with the type of the firm in case 2. In fact, in this case, the entrepreneur manages a family business.

Research limits. *The present research has two main limitations. First, research is still work in progress. This paper is a first exploratory analysis of the theoretical phenomenon. Considering the exploratory nature of the paper we can only interpret the possible meanings of these results in the light of previous research. Future studies will be needed to test these interpretations on a large sample of entrepreneurs.*

Second, the research considers only testosterone: cortisol ratio as a biomarker for entrepreneurial alertness, even if, in the case series presented here we are strengthening a group of pituitary and thyroid hormones that act on the nervous system.

Future research will repeat all the analysis (questionnaire and clinical routine hormones blood analysis) in the period post-lockdown, and we will compare the results; moreover, we will consider also other drivers to measure the personal environment (ex: psychological items, life experiences, etc). Moreover, next studies will test a large sample of entrepreneurs, by comparing also academic and non-academic entrepreneurs. Then, we will test with mydriasis visualizer.

Practical implications. *This study contributes to entrepreneurial supervision literature in three ways. First, this research is the first study that brings together literature on hormones and that on entrepreneurial opportunity recognition. In fact, the study provides empirical evidence of the importance of the relationship between testosterone: cortisol relationship and entrepreneurial alertness. In particular, the relationship between testosterone: cortisol ratio and the entrepreneurial alertness is positive in three out of four cases. Only in one case (case 2), a different trend is registered, probably because of the company's genesis. In fact, in this case, the entrepreneur inherited the business from her family.*

Second, the document provides empirical evidence with a procedure that is not yet used. In fact, most of the existing studies in literature analyze the relationship between hormones and entrepreneurship from a psychological and cognitive point of view. Moreover, most of the studies uses a saliva collection method. However, although saliva collection is a good indicator of hormone measurement, it is not as effective and accurate as analyzing the blood sample.

Third, it is the first study entirely focused on the hormone and female entrepreneurship relationship. Most of the studies seem to analyze the differences between female entrepreneurs and male entrepreneurs. However, this is one of the few studies that considers only women. The results related to the physiological parameters provide important hints both to the personal lifestyle of entrepreneurs, and to the possible best team building, in order to have a sustainable competitive advantage and to address key societal challenges.

Originality of the study. *As mentioned above, there are studies on testosterone: cortisol relationship in the entrepreneurial literature. Several studies have found that the interaction of testosterone and cortisol in predicting state-relevant behaviors, such as risk-taking and the desire to compete after a loss, is not moderated by gender (Mehta and Josephs, 2010; Mehta et al., 2015). A study conducted on women found that testosterone:cortisol ratio interacted in predicting reactive aggression, with higher testosterone associated with more reactive aggression but only for women with high cortisol (Denson et al., 2013) . However, most of the analysis use saliva (Sherman et al., 2015) and no studies have associated testosterone:cortisol ratio with entrepreneurial alertness as a gender issue.*

This study is one of the first exploratory studies that provides blood sample analysis and binds the relationship between testosterone: cortisol ratio in the female entrepreneurial alertness.

Key words: *entrepreneurship; testosterone:cortisol ratio; biology; blood analysis*

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