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Learning from the Patient - The Cooperative Endeavor of Analytic Psychotherapy

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Abstract

Communication involves intimate human interaction that creates shared realities and forges connections. Nowhere is this more apparent and more necessary than in the therapeutic relationship, where the communication is, essentially, the curative agent. By following the patient's lead, the many nuances of the various levels of communication are harnessed to promote insight and understanding. In this way, that analytic space becomes grounds for new restorative experiences and healing.

Keywords: Learning, Patient, Cooperative, Endeavor, Analytic, Psychotherapy

Introduction

"Psychotherapy is the systematic use of a human relationship for therapeutic purposes"

Hans Strupp, Vanderbilt University Psychologist

Psychoanalysis and its related therapeutic process can be conceptualized as both a science and an art. As a science, it seeks to forge an understanding of the human mind. As an art, it may be considered the endeavor by which an individual, in close relationship with an analyst, may become acquainted with his/her unconscious feelings and release imprisoned emotions, giving up illusions that were once useful, but have become exaggerated, redundant or outmoded and thus cause pain and dysfunction. Methods of psychoanalytic therapy, "provide for a situation in which a systematic exploration is undertaken of the patient's automatic, unconscious, defensive solutions to conflict, based on the fact that since childhood he or she has perceived certain wishes, fantasies, emotions and impulses as too dangerous to manage at a conscious level" (Moore & Fine, 1990, p.16). The major aim of such exploration is to help the patient achieve increasingly mature, conscious or preconscious solutions to his or her conflicts.

Often referred to as the "talking cure", psychotherapy relies heavily on the interaction and relationship between therapist and patient, which develops through extensive

communications. However, communication in a therapeutic environment, occurs on many levels and is not limited to the direct and explicit verbalizations that ensue in a session. On the contrary, the very nature of analysis determines that the majority of communication which addresses the underlying issues relevant to therapy is not of a direct and obvious nature. It is the derivative communication, “the indirect communication of thoughts or feelings unconsciously associated to or derived from whatever has primarily provoked them” (Casement, 1992, p. 14), and the subsequent response of the therapist to this communication, that often serves to direct therapy in a forward motion toward the exploration of the patient’s unconscious conflicts. It can be argued that in the context of therapy everything that occurs is a communication of some type. Greater attention to the content and process of interactive communication in the therapy session, while suspending premature theory-based interpretations, can facilitate the development of the trusting relationship and the progress toward more effective insight and subsequent change.

Elements of the Psychoanalytic Process - How One Learns from the Patient

Symptom Formation

Sigmund Freud hypothesized that symptoms of psychopathology arise when conflicting emotions produce unmanageable psychic distress. Mirroring scientific notions regarding the conservation of energy, he theorized that psychic conflict creates an energy imbalance in the psychiatric apparatus that manifests itself in the subjective experience of anxiety, which, in turn, induces the psyche to relieve the distress by transferring awareness of the conflict into the unconscious. This process of psychic repression, however, is typically incomplete and elements of awareness leak into consciousness, again causing anxiety. In response, the psychic apparatus further attempts to relieve the anxiety by transforming it into a neurotic symptom. In essence, Freud posited psychic defenses against intrapsychic conflict and anxiety and considered symptom formation largely as a consequence of the failure of the psychic defense mechanisms (Goldman, 2011).

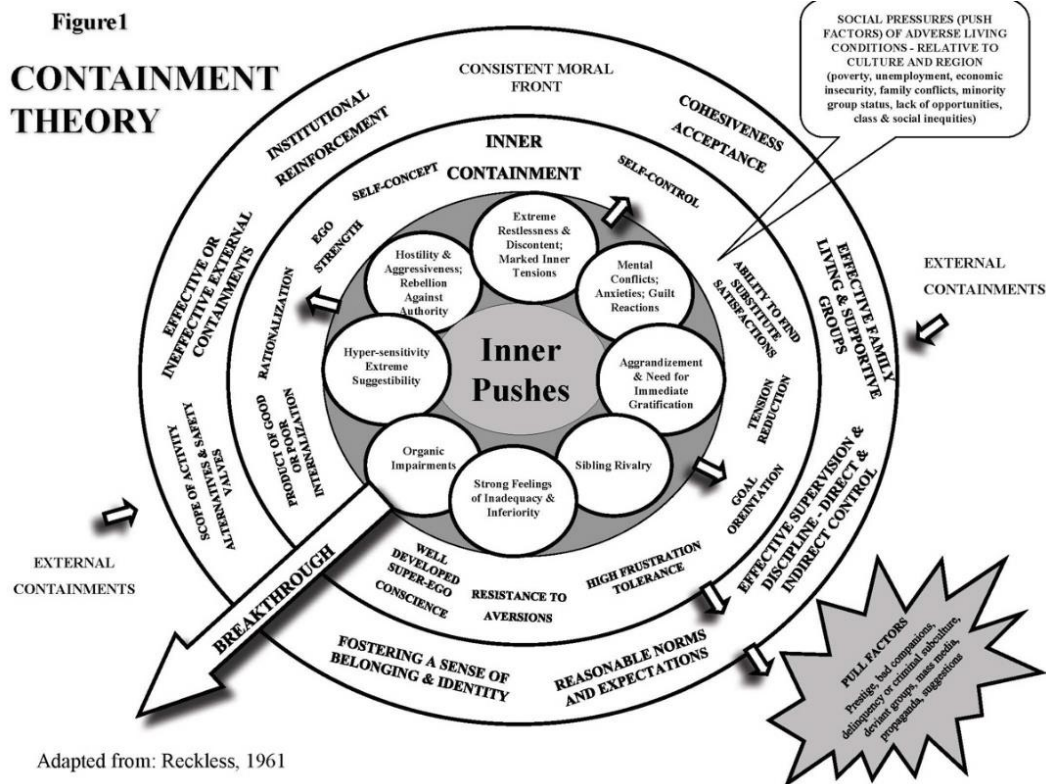
(See Table 1)

Table 1: Psychic Defense Mechanisms Goldman, H. H. (2011). <i>Review of general psychiatry, 10e</i> . New York, NY: McGraw-Hill.	
Denial	The unconscious literally deletes from awareness an unpleasant or anxiety-provoking reality.
Sublimation	The redirection of an unacceptable impulse into an acceptable form of behavior.
Reaction Formation	The redirection of an unacceptable impulse into its opposite.
Displacement	An impulse toward a given person or situation is redirected toward a “safer” less distressing object.

Projection	An unacceptable or anxiety-provoking impulse or affect is transplanted to another individual or situation.
Rationalization	An acceptable explanation for a feeling or behavior is used to camouflage the unacceptable underlying motive or impulse.
Intellectualization	The avoidance of “feeling” by taking refuge in “thinking”.
Repression	Disturbing psychological material is secondarily removed from consciousness or primarily prevented from becoming conscious.
Isolation of Affect	The removal of disturbing affect from an idea or event, with the dispassionate details or description remaining.
Suppression	Intentional repression of unpleasant conscious material.
Humor	A conscious and unconscious defense that allows material that stirs unpleasant affects to be better tolerated in consciousness.

Correspondingly, Walter C. Reckless proposed the Containment Theory which posited dysfunctional behavior (or alternatively functional behavior) as the product of interplay between various forms of stressors, known as pushes or pulls, and internal and external controls, known as containments. While originally formulated as a sociological premise, Containment Theory is extrapolated to a representation of intrapsychic functioning and conflict, encompassing the unconscious structure of both adaptive and maladaptive responses. It assumes that for every individual there exists, in varying levels of strength and functionality, containing external structures as well as protective internal structures. The relative integrity and stability of these entities determines one's predisposition toward either health or dysfunction (Reckless et al., 1956; Reckless, 1961, 1967). Therapy then, would seek to make conscious and fortify these psychic structures.

(See Figure 1)



Transference and Countertransference

The psychoanalytic orientation to psychotherapy specifically emphasizes the processes of transference and counter-transference in the progression of the therapeutic relationship. Transference refers to “the largely unconscious displacement of patterns of feelings, thoughts and behavior, originally experienced in relation to significant figures during childhood, onto the therapist or other significant figure” (Moore & Fine, 1990, p. 196). As therapy progresses transference concentrates more pointedly on the analyst and increases in intensity as it serves to replicate the childhood neurosis. Patients strive to elicit in an analyst a duplication of their basic life struggles, and analysts must interpret that transference while regressively experiencing and containing their own countertransference. In this way the analyst’s personal anonymity and neutrality creates a frame within which the transference issues can be worked through and resolved.

According to Freud, (1910; 1963) the concept of transference constitutes a one-person, intrapsychic construct reflecting the patient’s psyche. From this perspective, pathology is viewed as a manifestation of the manner and processes in which the individual’s instinctual drives are developed and defended against. Subsequently,

healing occurs when these drives are made conscious in a therapeutic environment through the development of a transference neurosis whereby a patient experiences regression and the drives are displaced from their original objects onto the analyst. In this context, the analyst represents a neutral “blank screen” and therefore does not contribute to the nature of the transference, but rather merely receives the patient’s projections. The analyst “is presented as a vessel for transference, a potential space within which the patient can live infantile life anew” and furthermore, “... is assumed to approach becoming a perfect observing instrument, transcending his or her idiosyncrasy through submission to the powerful analytic process” (Bollas, 2017, p.200). This strategy is designed to maximize conscious scrutiny of a patient’s previously unconscious mental life. Furthermore, this orientation contends that for an analyst to explicitly state his or her own view of reality constitutes a personal disclosure on the part of the analyst that tends to foreclose a patient’s exploration of his or her own view.

Conversely, Moreno (1937) espouses an interpersonal alternative to the intrapsychic perspective, stating that, “Transference does not take place toward a generalized person or a vague Gestalt, but toward a role which the therapist represents to the patient. The therapist, in turn, can be caught in experiencing the patient in complimentary roles” (p.8). Thus, Moreno implies that transference is the product of the engagement of two persons in commendatory roles, which, in terms of the therapeutic context, occurs as the reciprocal influence of therapist and patient represented by the processes of transference and countertransference. From this interactional viewpoint, the therapist is not viewed as a blank screen but rather as an active participant and the therapeutic transference is the product of both the patient’s inner world and the therapist’s behavior. Moreover, Yalom (2005) asserts that increasing therapist transparency would actually decrease transference because the process evolves not through projection but rather through engagement and complementarity.

From either orientation transference can be characterized as “a form of memory in which repetition in action replaces recollection of events” (Corsini & Wedding, 2013, p. 39). It represents the patient’s unconscious communication regarding the inner conflicts and motivations for defenses which constitute the integral issues of therapy. Through analysis and interpretation of the transference neurosis, insights can be gained, repressed memories recalled, issues re-worked in the safe therapeutic environment, and ultimately, substitute sublimated interests developed for effective functioning in the world at large.

Correspondingly, the analyst develops countertransferential reactions to the patient that may encompass a form of negative feelings and/or disproportionately positive, idealizing or even eroticized reactions. Countertransference refers to “the displacement onto the patient of attitudes and feelings derived from earlier situations in the analyst’s own life in response to the patient’s behavior toward the analyst or a

more specific reaction to the patient's transference" (Blum & Goodman, 1999, p.121). Countertransference may exist in relation to a particular individual, to a type of patient, to an aspect of psychopathology, to significant objects and figures in the patient's life, to tangential and adventitious aspects of the patient's current life situation or to his/her history or personality attributes. Additionally, countertransferences are generally a blend of the therapists' own displacements from the past and their reactions to the issues of the patient's transferences. Through this process of interpersonal collaboration therapists often adopt roles in reaction to subtle transference interactional pressures from their patients. Such induced roles indicate to therapists how the patient experiences the therapeutic relationship and provide a glimpse into the kinds of relatedness in the patient's earlier life.

While unanalyzed countertransference reactions are considered negative and even an impediment to effective therapy, conscientious scrutiny of this phenomena can facilitate discernment of the meaning of the patient's feelings, thoughts and behaviors as well as the dynamics of their interpersonal interactions. In many cases, when used appropriately, the process of countertransference makes transference a more efficient and effective agent for change. If, even more than being a blank screen, an analyst can be a detached, safe acknowledgment of the typical way a patient is experienced by others, then this representation can assist in the process of moving the patient beyond the underlying conflict fueling those repetitive reaction patterns. According to Freud, who first noted the existence of this interplay in the therapeutic context, "Countertransference is a major source of the trials and tribulations of the analytic encounter, with the potential for both destructive regression and constructive progress in understanding" (Freud, 1910, p. 151).

This powerful energy flow of transference and countertransference between analyst and patient constitutes the driving force of psychoanalytic work. Commenting on this complex interaction, Bollas (2017) writes, "...for differing reasons and in various ways, analysts re-create their infantile life in the transference in such a determined and unconsciously accomplished way that the analyst is compelled to re-live elements of this infantile history through his countertransference, his internal responses to the analysand" (p.200).

Effective management of the processes of transference and countertransference is essential in understanding the unconscious communication of the patient and ultimately in facilitating progressive insight and change. It is the therapist's role to step back from the subjective experience of these processes as they occur in the therapeutic session and to consider the various cognitive and affective aspects in the context of the patient's life history and problems. In this way, these issues, which characteristically represent recurring patterns of maladaptive and dysfunctional behavior, can be viewed in a new light and used to encourage new, more adaptive and functional responses. Casement (1992, p. ix) refers to this aspect of the therapist's role as the development of internal supervision whereby "analysts monitor the

interaction between themselves and their patients, and their impact upon the analytic process.”

Interpretation and Containment

Within the context of the evolving therapeutic relationship and the dynamic interplay of transference and countertransference previously described, the analyst offers both progressively insightful explanations and emotional support as the patient explores unconscious material. Interpretation refers to the central activity of the analyst during treatment whereby, “the analyst expresses an understanding of the patient’s mental life, based on the patient’s description of memories, fantasies, wishes, fears and other elements of psychic conflict that were formerly unconscious or known to the patient only in incomplete, inaccurate or otherwise distorted form, as well as on the way a patient distorts the relationship with the analyst to meet unconscious needs and to relive old experiences” (Moore & Fine, 1990, p.103). This process of interpretation requires the contribution of both therapist and patient and involves modification as new material emerges. Interpretation allows patients to understand their past and present inner life in a new, less distorted and more complete way, and thus lays the groundwork for the possibility of changes in feelings, attitudes and behavior. In a sense, interpretation represents the overt communication by the analyst based on the cumulative conscious and unconscious communications of the patient and is intended to offer patients explanation and extended knowledge about themselves and the previously unacknowledged aspects of their suppressed unconscious conflicts.

Containment occurs when an individual “projects a part of his or her psyche, especially the uncontrolled emotions, to be held or incorporated by another in a supportive relationship, who absorbs them and translates them into specific meanings, and acts upon them thoughtfully, the whole transaction resulting in a transformation of the projective identifications into meaningful and unthreatening thought” (Moore & Fine, 1990, p.32). Using the vehicle of the transference-countertransference experience patients purposefully communicate their need for the therapist to experience, understand and successfully manage those feelings which the patient has heretofore experienced as unmanageable. Typically, patients bring with them a history of past experiences whereby previous attempts at finding containment in the context of other relationships has failed. In this way, the patients’ desperate need to further suppress the emotions has been reinforced and strengthened. Therefore, unconsciously and/or consciously they expect and seek to induce the same reaction from the therapist. Through the process of analytic holding, the therapist’s ability to endure these emotions and interpret them in such a way that the patient feels truly understood allows patients to develop their own capacity to manage difficult feelings without resorting to the standard defenses of suppression, repression and avoidance (Casement, 1992, 2013).

In order to move the analysis forward toward useful insight, the therapist must, within the context of the ongoing therapeutic processes of transference and countertransference, provide an adequate balance of interpretation and containment. Interpretation without containment establishes a protective and defensive distance from the emotions a patient is communicating, reinforcing the notion that they are dangerously unmanageable and must remain repressed. Containment alone keeps a patient stuck in a dependency state with the therapist in relation to the quagmire of emotions which the patient experiences as unmanageable and bewildering. Through a balance of interpretation and containment the therapist communicates both a willingness and an ability to comprehend, connect with and tolerate those feelings which the patient experiences as overwhelming.

Analytic Space and Analytic Process

The analytic space, unlike the mental and emotional space in any other interpersonal interaction, exists for the purpose of allowing a unique type of relating, involving transference and subsequent working through the patient's resistance which will bring about significant and lasting change. While there is an exchange of ideas, the space exists for, and is focused on, the needs of the patient and is protected from internal and external influences which distract from the primary purpose. In order to be therapeutic, the analytic space must be free from the intrusive pressures of influence, expectation and judgment which exist in the space of most relationships. The therapeutic space allows the patients to spontaneously be, think, feel and express whatever is reflective of their experience of an autonomous self in that moment. It is from these natural projective expressions that the patient will consciously and unconsciously communicate their issues and lead the therapist toward accurate interpretation of their unresolved conflicts. Within the analytic space the analyst provides a reflective viewpoint and monitors his/her countertransference interactions in order to maintain a level of security that allows the patients to risk examination of heretofore repressed internal conflict and feeling states. It is the maintenance of the analytic space and a willingness to respond to the direction indicated by the unconscious communication of the patient which allows for progress in the analytic process.

As part of the analytic process some individuals may benefit greatly from a period of dependency on or idealization of the therapist (Kohut, 2009; Winnicott, 2014). Ultimately, however, for the patient to grow, this mode of relatedness must be worked through. As Kellerman (1985) states, "Learning to see who the therapist really is is one of the unavoidable steps in acquiring a greater capacity for reality testing and for achieving autonomy. The distortion of reality inherent in idealization leaves the patient a child, unable to grow up. And sooner or later patients will realize that they were cheated by a leader who did not challenge their flattering idealizations" (pp. 91-92).

Not-Knowing - the Uncomfortable Realm of the Unknown

Casement asserts that in “any unfamiliar situation elements that can be regarded as familiar are responded to as signs” (1992, p. 9). In this way, therapists as well as patients can sacrifice a true understanding of the uniqueness of a situation for the sake of the comfortable security of moving beyond the not-knowing and into the knowing. For therapists, theory-based expectations of typical behavior or a typical course of therapy can hamper progress by too quickly veering the analyst off course and not leaving room for discovery. Casement further asserts, “If too much weight is given to what is already known, then the unknown remains elusive and our attempts at understanding introduce their own distortions to what is being studied” (p. 190).

Conclusion

Communication has been referred to as “the process of constructing shared realities through human interaction” (Shockley-Zalabak, 2014, p.23). It can be argued that nowhere is it more imperative to establish a genuine understanding of a shared reality than within the context of a therapeutic relationship where the ideal, as first expressed by Freud, is “to replace the unconscious repression of impulses, wishes and attitudes with rational judgment, to give the patient the opportunity to make conscious decisions about his conflicts, to redirect the psychic energy into higher and more valuable social and cultural activities; in essence, to become the kind of individual he would have become had not the neurosis interrupted his development toward maturity” (Freud, 1963, p.68). From the first expressions of symptomatic behavior patients communicate their unconscious search for help and wholeness. Following their lead, the analyst must “be instrumental in generating a new experience of a different order and disconfirming the patient’s pathogenic beliefs” (Ehrenberg, 1984, p.23)

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An Empirical Analysis on the Relationship between Health Care Expenditures and Economic Growth in the European Union Countries

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Abstract

This paper empirically investigates the relationship between health expenditure and economic growth in the European Union countries over the period 1995-2014. By using the Dumitrescu-Hurlin Test (Dumitrescu and Hurlin, 2012) which is developed to test Granger causality in panel datasets (Lopez and Weber, 2017), it is found that there is a unidirectional relationship between these variables and gross domestic product (GDP) per capita. Granger causes health expenditure per capita. After determining the direction of the relationship between health expenditure per capita and GDP per capita we estimate the short run and the long run effects of GDP per capita on health expenditure per capita by using Mean Group (MG) and Pooled Mean Group (PMG) estimators which are developed by Pesaran and Smith (1995) and Pesaran, Shin and Smith (1999) respectively. According to the estimation results, GDP per capita has a positive effect on health expenditure per capita both in the short run and the long run.

Keywords: Health care expenditures, Economic growth, Panel Granger causality analysis, European Union

1. Introduction

Health is one of the significant factors which can have dramatic effects on economic performance of a country. Increasing health care expenditure leads to higher social security, safety and welfare and hence, it improves labour efficiency (Mladenovic et al., 2016).

There are quite a few studies which investigate the impact of health/health care expenditure on economic growth in the existing literature. These studies generally

find that health/health care expenditure has a positive influence on economic growth (see for instance; Rivera and Currais, 2003; Bloom et al., 2004 and LI and Huang, 2009). However, the number of studies which analyse the causality between health care expenditure and economic growth is very low. Unlike previous analyses, in this study we examine the causality between health care expenditure and economic growth in the European Union countries over the period 1995-2014. Moreover, after determining the direction of causality between these variables we estimate the short run and the long run effects of GDP per capita on health expenditure per capita.

The remainder of the paper is structured as follows: in section 2 we present a brief literature review, in section 3 we explain our methodology and data, in section 4 we discuss the results of our empirical analysis and finally in section 5 we conclude.

2. Literature Review

Although there is a vast literature which investigates the effect of health on economic growth the number of studies that focus on the direction of the relationship between health expenditure and economic growth is very low. Here, we briefly summarize the results of recent literature which examine the relationship between health and economic growth.

Rivera and Currais (2003) investigate the influence of health investment on productivity in OECD countries over the period 1960-2000. The authors estimate an Augmented Solow Model by using ordinary least squares and two stages least squares estimators and find that health expenditure has a positive effect on economic growth (Rivera and Currais, 2003).

Bloom et al. (2004) analyse the impact of work experience and health on economic growth for a panel of countries by estimating a production function over the period 1960-1990. According to the estimation results, Bloom et al. (2004) conclude that good health has a positive impact on economic growth.

LI and Huang (2009) examine the effect of health and education on economic growth for Chinese provinces between 1978 and 2005 by estimating Mankiw, Romer and Weil (1992)'s model. The results of this analysis show that both health and education positively affect economic growth (LI and Huang, 2009).

Narayan et al. (2010) analyse the relationship between health and economic growth for 5 Asian countries by drawing on panel unit root, panel cointegration with structural breaks and panel long run estimation over the period 1974-2007. According to the empirical results, Narayan et al. (2010) suggest that there is a long run relationship between health and economic growth and health positively influences economic growth.

Hartwig (2010) examines the impact of health capital formation on GDP growth by drawing on panel Granger causality analysis. Hartwig (2010) uses a data set covering

the period between 1970 and 2005 for 21 OECD countries and finds that health care expenditure does not Granger cause GDP per capita growth.

Wang (2011) investigates the causality between health care expenditure rise and economic growth for 31 countries by using both panel regression and quantile regression techniques over the period 1986-2007. According to the panel estimation results, Wang (2011) argues that while health care expenditure growth has a positive impact on economic growth economic growth decreases health care expenditure growth. However, the results of quantile regression indicate that the effect of health care expenditure growth on economic growth is positive in countries which have medium and high levels of economic growth (Wang, 2011).

Amiri and Ventelou (2012) examine the relationship between health care expenditure and economic growth in OECD countries by using a new version of Granger causality test suggested by Toda and Yamamoto (1995). In the empirical estimations, a data set for 20 OECD countries which covers the period between 1970 and 2009 is used. According to the estimation results, Amiri and Ventelou (2012) suggest that there is bidirectional causality between health care expenditure and economic growth.

Lago-Penas et al. (2013) analyse the relationship between health care expenditure and income for 31 OECD countries over the period 1970-2009. By estimating the short run and the long run elasticities Lago-Penas et al. (2013) investigate the adjustment process of health care expenditures to changes in GDP per capita and find that health care expenditures are more responsive to cyclical components of GDP per capita than to trend components.

To summarize, we can state that most of the empirical analyses in the existing literature focus on the effect of health/health care expenditures on economic growth and find a positive impact of health on income. However, the number of studies that examine the causality between health expenditure and economic growth is very low. The main contribution of our analysis is to investigate the direction of causality between health expenditure and economic growth empirically. Moreover, after determining the direction of causality we also estimate the short run and the long run effects of GDP per capita on health expenditure per capita.

3. Methodology and Data

In this paper we investigate the relationship between health expenditure and economic growth in the European Union countries. At first, we examine the direction of the causality between health expenditure and economic growth. In order to do this, we use the Dumitrescu-Hurlin Test (Dumitrescu and Hurlin, 2012) which is developed to test Granger causality in panel datasets (Lopez and Weber, 2017). The Dumitrescu-Hurlin Test can be explained by the following linear model (Dumitrescu and Hurlin, 2012):

$$y_{i,t} = \alpha_i + \sum_{k=1}^K \theta_i^{(k)} y_{i,t-k} + \sum_{k=1}^K \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \quad (1)$$

In equation 1, x and y are two stationary variables observed for N individuals on T periods (Dumitrescu and Hurlin, 2012). Dumitrescu and Hurlin (2012) suggest testing Homogenous Non Causality hypothesis by considering both the heterogeneity of the regression model and the casual relation. The alternative hypothesis of the Dumitrescu-Hurlin Test allows a subgroup of individuals for which there is no causality and a subgroup of individuals for which there is Granger causality (Dumitrescu and Hurlin, 2012). The null hypothesis of the Dumitrescu-Hurlin Test can be stated as follows (Dumitrescu and Hurlin, 2012):

$$H_0: \beta_i = 0 \quad \forall i = 1, \dots, N \quad (2)$$

In order to test the null hypothesis Dumitrescu and Hurlin suggest using the average of individual Wald statistics (Dumitrescu and Hurlin, 2012).

After determining the direction of causality between health expenditure and economic growth, we draw on Mean Group (MG) and Pooled Mean Group (PMG) estimators which are developed by Pesaran and Smith (1995) and Pesaran, Shin and Smith (1999) to estimate the short-run and the long-run effects of the variable which Granger causes the other variable. The PMG presumes that long run coefficients are equal across groups but, allows the constants, short run coefficients and error variances to be different (Pesaran, Shin and Smith (1999). When MG estimator is used regressions are estimated for each group separately and then the means of coefficients over groups are calculated Pesaran and Smith (1995).

The MG and PMG estimators can be explained by the following autoregressive distributive lag (ARDL) (p, q₁, ..., q_k) panel model (Blackburne and Frank, 2007):

$$y_{i,t} = \sum_{j=1}^p \varphi_{i,j} y_{i,t-j} + \sum_{j=0}^q \sigma'_{i,j} X_{i,t-j} + \mu_i + \varepsilon_{i,t} \quad (3)$$

In this equation, i= 1, 2, ..., N is the number of groups, t= 1, 2, ..., T is the number of periods, X_{i,t} is a k x 1 vector of explanatory variables, σ_{i,t} are the k x 1 coefficient vectors, φ_{i,j} are scalars and μ_i is the group-specific effect (Blackburne and Frank, 2007). By using equation 3 the error correction model can be stated as follows:

$$\Delta y_{i,t} = \theta_i (y_{i,t-1} - \vartheta'_i X_{i,t}) + \sum_{j=1}^{p-1} \varphi_{i,j}^* \Delta y_{i,t-1} + \sum_{j=0}^{q-1} \sigma_{i,j}^* \Delta X_{i,t-j} + \mu_i + \varepsilon_{i,t} \quad (4)$$

In equation 4, $\theta_i = -(1 - \sum_{j=1}^p \varphi_{i,j})$, $\vartheta_i = \sum_{j=0}^q \sigma_{i,j} / (1 - \sum_k \varphi_{i,k})$, $\varphi_{i,j} = -\sum_{m=j+1}^p \varphi_{i,m}$ j= 1, 2, ..., p-1, and $\sigma_{i,j}^* = -\sum_{m=j+1}^q \sigma_{i,m}$ j= 1, 2, ..., q-1 (Blackburne and Frank, 2007).

In this equation, θ_i is the speed of adjustment term (error correction term) and it is expected to be statistically significant and negative (Blackburne and Frank, 2007). The vector of ϑ'_i includes long-run relationships among the variables (Blackburne and Frank, 2007).

In our empirical analysis, we use gross domestic product per capita and health expenditure per capita in order to estimate the relationship between health expenditure and economic growth. Both of these variables are in current US Dollars and we draw on GDP deflator of the respective country to calculate the real values of the data. In the estimations, the logarithmic forms of the variables are used. The data set is annual and covers the period between 1995 and 2014 for 28 European Union countries. All of the data is obtained from the World Bank World Development Indicators (World Bank, 2018).

4. Results

Although the order of integration of the variables is not important for the MG (Pesaran and Smith, 1995) and PMG models (Pesaran, Shin and Smith, 1999) so long as the variables are integrated either in $I(0)$ or $I(1)$ the Dumitrescu-Hurlin Test assumes that the variables are stationary (Dumitrescu and Hurlin, 2012). So, we first estimate Im-Pesaran-Shin (Im, Pesaran and Shin, 2003) and Fisher type (Fisher-Augmented Dickey-Fuller (ADF)) (Choi, 2001) unit root tests in order to establish the order of integration of the variables. Table 1 shows the results of these unit root tests.

Table 1: Unit Root Test Results

Variables	Im-Pesaran-Shin	Fisher-ADF Inverse Normal	Fisher-ADF Inverse Logit
GDP per capita	-17.2327***	-9.6563***	-14.6831***
Health Expenditure per capita	-7.4784***	-6.3808***	-9.4002***

Note: *** indicates 1% significance level. The null hypothesis of Im-Pesaran-Shin Test and Fisher-ADF Test states that all panels contain unit roots. An intercept and a trend term are added to the models while estimating the statistics. For Im-Pesaran-Shin Test lag length is determined according to the Akaike Information Criterion.

Source: Authors' estimations.

According to table 1, both GDP per capita and health care expenditure per capita are stationary. So, we can estimate the MG (Pesaran and Smith, 1995) and PMG models (Pesaran, Shin and Smith, 1999) and the Dumitrescu-Hurlin Test (Dumitrescu and Hurlin, 2012).

Table 2 shows the results of the Dumitrescu-Hurlin Test (Dumitrescu and Hurlin, 2012). The results of the Dumitrescu-Hurlin Test indicate that while GDP per capita Granger causes health expenditure per capita there is no Granger causality from health expenditure per capita to GDP per capita. Therefore, it is argued that there is a unidirectional relationship between GDP per capita and health expenditure per capita and the direction of this relationship is from GDP per capita to health expenditure per capita.

Table 2: The Dumitrescu-Hurlin Test Results

Hypothesis	Test Statistic (Z-bar ~)
H_0 : GDP per capita does not Granger-cause health expenditure per capita.	3.8082***
H_0 : Health expenditure per capita does not Granger-cause GDP per capita.	0.4992

Note: *** indicates 1% significance level. Lag length is determined according to the Akaike Information Criterion.

Source: Author's estimations.

After determining the direction of causality between GDP per capita and health expenditure per capita we estimate the short run and the long run effects of GDP per capita on health expenditure per capita by using the MG (Pesaran and Smith, 1995) and PMG models (Pesaran, Shin and Smith, 1999). Table 3 shows these estimations. Before interpreting coefficient estimates we should determine which estimator is more efficient than the other one. According to the Hausman specification test (Hausman, 1978) result, PMG (Pesaran, Shin and Smith, 1999) is more consistent and efficient estimator than MG (Pesaran and Smith, 1995). So, we will evaluate the coefficient estimates which are obtained by using PMG estimator (Pesaran, Shin and Smith, 1999). The last two columns of table 3 show the coefficient estimates of PMG (Pesaran, Shin and Smith, 1999) model. When we look at these results we find that speed of adjustment term (ec) is statistically significant and negative as expected. Moreover, both the short run and the long run coefficient estimates of GDP per capita are statistically significant and have a positive sign. So, it is stated that GDP per capita has a positive effect on health expenditure per capita both in the short run and the long run. While a 1% percent increase in GDP per capita increases health expenditure per capita by 0.72% in the short-run this increase is 1.10% in the long run.

Table 3: MG and PMG Estimations

Variables	MG Model		PMG Model	
	Long Run	Short Run	Long Run	Short Run
GDP per capita	1.1526*** (0.1504)		1.1001*** (0.0177)	
ec		-0.3198*** (0.0422)		-0.2209*** (0.0402)
Δ GDP per capita		0.5676*** (0.0636)		0.7274*** (0.0647)
constant		-1.7145*** (0.3438)		-0.7860*** (0.1484)
Hausman Test Probablity		0.12 0.7294		

Note: *** indicates 1% significance level. Standard errors are in parenthesis. The chosen lag structure is ARDL(1, 1). Ec is the speed of adjustment term. The models are estimated by using xtpmg routine in Stata. Hausman test indicates that PMG estimator is more consistent and efficient than MG estimator.

Source: Authors' estimations.

In summary, our empirical results indicate that there is a unidirectional relationship between health expenditure per capita and GDP per capita and the direction of this relationship is from GDP per capita to health expenditure per capita. Moreover, when we investigate the short run and the long run effects of GDP per capita on health expenditure per capita we find that GDP per capita has a positive effect on health expenditure per capita both in the short run and the long run.

Conclusion

Without doubt, health care expenditure can have dramatic effects on economic performance of a country. In the existing literature, although there are numerous studies which analyse the impact of health/health care expenditure on economic growth the number of studies which focus on the causality between these variables is very few.

In this study, we empirically investigate the relationship between health expenditure and economic growth in the European Union countries over the period 1995-2014. Unlike previous studies, we first analyse the direction of causality between these variables and then, we estimate the short run and the long run effects of GDP per capita on health expenditure per capita.

The results of our empirical analysis indicate that there is a unidirectional relationship between health expenditure per capita and GDP per capita and the direction of this relationship is from GDP per capita to health expenditure per capita.

Moreover, we find that GDP per capita has a positive impact on health expenditure per capita both in the short run and the long run. So, we argue that economic growth is a significant determinant of health expenditure in the European Union countries over the period under investigation.

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Health Tourism and Alternative Medicine: A Study on the Offer and Profile of Establishments nearby Two Hospitals in the City of Porto Alegre-Brazil

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Abstract

Alternative medicine is a term that describes medical treatments that are used instead of traditional therapies. About 40% of adults in the United States say they use some form of alternative medicine. We analyze establishments that offer alternative treatments and are located in the vicinity of hospitals that receive health tourists. We found 10 establishments (through Google search) but only 04 responded to the survey. The reason for not performing in the other 06 was: 01 was not in attendance, in 03 it was not possible to contact, 01 was not found and 01 refused to respond. Among those who answered, 03 were not aware of health tourism. All attend patients from outside Porto Alegre and 03 from other states and countries. The percentage of out-of-town patient visits ranged from 0 to 10% in two establishments and 31 to 40% in two others. Chiropractic and Reike were the most commonly offered therapies, followed by Bach Flowers and others such as Orthomolecular Medicine, Chromotherapy and Aromatherapy. All the establishments have pages in the internet but only in 01 it is possible to obtain information in another language (in English, in the page of the parent company). We conclude that health tourism is still unknown by alternative medicine establishments and that even among those who receive patients from other sources, the movement can be considered small in half of them. Lack of sites in other languages may be a barrier to foreign tourists.

Keywords: health tourism, alternative medicine, medical treatments

Introduction

“Health tourism” refers to traveling to another country for medical care (Centers for Disease Control and Prevention [CDC], 2016). The segment can be divided into Wellness tourism and Medical tourism (Ministério do Turismo [MTUR], 2010). As stated in the specifications of the Ministry of Tourism of Brazil on health tourism, the distinction between the segments can be difficult. Therefore, we will only use the term “health tourism” when referring to this tourism modality. It is understood as characteristic motivations of this type of tourism the promotion of health, health maintenance, disease prevention and cure of disease (MTUR 2010). The Health Tourism segment can be a positive response to the challenge of tourism seasonality, since it allows greater mobility of the promotion of preventive or curative health services unrelated to the times of the year typically destined for travel (MTUR 2010).

It is a growing market. In its report on the health tourism market, the Transparency Market Research website valued the market at USD 10.5 billion in 2012, with an expected CAGR (Compound Annual Growth Rate) of 17.9 % from 2013 to 2019, reaching an estimated value of USD 32.5 billion in 2019 (Transparency Market Research [TMR], 2013). Spain, through projects in the area of health tourism, from a budget of just 2.7 million euros, increased their turnover from 140 to 500 million euros and by 80% the number of health tourists (M.M. 2016).

In the Study of International Tourism Demand 2012-2016, a publication of the Ministry of Tourism of Brazil, health tourism is not listed individually under reasons for traveling to Brazil (MTUR 2017). We can assume that it is included under a more comprehensive index. Tourists that travel for reasons other than leisure, business, events or visiting family account for 3.3% of the total (around 208,092 tourists). In its assessment of the health tourism sector, BEMTUR 2014 (Municipal Tourism Statistics Report for Porto Alegre 2014) (Secretaria Municipal de Turismo [SMTur] 2014) reports that the number of patients treated in the city was 4,428 or 5% of the total tourists.

In the present study the focus was on alternative medicine. It is defined by the World Health Organization as follows: the terms “complementary medicine” or “alternative medicine” refer to a broad set of health care practices that are not part of that country’s own tradition or conventional medicine and are not fully integrated into the dominant health-care system (World Health Organization [WHO], 2013). Alternative medicine includes yoga, chiropractic and osteopathic manipulation, meditation, massage therapy, acupuncture, relaxation techniques (National Center for Complementary and Integrative Health 2016)

According to an article published in the National Health Statistics Reports of 2015, about 33.2% of Americans over 18 years of age have used some form of alternative (or complementary) medicine in the year 2012 (Clarke et al. 2015). In Brazil, in a study conducted in a city in the countryside of the country, the number of users of alternative medicine was 70% (Rodrigues Neto, Faria & Figueiredo 2009).

The purpose of this study was to study the offer of alternative medicine services in the vicinity of two hospitals that receive health tourists in the city of Porto Alegre during a period linked to summer vacation in the country. We evaluated the services in relation to their functioning during the study period, the therapies offered, assistance to tourists from outside the city, knowledge about health tourism and the availability of the service page in a language other than Portuguese.

Methodology

The research was conducted in the city of Porto Alegre, the capital of the state of Rio Grande do Sul, from December 26, 2017 to January 8, 2018.

For the location of the establishments, a search was performed on the Google site, using the term "alternative medicine". We used as a center of research on the map two hospitals that are part of Porto Alegre Health Care (a cluster that brings together hospitals that receive international health tourists). These hospitals were chosen because they are in the most central area of the city, with the possibility of a greater number of services nearby. Establishments that offer care only in acupuncture and/or homeopathy were excluded, because they are recognized as medical specialties by the Federal Medical Council of Brazil. Establishments that offer these specialties together with other unrecognized ones have been included. The research area was also delimited using as a criterion the distance that can be walked on foot in up to 15 minutes (according to the same site).

Once the establishments were located, contact was made by telephone and, in those who were willing to respond, interviews were conducted through a questionnaire applied in person.

Results

We found 10 establishments related to alternative medicine. Of these, 01 was not in attendance, 03 did not attend, 01 establishment the address was not found/did not attend and 01 refused to respond.

Among the 04 establishments that responded to the questionnaire, the results were as follows: no service was in operation during the period between December 26, 2017 to January 1, 2018. All attend to patients from outside of Porto Alegre, 03 of them had patients from other states and countries and 01 was limited to other cities in the state of Rio Grande do Sul (predominantly the mountain areas). Movement related to out-of-town patients ranged from 0 to 10% in two of them and 31-40% in the other two. Of the 04 interviewees, 03 were unaware of health tourism and the other one knew about it from a television program dedicated to health promotion.

None of the establishments had their website in a language other than Portuguese.

The therapies most offered were chiropractic, Reike and Bach flower remedies. Other therapies included Orthomolecular Medicine, Chromotherapy, Aromatherapy and Phytotherapy.

Discussion

Health tourism is a market that moves billions of dollars worldwide, with forecasts of growth (TMR 2013). As stated above, it may be a response to the seasonality of tourism (MTUR 2010). This was the reason for choosing the summer period (in the southern hemisphere) to carry out this study. We checked the availability of services during a time that is traditionally associated with vacation and travel. In the period from 26 to 29 December 2017, none of the establishments were in operation. This is understandable because it is the period between Christmas and New Year. During the next study period, up to January 8, 2018, we found 05 services in operation, of which 01 refused to respond to the survey. The results showed that most of the interviewees were not aware of the sector, although the Ministry of Tourism of Brazil already published material on the sector in 2010. The fact that the only respondent who had knowledge of the sector, and having obtained the information from an unofficial source, may demonstrate that the sector is not receiving the necessary attention. As already reported by Ribeiro & Almeida (2017), one of the limitations to the arrival of international tourists to the city of Porto Alegre is the shortage of direct international flights. However, this can not be taken as a limitation on investments in the industry. We found that 70% of adults in a Brazilian city had already used some form of alternative medicine (Rodrigues Neto, Faria & Figueiredo 2009). This data shows that there is a latent market, which requires greater attention both by those responsible for its disclosure and those who offer the services. In relation to the latter, the fact that they do not have their websites in other languages limits the possibilities of expanding their service. We looked for services located near hospitals because, for the latter, there is no seasonality. Alternative medicine services could offer care to patients (national or international) as well as their companions. In the case of international tourists and their companions, a web page in other languages would be essential. Due to the location of the city, in the extreme south of Brazil, we believe that the pages should be available in Spanish as well as in English. We found two establishments where the movement related to people from outside Porto Alegre reached 40%, proving that this niche can be very profitable for the establishment. The fact that different modalities of alternative therapies have been found allows the services to be offered to a greater number of possible users.

Conclusion

Health tourism is still unknown by alternative medicine establishments, even though it is close to hospitals that receive foreign tourists and are part of a health cluster in the city of Porto Alegre. The fact that establishments do not provide a website in another language limits the access to information by foreigners, making it difficult to expand the service. There are a variety of therapies offered, which allows for more comprehensive care.

A limiting factor in this study is the small number of establishments visited. However, this number can be considered as important since one of the focuses of the work was to ascertain those who were operating in a period associated with vacations.

Strategies for the increase in the number of health care tourists include websites in other languages, operation during vacation times, greater dissemination of this type of tourism.

For the continuity of the research we have as points to be approached: to verify the impact of information on the health tourism segment (given during the current research) in the visited establishments, to increase the number of establishments visited, to check with the hospitals of the health cluster of the city if there is a demand for alternative medicine services (by their patients and/or their companions).

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Preliminary Data Regarding Pharmaceutical Forms Type Gels Based on Marine Algae Extracts with Antioxidant Activity

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Abstract

Particularly interest on herbs and plant extracts is due to their content of active principles with remarkable pharmacological properties. Different vegetal species contain natural antioxidants (polyphenols) used for their dermatological anti-inflammatory and healing activity, justified by their action on free radicals. The aim of this paper was to obtain selected phytopharmaceuticals formulations type gels with an increased antioxidant potential based on a mixture of fluid extracts from seaweeds species in the phylum Chlorophyta, *Cladophora vagabunda* (L.) C. Hoek, in the family Cladophoraceae, *Ulva lactuca* (L.) syn. *Ulva rigida* (L.), in the family Ulvaceae (sea lettuce) and species in the phylum Rhodophyta, *Ceramium rubrum* C. Agardh, in the family Ceramiaceae, frequently presents along the Romanian Black Sea coast. Fluid extracts concentration 10% were obtained using cold maceration extraction method, in solvents ethylic alcohol 40% and 70%. The obtained vegetal extracts were mixed in different ratio and analysed for physico-chemical properties, for the content of total phenols, chlorophylls, carotenoids, flavonoids and antioxidative capacity by photochemiluminescence method (ACL, Analytik Jena AG procedure). The selected mixed fluid extracts with greatest content of polyphenols and antioxidant activity were used for obtaining pharmaceutical forms type gels

which were analyzed for the physical-chemical properties appearance, pH, spreadability and total antioxidative capacity. Preliminary results emphasized that proposed pharmaceutical forms type gels had an appreciable antioxidant activity correlated with a good stability, an increased polyphenols content and would represent a possible new dermatological anti-inflammatory and healing preparation.

Keywords: pharmaceutical formulation, gels, marine algae, Black Sea littoral, total antioxidant capacity

Introduction

Seaweeds - are aquatic photosynthetic organisms used largely due to the variety of bioactive compounds in their composition that have begun to attract the attention of the food, pharmaceutical and cosmetic industries. Functional components extracted from algae biomass are widely used as food and health supplements with a variety of applications in food science and technology. The applications of algae in dermo-cosmetic products are increasing due to the fact that they have a high potential in various treatments for dermal diseases.

There is a growing concern for valorization marine phytobenthic bioresources in cosmetic therapy and treatments, by using new biotechnologies to obtain innovative pharmaceutical and dermo-cosmetic preparations, for biocompatible external use, based on soft fluid extracts or dried purified green algae containing natural bioactive compounds, with antibacterial, antifungal, antiproliferative, antioxidant activity, with maximum efficiency and minimal side effects, non-allergenic, regenerative and with skin protection effect against UV radiation (www.seaweed.ie/; www.irishseaweeds.com/sea-lettuce-ulva-lactuca; www.hawaii.edu/reefalgae/invasive_algae/chloro/cladophora_vagabunda.htm; www.algaebase.org/search/species/; Lindberg M., 2010; Mshigeni K.E., 1991; Drum R.; Leandro A., 2020; Noel Vinay, 2013; Kennedy J., 2020; Pooja S., 2014; Ajit Kandale, 2011)

Marine green algae species along Black Sea coast, in the phylum Chlorophyta, *Cladophora vagabunda* (L.) C. Hoek, in the family Cladophoraceae, *Ulva lactuca* (L.) syn. *Ulva rigida* (L.), in the family Ulvaceae (sea lettuce), respectively red algae species in the phylum Rhodophyta, *Ceramium rubrum* C. Agardh, in the family Ceramiaceae,

are used in traditional medicine most due to their content in polyphenolic acids with increased antioxidative capacity mainly useful in anti-inflammatory diseases (Negreanu-Pirjol, 2012; Sirbu R., 2019; Negreanu-Pirjol B., 2011; Negreanu-Pirjol B.S., 2015; Negreanu-Pirjol B.S., 2018; Sirbu R., 2014; Negreanu-Pirjol T., 2019).

The aim of this paper is the evaluation of the total phenols compounds, chlorophylls, carotenoids, flavonoids content in hydroalcoholic extracts of *Cladophora vagabunda*

(L.) C. Hoek, *Ulva lactuca* (L.) syn. *Ulva rigida* (L.), and *Ceramium rubrum* C. Agardh species along Romanian Black Sea coast, knowing that these three vegetal products present an increased antioxidant activity with a real phytotherapeutic potential. The selected fluid extracts with increased content of polyphenols were used for hydrogels obtaining (Negreanu-Pirjol T., 2015; Sirbu R., 2010; Negreanu-Pirjol T., 2014; Negreanu-Pirjol T., 2014). The pharmaceutical formulations type gels had a good stability in time and the most increased total antioxidant capacity, better than the fluid vegetal extracts used as raw materials.

Material and Methods

Fresh vegetal product selected for fluid extracts obtaining represented by *Cladophora vagabunda* (L.) C. Hoek (Chlorophyta, Fam. Cladophoraceae), *Ulva lactuca* (L.) syn. *Ulva rigida* (L.) (Chlorophyta, Fam. Ulvaceae) and *Ceramium rubrum* C. Agardh (Rodophyta, Fam. Ceramiaceae) species, were manual collected from the South Romanian Coast of Black Sea, sector between Mangalia – 2 Mai - Vama Veche, the medio-littoral area, in the period June - August 2019-2020 and sorted on species (Fig. 1). The three species are commonly found on the Romanian Black Sea coast, growing on rocky substrates (AOAC, 2016).

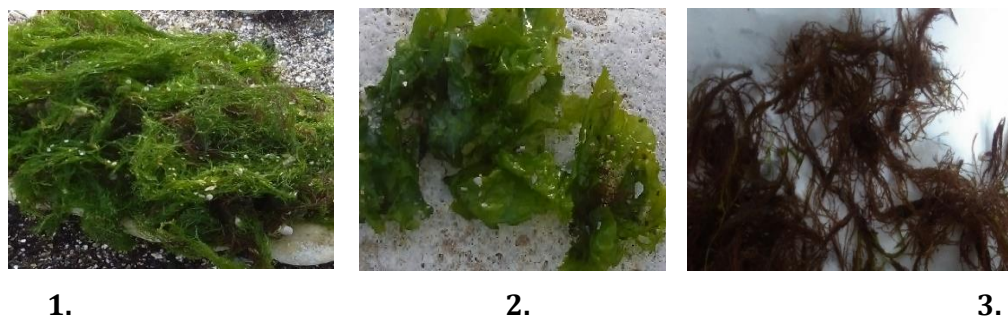


Fig. 1. Fresh vegetal material - marine algae species along Black Sea Cost

(1. *Cladophora vagabunda* (L.) C. Hoek (Chlorophyta, Fam. Cladophoraceae); 2. *Ulva lactuca* (L.) syn. *Ulva rigida* (L.) (Chlorophyta, Fam. Ulvaceae); 3. *Ceramium rubrum* C. Agardh (Rodophyta, Fam. Ceramiaceae) (photo: Dragonea)

The immediately pretreatment process after harvesting involves washing the biomass thoroughly several times with distilled water, to remove adhering sand particles and impurities and dried at room temperature, for 24 hours, in the dark. Fresh marine algae biomass was weighed to determine the loss of water through drying process. The dried algae material from three species, *Cladophora vagabunda*, *Ulva lactuca* and *Ceramium rubrum* was macerated to a fine powder (homogeneous, as well as a higher surface-to-volume ratio) and investigated for chlorophyll pigment, carotenoids, total flavonoids and total phenolic content and total antioxidant capacity, with triplicate samples of each determination.

For fluid extract obtaining - maceration method at cold of vegetal product was used: ethylic alcohol 40% and 70% 1:10 ratio, stir and allow soaking in the dark for 10 days in a constant temperature and stirred periodically. After 10 days, the extract is filtered and brought to a concentration of 10% with a 100 mL volumetric flask. After the 10 days obtained extract was filtered and stored at 4 °C (Negreanu-Pirjol B.S., 2015, Negreanu-Pirjol T., 2019). For the *fluid extracts*, pH, relative density were determined.

Semisolid gels based on Cladophora - Ulva – Ceramium (C-U-C) fluid extracts quality control standard tests were the follows: appearance, homogeneity, pH and spreadability, initial and after 30 days of obtaining (Negreanu-Pirjol T., 2015, Negreanu-Pirjol T., 2014).

pH was achieved using a Consort electronic pH-meter with temperature sensor

For relative density, the pycnometer method was used

For chlorophyll and carotenoid content, 0.1 g ground dry algal material was extracted in 10 mL 80% acetone (triplicate samples for each species), 1% final, through UV-Vis spectrophotometric analysis (using a S106 WPA spectrophotometer) at 470, 647 and 663 nm wavelengths. The concentrations of chlorophyll *a*, chlorophyll *b* (only in chlorophytes) and total xanthophyll and carotin were calculated by using the trichromatic equations (Lichtenthaler & Buschmann, 2001, Miazek K., 2011)

For total flavonoid determinations, 1 g ground vegetal tissue was extracted in 5 mL methanol and filtered (triplicate samples). 0.5 mL of extract was diluted in 4 mL water and 8 mL methanol mixture, and the spectrophotometric absorbance was read against a methanol blank at 340 nm wavelength (Szabo I., 2012).

For determining the concentration of total phenolic compounds, a spectrophotometric version of the Folin-Ciocalteu method was used. 0.1 g fruit tissue was extracted in 10 mL methanol and filtered. 1 mL of extract was reacted with 5 mL Folin-Ciocalteu reagent (10%) and 4 mL sodium bicarbonate solution (7.5%) for 30 minutes. Spectrophotometric absorbance was read against a blank at 765 nm. A calibration curve was prepared, by using different gallic acid concentrations [10-12]. The resulting concentration was expressed as mg/kg dry weight and mg/kg DW gallic acid equivalent (GAE), (Stanković M.S., 2011; Stanković, 2011; Siddiqui N., 2017).

Semisolid gels preparation based on Cladophora - Ulva – Ceramium (C-U-C) seaweeds species fluid extracts was as follows (Tables 1, 2) (Popovici I., 2011):

Table 1. Samples Codification

Seaweeds concentration	C-U-C 10%	fluid extracts	Gels
Maceration in 40% alcohol	(1:1:1) ratio		G1
Maceration in 70% alcohol	(1:1:1) ratio		G2
Maceration in 40% alcohol	(1:2:2) ratio		G3
Maceration in 70% alcohol	(1:2:2) ratio		G4

Table 2. Carbopol gel 1% formula based on C-U-C fluid extracts (G1 – G4)

Ingredients	Quantities (g)	Quantities (g)
	G1 – G2	G3 – G4
Carbopol 940	1	1
Triethanolamine	0.8	0.8
Propylenglicole	5	5
C-U-C fluid extracts (1:1:1) ratio	7.5	-
C-U-C fluid extracts (1:2:2) ratio	-	7.5
Preservative solution ad	100	100

Carbopol 940 1% gel based on C-U-C fluid extracts obtaining: disperse carbopol 940 in the preservative solution, shake vigorously (with a high speed electric stirrer) to avoid the formation of agglomerates. The dispersion was neutralized gradually with triethanolamine solution so as not to include air. Fill with preservative solution to 100 g add and mixed the fluid extracts.

Total Antioxidant Capacity (TEAC) by photochemiluminescence method

Apparatus: photochemiluminometer PHOTOCHEM, Analytik Jena AG, Germany

Samples preparation:

Stock solutions for seaweeds C-U-C fluids extracts, were prepared as follows: 10 g powder mixture of seaweeds (molar ratio C-U-C 1:1:1, respectively molar ratio 1:2:2) were diluted with 100 mL ethyl alcohol concentration 40%, respectively 70%. From the stock solutions, were taken 10 µL working volume, according with Antioxidative Capacity in Lipid-soluble substances (ACL) (Hermann H., 2004).

Stock solution for semisolid pharmaceutical forms type gels, were prepared as follows: 5 g of C-U-C gels were diluted with 5 mL ethyl alcohol 95%. From the stock solutions, were taken 10 µL working volume, according with Antioxidative Capacity in Lipid-soluble substances (ACL) (procedure, Analytik Jena AG, 2004).

The total antioxidant capacity of the samples were quantified by comparison with the standard Trolox (constructing a calibration curve with Trolox®) (Fig. 2) and were quantified as equivalent units of standard substance Trolox equivalent antioxidant activity (TEAC) is a measurement of antioxidant strength based on Trolox, (6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid), a water-soluble derivative of vitamin E, in units called Trolox Equivalents (TE). Due to the difficulties in measuring individual antioxidant components of a complex mixture, Trolox equivalency is used as a benchmark for the antioxidant capacity of such a mixture, nmol/sample (Shahidi F., 1999; Popovov I., 1999; Le Tutour B., 1990; Döll M., 2003; Winnefeld K., 1995).

From stock solutions were prepared the samples, as follow (Table 3):

Table 3. Working scheme (volumes in μL), (Hermann H, 2004)

Reagent	R1		R2	R3	R4	Sample
Blank	2.300		200	25	0	0
Calibration curve	2.300 (μL)	- vol.	200	25	vol. (μL)	0
Measurement samples	2.300 (μL)	- vol.	200	25	0	vol. (μL)

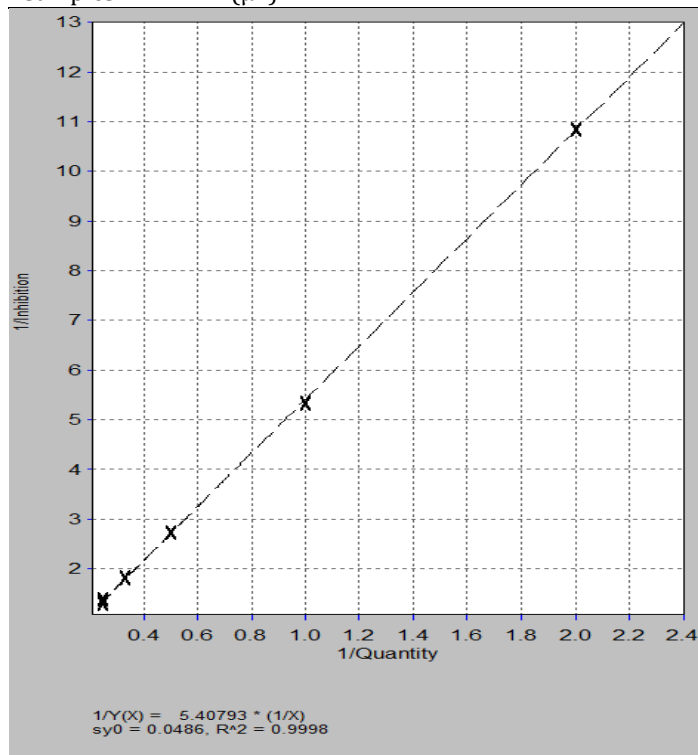


Fig. nr. 2. Trolox standard calibration curve (ACL method, Analytik Jena AG)

Results and Discussions

The values of the $p\text{H}$ and relative density parameters did not significantly modified, proving a good compatibility between the selected bases and C-U-C seaweeds fluid extracts (Table. 3).

Table 3. Seaweeds C-U-C fluid extracts quality control results

Seaweed extract	Fluid	$p\text{H}$	Relative density
C		5.5 – 5,9	1.0276 – 1.0281
U		5.6 -5.8	1.0260- 1.0269

C	5.8 – 6,1	– 1.0388
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- *Macroalgae fluid extracts chlorophylls pigments content determination*
- Chlorophylls pigments contents of green algae fluid extracts at 10% concentration of algal extracts, emphasize an increased values for both species, as follows: Chlorophyll *a* concentration was the highest in *Cladophora* (488,427 mg/kg), while maximum *chlorophyll b* content was found in *Ulva lactuca* (321,700 mg/kg), Fig. 3.
- The *chlorophyll a* content was highest in the case of *Ulva lactuca*, (918,988 mg/kg), than *Cladophora vagabunda* (488,427 mg/kg) and *Ceramium rubrum* (119,597 mg/kg), Fig. 3.
- *Macroalgae fluid extracts carotenoids pigments content determination*
- High carotenoid concentrations were found in *Cladophora vagabunda* (196 mg/kg) and *Ceraminum rubrum* (90 mg/kg), compared with a decreased content registered for *Ulva lactuca* (11,366 mg/kg), Fig. 4
- *Macroalgae fluid extracts flavonoids content determination*
- Dry *Cladophora vagabunda* tissue contain the highest amount of flavonoids (2,707 mg/kg), compared with a decreased content of *Ulva lactuca* (44,590 mg/kg) and *Ceraminum rubrum* (19,110 mg/kg), Fig. 5.
- *Macroalgae fluid extracts total phenols content determination*
- Total phenols content was less variable, with the highest value in *Cladophora* tissue (5,888 mg/kg GAE) and a decreased values for *Ceraminum rubrum* (4,201 mg/kg) and *Ulva lactuca* (3,780 mg/kg), Fig. 6.

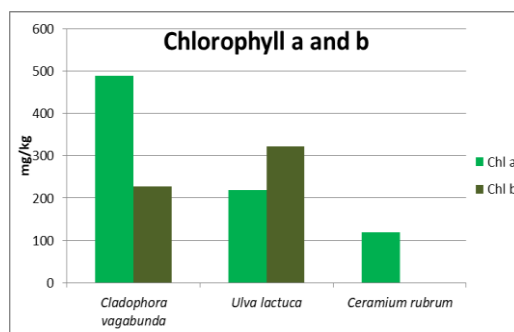


Fig. 3. Chlorophyll content in dry algal tissue (mg/kg)

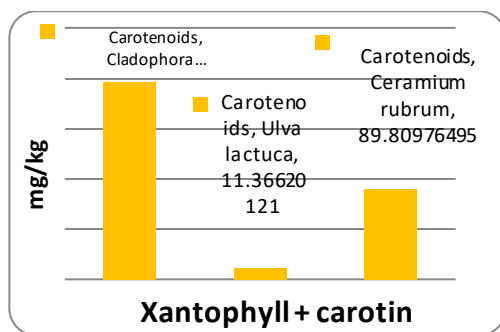


Fig. 4. Total carotenoid content in dry algal tissue (mg/kg)

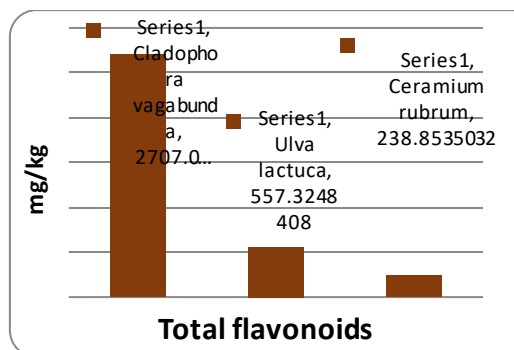


Fig. 5. Total flavonoid content in dry algal tissue (mg/kg)

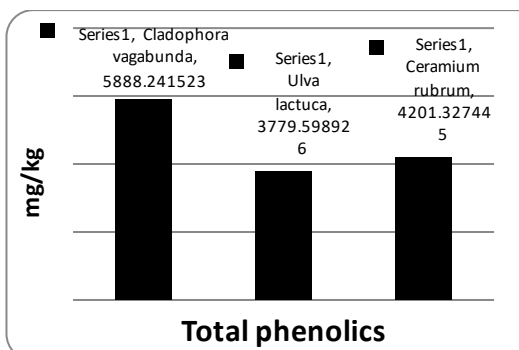


Fig. 6. Total phenolic content in dry algal tissue (mg/kg)

The values of the determined physical-chemical parameters did not significantly modified, proving a good compatibility between the selected pharmaceutical bases and seaweeds C-U-C fluid extracts (Table 4).

Table 4. Physical-chemical parameters for semisolid pharmaceutical preparations type gels based on

C-U-C seaweeds fluid extracts

Parameter	Gels based on UCT fluid extracts (G1 – G4)
appearance	translucent mass, yellow – greenish color, sweet taste, characteristic smell
homogeneity	homogenous aspect without air bubbles, drops or particle clusters
pH	5.6 – 6.5
spreadability (cm)	10.56 – 32.448

Total antioxidant capacity (*TEAC*) for seaweeds C-U-C fluid extracts, respectively for gels G1 – G4 based on seaweeds C-U-C fluids extracts in presented in Table 5.

Table 5. Total antioxidant capacity (*TEAC*) of seaweeds C-U-C fluids extracts and gels based on seaweeds C-U-C fluid extracts

N o.	Sample type (stock solution)	Volume sample (μL)	Inhibition value	Quantity mean (<i>TEAC</i>) (nmol equiv. Trolox/ volume sample)
1	Seaweeds C-U-C fluid extracts (1:1:1) ratio in ethyl alcohol 40%	10	0.280	1.112
2	Seaweeds C-U-C fluid extracts (1:1:1) ratio in	10	0.410	3.526

	ethyl alcohol 70%					
3	Seaweeds	C-U-C	fluid	10	0.387	2.879
	extracts (1:2:2)	ratio in				
	ethyl alcohol 40%					
	C-U-C	fluid	extracts	10	0.443	3.702
	(1:2:2)	ratio in	ethyl			
	alcohol 70%					
4	Gel 1			10	0.123	1.127
5	Gel 2			10	0.224	1.430
6	Gel 3			10	0.359	2.341
7	Gel 4			10	0.389	2.991

The results obtained for **total antioxidant capacity (TEAC)** determinations, emphasize the follows:

at the working solution volume (10 µL) according to the procedure, it was observed a valuable *TEAC* for all the analyzed semisolid pharmaceuticals preparations type gels (G1 – G4), between 1.127 – 2.991 nmol equiv. Trolox / volume sample, but more decreased compare with the raw material – seaweeds C-U-C fluid extracts. The most increased total antioxidant capacity value for sample Gel 4 (2.991 nmol equiv. Trolox / volume sample), was registered.

at the working solution volume (10 µL) according to the procedure, it was observed an increased *TEAC* for seaweeds C-U-C fluid extracts samples, with values between 1.112 – 3.702 nmol equiv. Trolox / volume, more increased compare with the registered values of gels (G1 – G4) obtained from the same seaweeds C-U-C fluids extracts. The most increased total antioxidant capacity value for sample C-U-C fluid extract (1:2:2) ratio in ethyl alcohol 70% (3.702 nmol equiv. Trolox / volume sample), was registered.

Conclusions

Gels based on C-U-C seaweeds fluid extracts did not have modifications in quality parameters change during 30 days of observation,

Total antioxidant capacity was highest for semisolid pharmaceuticals preparations Gel 4 and seaweeds C-U-C fluids extracts used for obtaining G4 were extracted under maceration with alcohol 70%, mixed in 1:2:2 ratio.

Method of extraction, nature of used vegetable products, fluid extracts ratio determined good values for total antioxidant capacity, in this case, nature of the pharmaceutical base used for gels obtaining, did not interfere with total antioxidant capacity, which was increased for semisolid pharmaceuticals preparations Gel 4.

The obtained semisolid preparations G4 could be further submitted to other tests for its antioxidant properties valorification.

Pharmaceutical formulations type gels based on marine algae, had an increased total antioxidant capacity correlated with a good stability and increased polyphenols content and would represent a possible new dermatological anti-inflammatory and healing preparations with antioxidant potential against free radicals action.

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Study of Antimicrobial Activity of Vegetable Alcoholic Extracts Obtained from *Vinca Minor* L.

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Abstract

Important natural antimicrobial compounds derived from *Vinca minor* L. plant contain a wide variety of secondary metabolites which are useful for brain health (increasing blood circulation in the brain, supporting brain metabolism, preventing memory loss and problems with concentration and premature aging of the cell), and externally they play a role in tissue repair and skin lesion healing. The testing of the antimicrobial activity of the alcoholic plant extracts obtained from *Vinca minor* plant was performed on two types of pathogenic germs: a Gram-positive strain, *Staphylococcus aureus* ATCC 25923 and a Gram-negative strain, *Escherichia Coli* ATCC 25922, as well as on a yeast strain pathogenic, *Candida albicans* ATCC 900288. Quantitative evaluation of antimicrobial activity was performed by a variant of the Kirby-Bauer diffusimetric method, a simple and fast method that allows the determination of the spectrum of sensitivity / resistance to antibiotics of the microorganism. Experimental studies have shown that all samples of alcoholic extract of 70% concentration, in volumes of 7µL, exerted a total antibacterial inhibitory action against the reference strains *E. coli* ATCC 25922 and *C. albicans* ATCC 10231 and moderate against the strain *S. aureus* ATCC 25923, results that agree with the literature. Regarding the alcoholic plant extracts with a concentration of 40% ethyl alcohol, obtained from the leaf and stem of *Vinca minor* plant, they did not show antimicrobial activity, which suggests that 40% ethyl alcohol does not extract bioactive compounds with antimicrobial activity.

Keywords: *Vinca minor*, bioactive substances, antimicrobial activity, *Staphylococcus aureus*, *Escherichia Coli*, *C. albicans*

Introduction

It is known from the literature that the plant material of *Vinca minor* L. plant is a valuable source of antimicrobial compounds, and alcoholic extracts obtained from this plant have antibacterial and antifungal activities on a variety of bacterial and fungal cultures [Kwiecinski J, 2009]. Natural plant products are a useful source of substances with antimicrobial properties, active mainly on bacteria and fungi. Given that many of these compounds may be a source of new drugs, herbal extracts may become useful therapeutic tools [Savoia D. 2012]. Important natural antimicrobial compounds derived from *Vinca minor* L. plant contain a wide variety of secondary metabolites, which are useful for brain health (increasing blood circulation in the brain, supporting brain metabolism, preventing memory loss and problems with concentration and premature aging of the cell) and externally they play a role in tissue repair and healing of skin lesions [Hadiakhoondi A., 2011, Farahanikia B., 2011].

In addition, the natural substances present in *Vinca minor* L. plant are a useful source of antimicrobial compounds active against bacteria and fungi. Numerous studies provide a wealth of information regarding the antibacterial [Mehrab S., 1995, Phillips JD, 1992] and antifungal [Ferrieres L, 2007] activities of compounds. bioactives from various plant extracts of the species *Vinca minor* L [Rongai D., 2012], Recent findings indicate that phenol and natural phenolic compounds existing in this plant have antibiotic effect on biofilm formation [Jagani S., 2009]. It has been concluded that these polyphenolic compounds can interfere with the formation of bacterial biofilm, preventing its formation, because bacteria possess sophisticated systems for regulating metabolic activities depending on population density [Huber B. 2010]. Research into plant extracts with antimicrobial activity is an important alternative strategy in the control of infectious diseases, caused by antibiotic-resistant pathogens. The natural antimicrobial capacity of plant extracts has been the basis of many applications, including raw materials and preservation of processed foods, pharmaceuticals, cosmetics, in alternative medicine and natural therapies [Martinez-Tome M. 2011].

In this study, the antimicrobial activity against the pathogenic bacterial strains *S. aureus*, *E. coli* and *C. albicans* mentioned, was for 4 alcoholic plant extracts from the leaf and stem of *Vinca minor* plant, obtained in ethyl alcohol of 40% and 70% concentration (two leaf extracts and two stem extracts). In choosing these microbial strains, we took into account the fact that all strains are common commensal species in the normal microbiota of the skin and mucous membranes, but which, under certain conditions of imbalance, following associated diseases, immunocompromise, old age, etc., can become pathogenic.

Staphylococcus aureus is a Gram-positive bacterium that causes suppurative infections or sepsis, skin infections, causing secondary wound infection [Martinez-Tome M. 2011].

Escherichia coli is a Gram-negative, commensal bacterium in the digestive tract of mammals and humans, frequently detected in a wide variety of food sources: water, raw meat, vegetables and dairy products. It is an important indicator of sanitation, its presence on the skin showing a fecal contamination of animal and / or human nature [Andrews J. M., 2005].

Candida albicans is an opportunistic fungus, which is found in the normal microbiota of the skin, intestines and genitourinary tract, but which can turn into a pathogen under conditions of low immunity or due to an imbalance of the bacterial microflora [Wilson C.L, 1997, Berman], 2012].

There is a difference in the architecture of the bacterial cell wall, which is complex in Gram-positive bacteria, by the presence of peptidoglycan (murein), its own constituent of the bacterial cell, a giant molecule, a heteropolymer with three-dimensional network, composed of glycan and a peptide, compared to Gram-negative bacteria, in which the architecture is simpler, the wall being thinner, with only two layers. This architecture will condition the selective permeability of the bacterial coating and its synthesis mechanisms, with consequences in terms of sensitivity / resistance of bacteria to various bioactive compounds, with potential antibiotic effect [Moldoveanu D., 2004]. In yeast, the cell wall has a complex structure and plays an important role in the relationship with the external environment, the host or the substrate on which the fungus is attached and in the defense of the yeast cell. Thus, *C. albicans* has complex structures consisting of chitin, (1–3) -D-glucan, (1, 6) beta-glucans, lipids and peptides, embedded in a protein matrix [Andrews J. M., 2005].

Material and Methods

Plant materials

The materials used to analyze the antimicrobial activity are represented by:

40% and 70% alcoholic plant extracts obtained from the leaf and stem of *Vinca minor* plant

bacterial and fungal pathogenic strains: *Escherichia coli* ATCC 25922; *Staphylococcus aureus* ATCC 25923; *Candida albicans* ATCC 10231.

To perform microbiological analyzes, the microbial strains were revitalized and maintained by culturing on the Plate Count Agar (PCA) culture medium (Fig. 1.) At 37 ° C ± 0.5 for 22 ± 2 hours.



Fig. 1. Bacterial strains grown on Plate Count Agar (PCA) culture medium

Preparation of plant extracts

The dried and crushed plant material was extracted with ethyl alcohol: 40%, 70%, 96% alcoholic extractive solutions obtained from the leaf and stem of the *Vinca minor* plant were prepared according to the 10th edition of the Roman Pharmacopoeia. This process involved crushing 10 g of plant product from the leaf and stem of the *Vinca minor* L. plant, to which was added ethyl alcohol of 40%, 70% and 96% to 100 mL, respectively (Ratio 1:10). The extracts were left for 10 days in optimal conditions, away from light and moisture, in a cool place. During the 10 days, the extracts were carefully monitored and shaken 2-3 times a day. At the end, they were filtered using cotton cloth filters so that they could be separated from the plant material. The liquid collected on filtration was stored in sterile, dark containers.

Diffusimetric method

Quantitative evaluation of antimicrobial activity was performed by a variant of the Kirby-Bauer diffusimetric method [Moldoveanu D., 2004], a simple and fast method that allows the determination of the spectrum of sensitivity / resistance to antibiotics of the microorganism, variant in which the microtablets with classical antibiotics were replaced with quantities of 5 μ L and 7 μ L respectively of the test samples, arranged by micropipetting on the surface of the PCA medium inoculated with the test microorganism (Fig. 1.). This method was used both for the extracts obtained from the stem and for those obtained from the leaf of *Vinca minor* plant.

For the preparation of the inoculum, the method of direct homogenization of the colonies was used, consisting in the homogenization in sterile physiological serum of 3-5 colonies from the culture plate, in the stationary growth phase, after 18 hours, to obtain a standardized turbidity. A 0.5 McFarland standard was used to control the density of the inoculum (optical density at λ of 550 nm is 0.125), as well as the Densimat digital densitometer.

The suspensions were homogenized using a Vortex stirrer for 15–20 seconds. Calibration of the suspension was performed by adding a larger or smaller amount of isotonic chlorinated solution, until the desired optical density was obtained. 1/10 dilution was made from the initial suspension. The plates were sown no later than 15

minutes after the preparation of the inoculum, by the technique of sowing "in cloth", by flooding. On the surface of the agarized Muller-Hinton medium, 500 µL of the 1/10 dilution of the 0.5 McFarland suspension were dispersed with the help of a Drigalski rod. After sowing, the plates were left for 3-5 minutes to absorb the inoculum. The extracts obtained from the leaf and stem of *Vinca minor* plant were applied in a spot of 5 µL and 7 µL. To assess the diameters of the inhibition zones, the extracts were pipetted into wells, practiced using sterile durham tubes, in the medium inoculated in cloth with the test microorganism, with a diameter of 5 mm and 7 mm, respectively. After 15 minutes from the placement of the spots, respectively of the volumes in the wells, the plates were thermostated at $35 \pm 2^{\circ}\text{C}$, for 16-18 hours, under aerobic conditions. The reading and interpretation of the results was done only qualitatively, measuring the diameter of the zones of inhibition in the reflected light, on the back of the Petri dish, with a graduated ruler, the presence of any zone of inhibition being interpreted as sensitivity (S), and its absence as resistance (R).

Results and Discussions

After the expiration of the incubation time, the population density of the culture in each spot was assessed, compared to the control of ethyl alcohol in a concentration of 40% and 70%. In Table 1. are represented the results obtained following the antimicrobial analysis of the alcoholic extracts of 40% and 70% concentration obtained from the leaf and stem of *Vinca minor* L. plant, by the diffusimetric method.

Table 1 shows that the values of inhibition rays obtained when testing plant extracts against the selected reference strains (*S. aureus*, *E. coli*, *C. albicans*) are close in order of size, both for alcoholic extracts in concentration 40% and 70 % prepared from leaves, as well as for those from the stems of *Vinca minor* L. plant, which indicates the presence of bioactive compounds with similar antimicrobial activity in the extracts obtained from both studied plant materials.

Experimental studies have shown that all samples of alcoholic extract of 70% concentration, in volumes of 7µL, exerted a total antibacterial inhibitory action against the reference strains *E. coli* ATCC 25922 and *C. albicans* ATCC 10231 and moderate against the strain *S. aureus* ATCC 25923, results consistent with the literature [6]. From the data obtained by other researchers it was found that the efficiency of ethanolic extracts obtained from *Vinca minor* plant on microorganisms is influenced by certain factors, such as: the source from which the plant was harvested, but also their seasonality. Another important factor that can influence the efficiency of antimicrobial activity is the type and concentration of the solvent used in the preparation of extracts (water, alcohol, acetone), because inhibition rates can differ greatly depending on the chosen solvent [Kwiecinski J, 2009, Rongai D, 2012].

Vegetable alcoholic extracts with a concentration of 40% ethyl alcohol, obtained from the leaf and stem of *Vinca minor* plant did not show antimicrobial activity, which suggests that 40% ethyl alcohol does not extract bioactive compounds with antimicrobial activity.

Table 1. Results obtained from antimicrobial analysis of plant alcoholic extracts obtained from *Vinca minor* L. plant by diffusimetric method

Samples of vegetable alcoholic extracts	Tested volume	Φ Inhibition area expressed in mm		
		<i>S. aureus</i> ATCC 25923	<i>E. coli</i> ATCC 25922	<i>C. albicans</i> ATCC10231
F40	5µl	0	0	0
T40	5µl	0	0	0
F70	5µl	0	7	8
T70	5µl	0	7	7
Alcohol witness	5µl	0	0	5
F40	7µl	0	0	0
T40	7µl	0	0	0
F70	7µl	7	9	12
T70	7µl	7	8	12
Alcohol witness	7µl	0	0	10

In Figures. 2. 3 and 4 is the comparative study of the antimicrobial activity of plant alcoholic extracts of 40% and 70% concentration obtained from the leaf and stem of *Vinca minor* plant, tested on strains of *S. aureus*, *E. coli* and *C. albicans*. It is observed that ethyl alcohol in a concentration of 70% used in the preparation of extracts is the solvent with the highest extraction power of compounds with antimicrobial activity, highlighted by the appearance of halos of inhibition of microbial growth (right plates on figures).

In figures 5 and 6 are presented the inhibition halos formed as a result of the antimicrobial activity exerted by the alcoholic plant extracts of 70% concentration obtained from the leaf and stem of *Vinca minor* plant, on the strains of the bacteria *E. coli*, *S. aureus* and *C. albicans*.

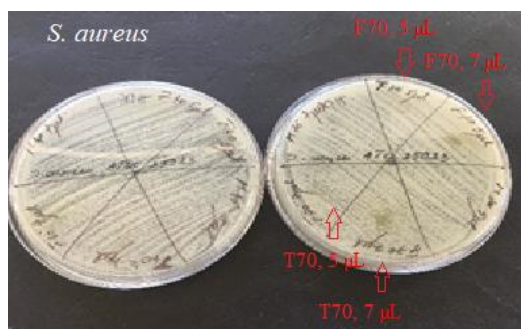


Fig. 2. Antimicrobial activity of alcoholic plant extracts of concentrations 40% and

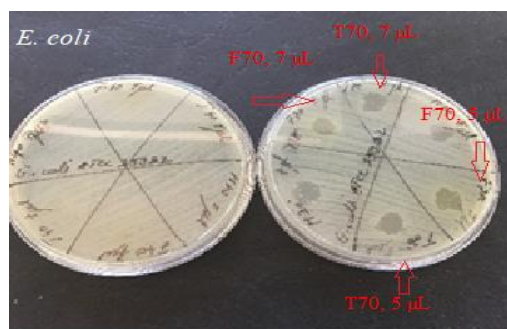


Fig. 3. Antimicrobial activity of alcoholic plant extracts of 40% and 70%

70% obtained from the leaf and stem of
Vinca minor L. on *S. aureus*

concentration obtained from the leaf and
stem of *Vinca minor* L. on *E. coli*

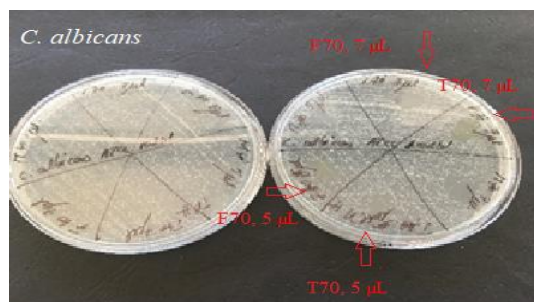


Fig. 4. Antimicrobial activity of alcoholic plant extracts of concentration 40% and 70% obtained from the leaf and stem of *Vinca minor* L. on *C. albicans*

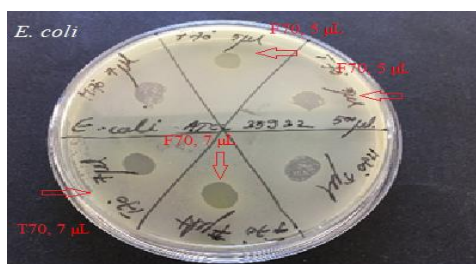


Fig. 5. Antimicrobial activity of alcoholic plant extracts of 70% concentration obtained from the leaf and stem of *Vinca minor* L. (F70 and T70) on *E. coli*

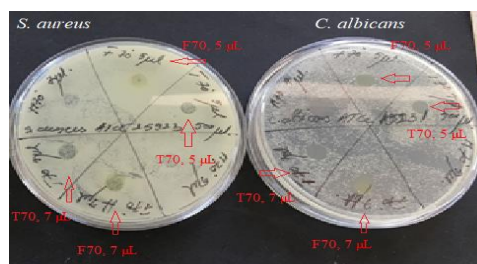


Fig. 6. Antimicrobial activity of alcoholic plant extracts of 70% concentration obtained from the leaf and stem of *Vinca minor* L. (F70 and T70) on *S. aureus* and *C. albicans*

Following the results obtained for the alcoholic extracts studied from *Vinca minor* L., it was observed that their antimicrobial action was influenced by factors such as: concentration of solvent used, volume of solution used and the type of microorganism for which these extracts showed antimicrobial properties.

The study performed for alcoholic extracts in a concentration of 70% highlighted the antibacterial properties of this extract on the tested microorganisms. The results obtained showed that all samples of alcoholic extract of 70% concentration, in volumes of 7 µL, exerted a total antibacterial inhibitory action against the reference strains *E. coli* and *C. albicans* and moderate against the strain *S. aureus*, results that agrees with the literature [Berman J., 2012]. The obtained results show that the alcoholic extracts in concentration 70% are close in value both for those obtained from the leaf of *Vinca minor* L. and for those obtained from the stem, which indicates the presence of compounds with similar antimicrobial activity for the extracts obtained from both studied plant materials.

Conclusion

In this study were analyzed by diffusimetric method, the antimicrobial properties of plant alcoholic extracts in a concentration of 40% and 70% obtained from the leaf and stem of *Vinca minor* plant. Testing antimicrobial activity was performed on two types of reference bacteria positive: *S. aureus* and one Gram-negative: *E. coli* and a species of yeast (*C. albicans*). Studies performed for alcoholic extracts of 70% concentration have demonstrated the efficacy and antibacterial character of these extracts on various microorganisms tested, such as: two types of bacteria: Gram-positive: *S. aureus* and Gram-negative: *E. coli* and a species yeast: *C. albicans*, using the diffusimetric method. The results obtained underlined that all samples of alcoholic extract of 70% concentration, in volumes of 7 μ L, exerted a total antibacterial inhibitory action against the reference strains *E. coli* and *C. albicans* and moderate against the strain *S. aureus*, results that agrees with the literature. For plant extracts obtained in alcohol of 40% concentration, the results obtained from antimicrobial testing showed that they do not show antimicrobial activity. For alcoholic plant extracts with a concentration of 70%, the results obtained showed close values for both those prepared from the leaf and those prepared from the stem of *Vinca minor* plant, which highlights the presence of compounds with similar antimicrobial activity for extracts obtained from both studied plant material.

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Antioxidant Activity of Some Fluids Extracts of Indigenous Wild Cherry Fruits

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Abstract

The paper presents un study regarding the comparative total antioxidant capacity of some fluids extracts of the soluble lipid compounds of *Cerasus avium* (L.) Moench. syn. *Prunus avium* (L.) var. *sylvestris* Ser fruits, popular named wild cherry, species undertaken aiming at exploiting the nutrient profiles and promoting the further development of these indigen phytopharmaceutical resources. For analysis, the photo-chemiluminescence method, ACL procedure, Analytik Jena AG, by comparing with the standard Trolox® solution, was used. Wild cherry fruits fluid extracts analyzed emphasize an increased total antioxidative capacity which may be attributed to the high level content of polyphenolic compounds and minerals content which sustains the possibility to use this valuable vegetal product for nutraceutical or comeceutical preparations.

Keywords: wild cherry, fruits, fluid extract, total antioxidant activity

Introduction

The name of the plant *Cerasus avium* (L.) Moench. syn. *Prunus avium* (L.), popular known as wild cherry or bitter cherry, derives from the city name Cerasus on the shores of the Black Sea in Asia Minor (today Kerasun), from where the plant, in 74 BC, was brought to Europe by Locullus. Was also the name of the cherry at Columella indigenous tree, microphanerophyte - megaphanerophyte, spontaneous and cultivated, with food, industrial, medicinal importance. Phytocenological, wild variety, Carpinion, Quercu-Beech, widespread in Europe, Asia Minor, North Africa, the Caucasus Mountains, Turkmenistan, from where it spread to all continents. The cherry (*Cerasus avium*) has the following varieties: *sylvestris* Ser., wild cherry, with small fruits, up to 1 cm in diameter, black, slightly juicy, sweet-bitter and early ripening; *juliana* (L.) Pojarkova, ispas cherries, with medium fruits, soft pulp, early and medium ripening; *duracina* (L.) Pojarkova, *stony cherries*, with large fruits, hard, stony pulp, slightly juicy and late ripening. Most of the varieties are derived from these three botanical varieties [1 - 6]. In Romania, wild cherry with the varieties Amar Maxut and Amar Galata [6], are considered in literature as having the center of origin in Northern Moldova, but also it was acclimatised in Dobrudjia.

Numerous studies have proven that vegetal compounds originated from plants or fruits possess a high spectrum of biological activity. However, polyphenolic extracts (e.g. flavonoids, anthocyanin, tannins etc.), despite having excellent in vitro bioactivity, sometime present a decreased action in vivo due to their improper molecular size, resulting in an absorption and bioavailability decreased. Moreover, the efficacy of natural polyphenols depends on preserving the stability, bioactivity and bioavailability of the active compounds [7, 8,].

Cherry fruits are considered nutritional products for humans. They are consumed fresh, dried or in preparations such as: compote, tea, jams, marmalade, etc. From the fruits are obtained juices, candied fruits, ice cream or various assortments of yogurts, liqueurs or cakes. Fruits contain fiber, water, vitamins A, B1, B2, B3, B5, B6, B9, C, E, carotene, minerals (iron, calcium, phosphorus, chlorine, sulfur, magnesium, potassium), trace elements (zinc, copper, manganese, cobalt) and sugar in the form of levulose which can also be assimilated by diabetics. Cherry tails contain potassium salts, catechic tannins and flavonoids. Also, cherries contain protein, lipids, carbohydrates (of which glucose, fructose, sucrose and pectins). Organic acids are represented by: malic acid, citric acid, chlorogenic acid, ferulic acid, caffeic acid, p-coumaric acid and oxalic acid [9, 10]. Cherries are powerful antioxidants, being rich in ascorbic acid, nicotinamide, tocopherol, pantothenic acid, pyridoxine, riboflavin, thiamine, as well as small amounts of biotin and folic acid [11, 12]. The content of mineral substances is relatively increased, such as potassium, phosphorus, calcium, magnesium, fluorine, sodium and zinc were determined in tissue [13, 14]. The anthocyanin content of fruits varies for dark-colored varieties compared with light varieties. All dark-colored varieties contain higher amounts of cyanidin-3-rutinoside

and cyanidin-3-glucoside and lower amounts of pelargonidin-3-rutinoside than light-colored varieties [15-18].

Cerasus avium (syn. *Prunus avium*) Moench. species, wild cherry, are often used in popular medicine most due to its content in polyphenolic acids with great antioxidative capacity mainly useful in anti – inflammatory diseases, hypoglycemic activities, tonic action due to their synergistic action. For medicinal purposes, the fruits stalk are used for the content in flavonoids. The main components of the peduncles are: tannins, catechins, saponins, proanthocyanidols and minerals (potassium salts) [14-18]. Flavones are represented by quercetol, genistein, dihydrovogonin and naringenol [19-23]. Due to its flavonoid, C and E vitamins, oligoelements content known for their antioxidant activity, the raw material expressed as fresh wild cherry fruits, will be studied to establish their antioxidant capacity and therapeutically potential [24-30]. With rich content in vitamins, minerals, polyphenols, carotenoids and many other compounds, *Cerasus avium* (syn. *Prunus avium*) Moench. fruits extracts, may be useful as an adjuvant in the treatment or in preventing many diseases which arise from oxidative stress action of free radicals [31, 32].

The aim of this paper was to determined the total antioxidant capacity of some fluids extracts of the soluble lipid compounds of *Cerasus avium* (L.) Moench. syn. *Prunus avium* (L.) var. *sylvestris* Ser, wild cherry fruits [33-35], aiming at exploiting the nutrient profiles and promoting the further development of these indigen phytopharmaceutical resources in some new nutraceuticals, in order to promote their phyto-therapeutic potential in hepato-digestive disorders [36-37].



Figure. 1. *Cerasus avium* (L.) Moench. syn. *Prunus avium* (L.) var. *sylvestris* Ser, wild cherry fruits

Material and Methods

The vegetal product represented by the mature drupes, without seeds of the wild cherry fruits (Fig. 2), was collected from Romania, Dobrudjia area, Constanta county, in the period of July 2018 – July 2019.

- *Sample preparation*: 0,5 g, respectively 5 g of fresh vegetal product were extracted with 50 mL ethanol 40%, 70%, 96% concentration, by cold maceration for 10 days. It was kept in the dark with periodic stirring. Extractive solution obtained was filtered on quantitative Whatman filter paper and 100 mL volumetric flask was filled in to the mark with ethanol sol. 40%, 70%, respectively 96% concentration. Due to the increased values of concentration (*TEAC*), which exceed Trolox standard calibration curve, respectively the detection limit, for the working solution, all stock solutions of extracts were diluted with 50 mL of ethanol 40%, 70%, respectively 96% concentration, molar ratio 1:2. From the diluted solutions, were taken work volumes of 5 μ L, for all samples.



Figure. 2. Mature drupes wild cherry fruits



Figure.3. Photochemiluminometer Photochem, Analytik Jena AG, Germany

Antioxidant activity by photochemiluminescence method

Evaluation of total antioxidant activity of hydro-alcoholic extract of *Cerasus avium* fruits was performed through photochemiluminescence method, determining the Antioxidant Capacity of Lipid soluble substances (ACL), according to Analytik Jena procedure, using photochemiluminometer PHOTOCHEM, Analytik Jena AG, Germany, coupled to a PC.

Total antioxidant activity was quantified by comparison with Trolox® standard solution, Hoffman-LaRoche's trade name for 6-hydroxy-2,5,7,8-tetramethylchroman-2-carboxylic acid, a water-soluble derivative of vitamin E. It is an antioxidant used in biological or biochemical applications to reduce oxidative stress or free radicals damage. External light source is mercury lamp covered with phosphorus, which ensure maximum power at $\lambda = 351$ nm and the source of free radicals is luminol (5-amino-2, 3-dihydro-1,4-phthalazinedione). The measuring signal produced by the luminescence is traced over 120 sec., [38, 39].

Calibration curve of Trolox standard was done by measuring 4 solutions of 0.5, 1.0, 2.0, 3.0 nmol of standard Trolox® (Fig. 4) and samples measurements (Fig. 5) were

performed according to the standard protocol of the ACL method, Analytik Jena AG, using volumes according to the scheme below (Table 2).

Reagent R₁ - methanol p.a.;

Reagent R₂ – buffer solution;

Reagent R₃ - photosensitizing reagent and free radical detection reagent;

Reagent R₄ – calibration standard (Trolox), for antioxidant quantification of lipid-soluble substances.

Table 2. Working procedure, Analytik Jena AG

Measurement	Volum reagent R ₁ (μL)	Volum reagent R ₂ (μL)	Volum reagent R ₃ (μL)	Volum reagent R ₄ Calibration curve (μL)	Volum sample (μL)
Blank	2.300	200	25	0	0
Calibration curve	2.295			5	0
	2.290			10	0
	2.280			20	0
	2.270			30	0
Samples curve	2.295			0	5

The signal emitted by free radicals remaining in the sample which did not reacted with the antioxidants of the sample, was measured. This reaction occurs by emission of light quanta and registered by the detector (PMT). The voltage (V) is proportional with generate luminiscence in timp (s). Trolox equivalent antioxidant activity (TEAC) is a measurement of antioxidant strength, measured in units called Trolox Equivalents (TE), [nmol/sample], [38, 39].

Apparatus used: photochemiluminometer Photochem, Analytik Jena AG, Germany (Fig. 3).

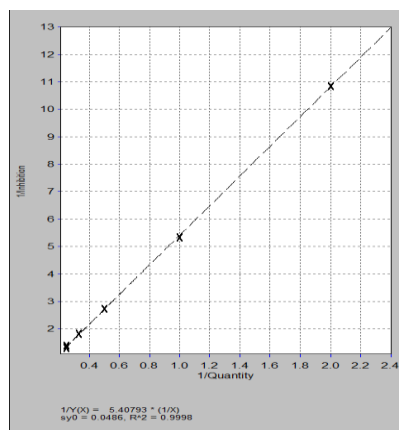


Figure 4. Trolox standard calibration curve

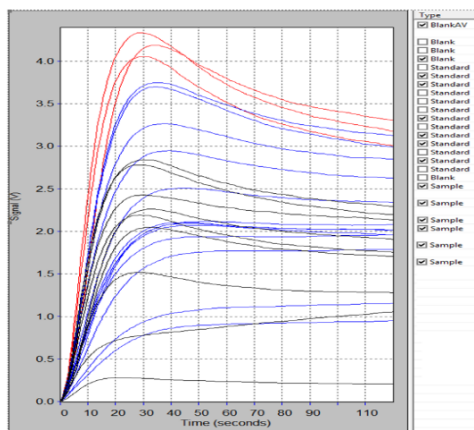


Figure 5. TEAC curves of blank, standards and samples

Results and Discussion

The results regarding the total antioxidative capacity (TEAC) of the wild cherry fruits fluid extracts, registered for the analyzed period, are presented in Table 2.

Table 2. Total antioxidant capacity (TEAC) of wild cherry fruits fluids extracts

No.	Sample	Free radicals Max. Inhibition	Total capacity antioxidant (nmol vol. equiv. Trolox/sample)	Concentration (µg/mg)
1.	Extract 1% in 40% ethanol, stock sol.	0.846	4.630 too high	exceeds calibration curve
2.	Extract 1% in 70% ethanol, stock sol.	0.871	4.683, too high	exceeds calibration curve
3.	Extract 1% in 96% ethanol, stock sol.	0.893	4.703, too high	exceeds calibration curve
4.	Extract 10% in 40% ethanol, stock sol.	0.995	4.898 too high	exceeds calibration curve
5.	Extract 10% in 70% ethanol, stock sol.	>1	Not registered Over detection limit	Over detection limit
6.	Extract 10% in 96% ethanol, stock sol.	>1	Not registered Over detection limit	Over detection limit
7.	Extract 1% in 40% ethanol, dil. 1:2	0.475	0,632	6,327
8.	Extract 1% in 70%	0.504	0,659	6,597

	ethanol, dil. 1:2			
9.	Extract 1% in 96% ethanol, dil. 1:2	0.566	0.767	7,679
10.	Extract 10% in 40% ethanol, dil. 1:2	0.517	0.674	6,748
11.	Extract 10% in 70% ethanol, dil. 1:2	0.625	0.785	7,859
12.	Extract 10% in 96% ethanol, dil. 1:2	0.638	0.886	8,870

The highest values of the total antioxidative capacity (TEAC) of wild cherry fruits alcoholic extract from fresh vegetal product at the concentration 10% in ethanol 96% was 0.886 nmol equiv.Trolox/volum sample (8,870 µg/mg), respectively 0.767 nmol equiv.Trolox/volum sample (7,679 µg/mg) at the concentration 1% in ethanol 96%, were registered.

The decreased values of the total antioxidative capacity (TEAC) of wild cherry fruits alcoholic extract from fresh vegetal product at the concentration 10% in ethanol 40% was 0.674 nmol equiv.Trolox/volum sample (6,748 µg/mg), respectively 0.632 nmol equiv.Trolox/volum sample (6,327 µg/mg) at the concentration 1% in ethanol 40%, were registered.

The results obtained regarding the total antioxidant capacity (TEAC) of wild cherry fruits alcoholic extract, recommend the extraction of soluble substances by cold maceration in ethyl alcohol of 96% or 70% concentrations, as an optimal method of extracting valuable antioxidant compounds, with pharmaceutical/nutraceutical potential applications.

Conclusion

Up to now, the development of pharmaceutical formulations has remained restricted to individual chemical drugs, even the properties obtained by using an optimal mixture of bio-active compounds could be strongly influenced by the synergism appeared in the system. The increased total antioxidant capacity registered in the case of wild cherry fruits fluid extracts, sustain the possibility to use this valuable vegetal product as ethanolic extract in different concentration, for some new nutraceutical products obtaining.

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Important Properties of Grapes and Wine from the Dobrogea Area for Therapeutic Use

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Abstract

Starting from Herodotus who states that: No cure can cure like wine and can not inspire like it. From antiquity until now grapes and wine represent a viable alternative in multiple therapies if we know how and when to consume these products. This paper is a study that comes to present concretely the beneficial impact of the products that the vine offers us, the plant cultivated in the location of our Dobrogean area. Grapes contain reducing sugars, malic acid, succinic acid, flavonic derivatives, lecithin, choline, leucine, wax and minerals. Wine also has special properties in cellular and mental balance, being a good anti-stress remedy. Medicinal wines are elixirs with beneficial effects on health only if they are prepared correctly. In this paper important properties of wine and grapes are analysed and application of wines and their specific effects in different therapies was systematized. The paper aims to open interest in this topic for scientifically controlled consumption and for the use of these natural products in beneficial alternative therapies.

Keywords: wine, grapes, sugar content, polyphenols content, total acidity, anthocyanins content

Introduction

In ancient Greece, Hippocrates, the father of medicine, recommended the wine of those with pneumonia, physical weakness, in the treatment of open wounds, but also as an antidote if someone was bitten by a venomous snake. Grape belts are suitable for both healthy and especially sick people. Grapes contain reducing sugars, malic acid, succinic acid, flavonic derivatives, lecithin, choline, leucine, wax and minerals. The Dacians used wine in the preparation of eye ointments. Today, the virtues of wine are well known: invigorating, euphoric, vasodilator and tranquilizer. Its therapeutic properties do not stop here, the wine also having antiviral action, especially against polio virus, liver virus and enteroviruses [1]. About wine we know that it helps lower cholesterol and, consumed in moderation, even helps increase good cholesterol. The polyphenols contained in wine protect the walls of blood vessels. The condition is that they should be consumed in moderate quantities (1-2 or at most 3 glasses a day, at the table), for long periods of time and, obligatorily, from a natural wine [1]. A study published in the British Medical Journal [2] says that those who consume up to seven glasses of wine a week have a 30% lower risk of having a stroke. The study was conducted on 599,912 consumer respondents taken from 19 high-income UK countries that do not have a history of cardiovascular disease. The wine has special properties in the cellular and mental balance, being a good anti-stress remedy. Wine is also a medicine for women, but consumed more by men, experts say.

Material and Methods

The most representative varieties are from the Murfatlar Viticulture and Vinification Research and Development Station. The qualities of grapes and wines were analyzed on these varieties. Among the white varieties, Chardonnay, Pinot Gris and Columna were chosen, and among the red ones, the varieties were chosen: Cabernet Sauvignon, Fetească Neagră and Pinot Noir. White, pink or red, served as the basis for macerations and therapeutic vegetable decoctions. Medicinal wines are said to be elixirs with beneficial effects on health only if they are prepared correctly. Experts say that the vegetal parts used should be crushed, then used a natural wine, of high quality, free of impurities. From washing to drying, then mixing with special wooden spoons to storage in dark bottles, hermetically sealed and conditioned in areas with a constant temperature, necessarily requiring an alcohol of at least 40% alcohol, all must be observed. Once obtained, like the wine with medical application, this acquires well-defined active principles and must be consumed slowly, in small sips.

The determination of sugars

The analyzes are successive, every 3 days or 5 days, from the entry of the grape in the leek. The determination of sugars can be done with the help of the refractometer, which is based on the physical principle of refraction of light rays through a prism, on which is placed a film of liquid, must, with different density, according to the sugar content [3].

Determination of total acidity

The titratable acidity or total acidity is the totality of the acidic substances present in the wine and can be titrated with an alkaline solution in the presence of an indicator which turns to pH 7. The acidic substances found in the wine are organic acids or acidic salts.

The dosage of the titratable acidity is done titrimetric. Take 10 mL of the analyzed white wine with a pipette and transfer to an Erlenmeyer flask. The new wine is heated to 40 degrees before titration in the sea bath to remove carbon dioxide and sulfur dioxide, which increase the titratable acidity. Then cool and add 10 mL of distilled water and 1 drop of 1% phenolphthalein. Titration takes place: from a burette add solution NaOH 0.1N drop by drop, stir the contents until pale pink is formed. It should persist for 1-2 minutes. Phenol red or red litmus paper with a turning pH can also be used as an indicator solution.

To red wines, over 10 mL of wine add a double amount of distilled water or even more, to open the red. It is then titrated to neutralization, ie until olive or muddy green appears. The calculation of acidity is expressed in grams per liter in sulfuric acid or tartaric acid. There is also a limit to the acidification of wines. The maximum limit is 2.50 g/L expressed in tartaric acid. [4].

$N \times F \times 0.0049 \times 100 = \text{acidity g / l expressed as sulfuric acid}$

To express the acidity in sulfuric acid, multiply the number of milliliters of alkaline solution used to neutralize the wine (N) by the solution factor (F), then by the equivalent in sulfuric acid - 0.0049 and by 100.

Determination of alcohol from wine

The main component of wine is ethyl alcohol from a legislative point of view and is the result of alcoholic fermentation of must sugars. Ethyl alcohol is a saturated, monohydric aliphatic alcohol, a colorless, flammable liquid with a specific taste and odor, with a boiling point of 78.4 density 0.7894 which has the formula: C_2H_5OH

The alcoholic strength of a wine can be determined by the ebullioscopic method. Other methods may be used, provided that the wine has been previously distilled. In this case, the alcohol is determined on the distiller obtained, with the help of the alcohol meter, the pycnometer, of the Mohr - Westphal balance.

The dosing of alcohol with the ebullioscope is based on the fact that water and wine have different boiling temperatures. The mixture boils between 78.4 °C and 100°C at normal pressure. Water boils at 100 degrees Celsius, while wine at 92.4 degrees Celsius. Wine, like water, is evacuated by boiling, and the division inscribed on the mobile disk remains on the ebulliometer disk. By mathematical calculations it is established at the respective temperature which alcoholic degrees correspond on the metal plate. The dosing of alcohol from wine by distillation consists in extracting the

alcohol by distillation and determining the amount of alcohol using an alcohol meter or pycnometer.

Determination of polyphenols content

The dosage of polyphenols can be performed by the Folin-Ciocalteu method, using the European Pharmacopoeia, 10th Edition. The results obtained from reading the absorbances of the samples on the spectrophotometer can be taken from the calibration curve. This is done by reading the absorbances of the increasing concentrations of gallic acid. The determination is made with the VWR UV-6300PC Spectrofotometru. The polyphenols can be oxidized by the Folin-Ciocalteu reagent to form a blue oil with a maximum absorption at 750 nm.

Determination of anthocyanins content

Total anthocyanins were determined by measuring the A520 of the aqueous phase using a VWR UV-6300PC spectrophotometer. All wine samples were made in triplicate.

Results and Discussion

Grapes

And if other foods contain sugars in the form of disaccharides or polysaccharides, requiring an expenditure of energy by the body, grapes provide sugars in the form of directly absorbable and usable. For this reason, grapes are suitable for those who consume a large amount of energy in a short time. In Figure 1 was presented the sugars (glucose and levulose) in grapes. The determination can also be done with the help of mustimeters, which are in fact aerometers or densimeters for liquids heavier than distilled water.

Grapes contain reducing sugars, malic acid, succinic acid, tanoids, flavonic derivatives, lecithin, choline, leucine, wax and minerals. When fresh, grapes contain 72-73% water, sugars 16-22% (glucose and levulose), free tartaric acid, other organic acids 0.30 - 0.35%, mineral salts (potassium, manganese, zinc, bromine, calcium, sodium, iron and magnesium oxide, chlorine, silicon, phosphoric acid, iodine, arsenic), provitamin B (0.06 mg per 100 g), vitamins B1, B2, B5, C /7 mg /100 g, vitamin E and P factors (vascular protectors), enocinamine (black grape dye with tonic effect), tannins in the skin (1.2%), etc. They can be an alternative to nutrition. The beneficial effects of grapes can be highlighted. Grapes have a tonic energy appetizer, remineralizing, vitaminizing, diuretic, but also antitoxic, stimulant and laxative liver decongestant (1). Grapes have a cholagogue effect (favors the elimination of bile), eliminator of uric acid, with properties in regulating metabolic functions, hypotensive and lowering blood cholesterol. Grapes are used in anemia, pregnancy, obesity, in demineralization, rheumatism, intoxication, hepatitis, atherosclerosis, hemorrhage.

According to T. Martin, grapes have an energetic action. "The sugars (glucose and levulose) in grapes and must represent a strictly necessary element for muscle effort

and become indispensable for the function of the heart muscle and the central nervous system" [5]

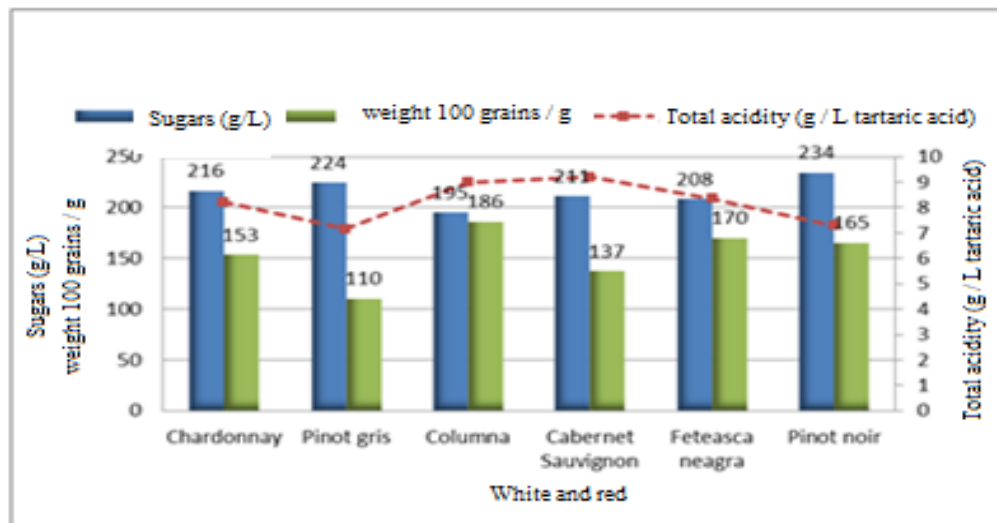


Figure 1 Grape quality, 2019 harvest

Grapes also have an alkalizing role, explained by the fact that they have a high content of acids that determine the formation of carbonates and phosphates. Therefore, grapes maintain the acid-base balance.

The remineralizing role of grapes is given by the varied content of mineral salts and ions. Grapes are a good diuretic and, being poor in albumin and sodium chloride, are indicated in kidney disease.

Rich in cellulose, grapes are also indicated in intestinal diseases, having a laxative action. "Some components of the must act in the same sense: tartrates, due to the fact that they are practically unabsorbed by the intestinal mucosa, sulfates and magnesium" [5]. Grapes are also indicated in putrefaction colitis, due to the intensification of fermentation processes.

Both grapes and must produce a stimulation of liver function, with carbohydrates having a protective role on the cells, while phosphates and potassium influence the formation of liver glycogen.

And some dermatitis can be treated with grapes, as can acne and hives. In addition, grapes are part of the diet of diabetics, due to the presence of fructose, whose metabolism is independent of insulin.

The wines

The wines from the Dobrogea hills, showed us the physico-chemical analyses, have extraordinary properties and can be used for their superior healing qualities.

The dynamic of sugar was presented in Figure 2 – (Fig. 2.a for white wine and Fig. 2.b. for red wine). The dosing of sugars is an extremely important stage, because it is taken into account to determine the time of ripening of the grapes.

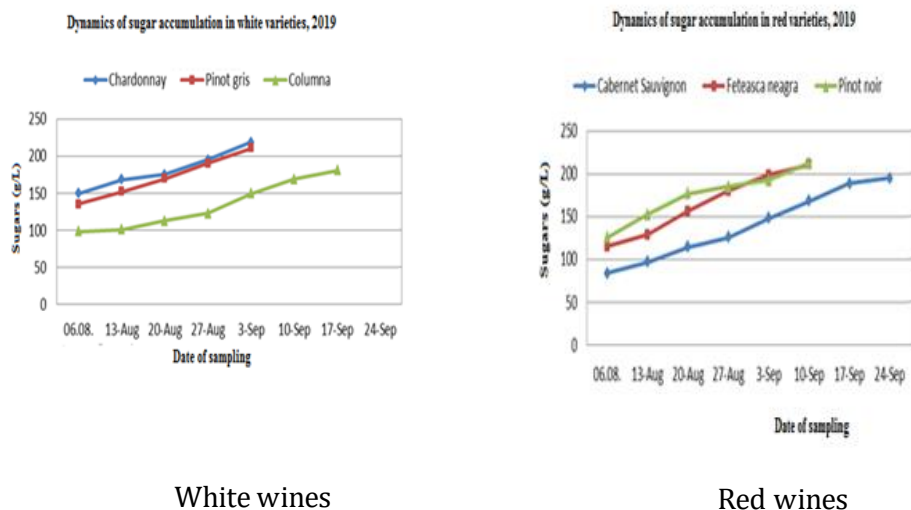


Figure 2 Evolution of sugar accumulation in white and red wines

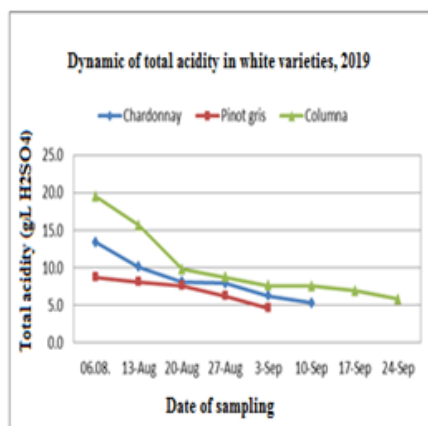
Sweetening is a common process in the wine industry. This can increase the sugar content and is made with grape must. It can also be made with concentrated grape must or rectified concentrated grape must. Determining sugars is perhaps one of the most important parameters, along with acidity. The amount of sugars helps us not only to choose the optimal time of harvest, but also to establish the vinification strategy.

The dynamic of total acidity in wine was presented in Figure 3. The wine contains tartaric acid and malic acid. In wine, some of the acids come from the must, and another part is formed in the process of alcoholic fermentation or other fermentations, but also during storage. Among the acids that come from the must we find:

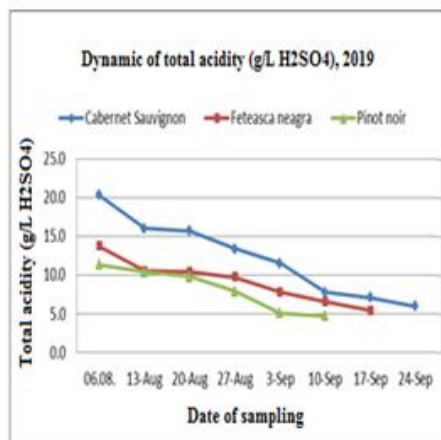
Tartaric acid (0.4 - 5.6 g / L) and constitutes 2/3 of the total acids found in wine. Tartaric acid is what imparts to the wine the specific taste of wine, in the presence of alcohol, the solubility decreasing

Malic acid is found in wines that have been made from grapes that have not fully ripened

Citric acid is found naturally in wine. It is added only if the wine has low acidity for improvement [3]



White wines



Red wines

Figure 3. Evolution of total acidity in white and red varieties in 2019

Acids are also formed during normal alcoholic fermentation:

Succinic acid 0.25 - 1.5 g / L

Lactic acid 0.5 - 6 g / L

Acetic acid, which is a normal product of the fermentative activity of yeasts in alcoholic fermentation [4].

Normal acetic acid values should be:

0.2 - 0.6 g / L for white wines

0.6 - 0.9 g /L for red wines.

The determination of the acidity of the must and the wine is made in order to decide which is the date of harvest for the type of wine proposed to be obtained. Determining the acidity helps us to correct the acidity of the musts, but also that of the more acid-rich wines. Determining the acidity also helps us to correct wines with a high acidity, in order to ensure the health of the wine. We know that acids, along with alcohol and tannin decide to preserve and age the wine, to determine the quality of the wine. [3]. The total acidity of the wine varies between 3 and 6 g /L sulfuric acid.

It should be noted that the determination of total acidity is made only for wines in which we have absolutely no carbon dioxide. If present, it is removed with a vacuum-resistant vessel. Volatile acidity is also taken into account. Volatile acidity refers to all acids that evaporate at 100 degrees Celsius. In normal wines, volatile acidity is formed as a by-product in the fermentation process and is given by acetic acid.

A normal wine contains 0.3 - 0.6 g / L volatile acidity, expressed as sulfuric acid. If the volatile acidity exceeds the ranges of 0.5 - 0.8 g /L for white wines and 1.5 - 2 g /L for red wines, then the wines acquire a sour, unpleasant taste, which irritates the taste buds, making them uneatable [3]. The law prohibits the sale of white wines that exceed 1g /L or red wines that exceed 1.25g /L. The volatile acidity of the wine is what tells us how healthy a wine is. The determination of volatile acidity is therefore necessary to protect the wine from vinegar and to control its bouquet.

The alcoholic strength of wine was presented in Figure 4. After water, ethyl alcohol is the main liquid element of wine, forming in the process of alcoholic fermentation of must. Under the action of yeast, natural sugar decomposes into approximately equal amounts of alcohol and carbon dioxide. Wines can reach a concentration in alcohol between 8-14 degrees, sometimes even 15 degrees.

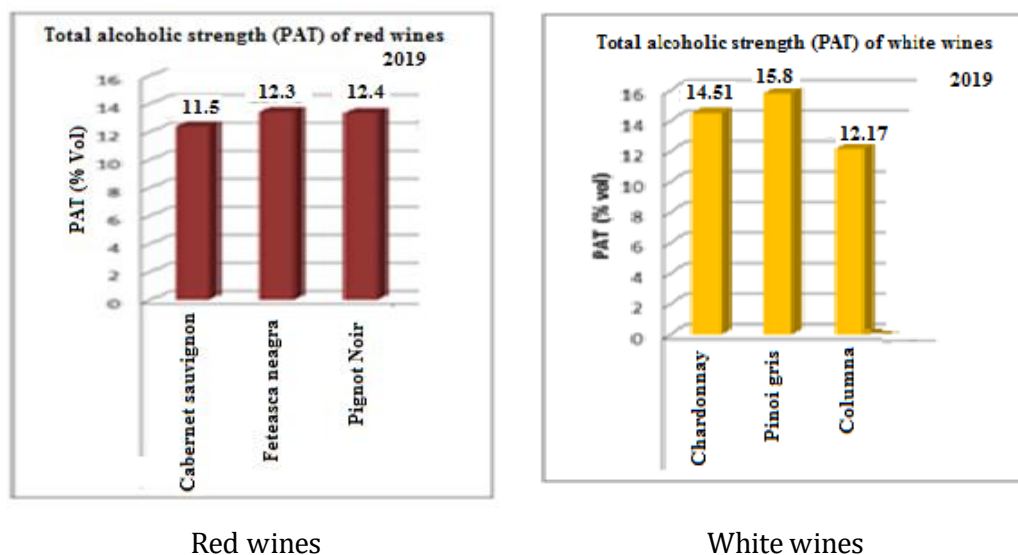


Figure 4 Alcohol concentration (% vol) for red and white wines

The alcoholic strength resulting from a normal fermentation may not exceed 15 degrees [6].

The alcoholic strength of the wine or the alcoholic strength is the amount of one hundred percent pure ethyl alcohol in ml contained in 100 mL of wine. The alcohol content of a wine can vary during its life. As they age, wines usually lose alcohol by evaporation. The higher the storage temperature, the lower the alcohol content of the wine by evaporating the alcohol [3]. The alcohol content of a wine variety is equally influenced by the soil (limestone gives wines richer in alcohol than sands), the type of vine, the climate, the year of harvest (the warm years give a wine with a higher degree high alcohol).

Wine alcohol is a good preservative, alcohol content being considered a quality criterion. The words "*wine*", "*spirit*", "*which goes up to the head*" characterize wines with a high alcohol content [6].

Polyphenols are compounds that are a fine part of the group of phenols, which are found in wines, in small quantities in white wines, large in red wines, having antioxidant properties. A phenol group is a compound with a hydroxyl group (-OH) attached to an aromatic carbon group. Depending on the number and arrangement of these phenolic groups, different polyphenolic compounds will have different biological and chemical effects in the body. In Figure 6 was presented total phenols content in red wines.

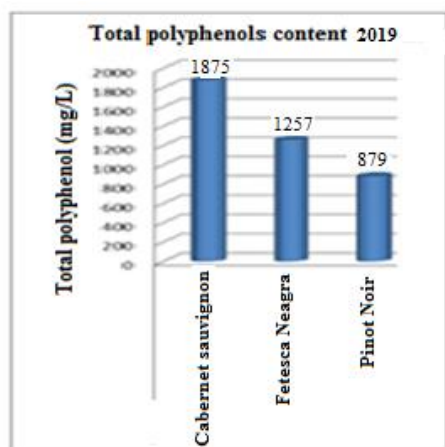


Figure 6 Total polyphenols in red wines

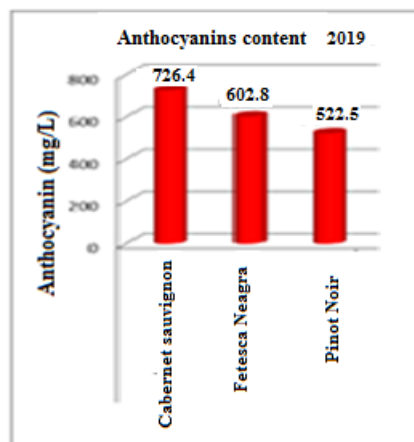


Figure 7 Anthocyanins content in red wines

Polyphenols reduce oxidative stress, have anti-inflammatory, immunoprotective and anti-cancer properties. One of the best known polyphenols is resveratrol, which is found in red grapes. Hence the recommendation of the French to consume a glass of red wine daily.

Polyphenols are often used by the ester industry, providing elasticity to the skin and preventing the unwanted appearance of wrinkles. In addition, polyphenols are used because they give ferments to the skin, but also help regenerate cells and tissues. Moreover, they have the ability to stimulate the synthesis of collagen and elastin in the skin. Polyphenols can be consumed in the form of antioxidant supplements, and are generally obtained from grape seed extract. The polyphenolic profile of a variety represents the genetic potential.

Anthocyanins content in red wines

In Figure 7 was presented Anthocyanins content in red wines. The highest anthocyanin content was recorded, the Cabernet Sauvignon variety, and the lowest in

Pinot Noir in 2019. Anthocyanins have a strong antioxidant role, they prevent the destructive action of free radicals on protein cells and DNA. Protects the body against serious diseases such as cancer or heart disease.

Therapeutic indications

A glass of white wine covers 10% of the body's magnesium and 20% of the body's manganese. It contains 120 more substances, the most important being vitamins and minerals. It is recommended to be consumed in the evening, in small quantities. To maintain our silhouette, mineral water spray (which halves calories) is recommended. Red wine belts prevent allergies. Red wine should be drunk daily, a glass of 125 mL. The first signs of healing appear after 3-4 weeks of treatment, and as a time of year, the spring and autumn months are ideal. At the same time, red wine is also recommended for people with allergic asthma. The medical explanation for the success of this procedure is that red wine stimulates the formation of histamines, which are nothing more than the antibody produced by the body to defend against allergies.

In patients with atherosclerosis, polyphenols synergistically inhibit oxidative stress in subjects receiving red and white wine [7].

In the case of kidney disorders, it has been established that there is a link between wine and disease [8]. The analyses performed on the subjects showed an association of moderate wine consumption with a low risk of cardiovascular and neurological diseases. The health benefits of moderate wine consumption can be partly attributed to its antioxidant properties. The antioxidant defense system of the kidney is increased after chronic exposure to moderate amounts of wine. This view is partially supported by direct evidence that wine and antioxidants isolated from red wine, as well as other antioxidants, significantly attenuate or prevent oxidative damage to the kidney [8].

British researchers have analyzed the effects of resveratrol on the human body and concluded that this powerful antioxidant in red wine can reduce the incidence of colon cancer by up to 50%, but also intestinal tumors [2]. Harvard specialists are convinced that the elixir of youth is found in wine. They were the first to notice the anti-aging effect of red wine [2].

Chinese experts say that diluted ethanol in wine enhances cellular phenotypic changes in human breast cancer and esophageal carcinoma, but also that cell growth suppression, colony formation and Pol III genes by mature wines are much stronger than young wines [9].

Conclusion

We started from the idea that there should be common elements between the health field and the pharmaceutical industry, on the one hand, and Murfatlar wine, on the other hand.

Following the laboratory analyses, we discovered not only that all the chosen wines correspond to the quality criteria in the field, but also have superior properties. Chardonnay, Pinot Gris or Columna, among the white wines, or Cabernet Sauvignon, Fetească Neagră or Pinot Noir, whichever you would like to choose, you will have an ally on your side.

Whether we are talking about wine polyphenols that protect blood vessels, or we use it as a remedy for cellular or physical balance or it serves as a basis for macerations and herbal therapeutic decoctions, we say that Bachus liqueur is a true elixir with beneficial effects on the our body.

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Characteristics of Techirghiol Sludge and Different Methods of Peloid Therapy

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Abstract

The paper highlights the physical, chemical and biochemical composition of the sludge and systematizes the beneficial effects obtained by applying Techirghiol sludge through specific procedures. Techirghiol sludge is a well hydrated sapropelic sludge, with a high content of minerals and organic compounds. Following the application of sludge on the skin, a series of processes take place: stimulation of sensitive endings, energy and substance exchanges, general thermoregulation, vitamin D synthesis, regulation of homeostasis balance by immune, endocrine and neurovegetative mechanisms, better tissue oxygenation. The use of Techirghiol sludge in medical therapies is often alternative and complementary treatments in the treatment of diseases that can be good solutions for amelioration various diseases.

Keywords: sapropelic sludge, Techirghiol, sensitive endings, tissue oxygenation, general thermoregulation

Introduction

In 2011, Techirghiol sludge was recognized by the World Federation of Hydrotherapy and Climatotherapy as the best sludge in the world. Also called "Techirghiol black gold", Techirghiol sludge has been known for 200 years for its prophylactic, healing and recovery effects. Peloid therapy (pellos, lb.Greek = shore; lb.engl. Mud-therapy, peloidotherapy) is therapy with peloids or muds, which are substances formed naturally, following geological processes, which in a finely divided state and mixed with water is used in medical practice for therapeutic purposes, in the form of local or general procedures (definition of the International Society of Medical Hydrology) [1]. The use of sludge has been done since antiquity. In ancient Egypt, people anointed themselves with the mud brought by the Nile during the floods. The Romans knew and used mud as a therapeutic agent [1]. Pliny (23-79 e.n.) recommends the use of spring sludge, Dioskorides (50 e.n.) recommends in his pharmacology the use of sludge and later Galenos (131 - 201 e.n.) indicates the use of sludge in various treatments [1]). In ancient times, Cleopatra, considered a beauty of her time, used mud for bodily maintenance for skin health. The beneficial effects of the mud and salt from the Dead Sea led her to ask Marc Antoniu to conquer this region in order to benefit from this remedy. Therefore, the use of Dead Sea mud for therapeutic purposes dates back thousands of years, from the time of the Roman Empire to the present day, without anyone complaining to this day about side effects [1].

Peloid therapy was frequently used in medieval times. Emanuel Felke, a therapist of German origin, nicknamed "Clay Pastor" tried to bring this therapy back to the modern era. In the 17th and 19th centuries, peloidotherapy became quite popular in Europe [2]. The first record of the therapeutic effects of the water of Lake Techirghiol and the mud dates from 1854, when the Ottoman commander Said Pasa made several mud baths at the instructions of the locals. Starting with the 19th century, medical research in the area will be subsidized by the Romanian state. Sapropelic sludge formed by underwater sedimentation of organic and mineral materials under the influence of biological, microbiological and physico-chemical processes, with a content of organic substances in dry mud of over 10% - exist in a continental lake, or lagoon [3]. At present, peloidotherapy is associated with other types of therapies that exist in Physical Medicine, Recovery and Balneology (electrotherapy, physiotherapy, massage therapy, etc.), creating an individualized therapeutic plan, adapted to each patient, depending on his condition. which corresponds to a personalized medicine.

General Data About Lake Techirghiol

Lake Techirghiol, located on the shores of the Black Sea, between the localities of Techirghiol, Eforie Nord and Eforie Sud, is the largest salt lake in Romania. It has a length of 7,500 m, a maximum depth of 9 m. This lake is fundamentally different from other lakes in its physical and geographical aspects, although the genesis is the same (fluvio-marine estuary). The average water temperature is generally close to that of

the air. Lake Techirghiol is located S-SW of Constanta and 150 m away from the Black Sea. It has an irregular shape, being formed by a central basin from which start three branches: an arm directed towards the locality Techirghiol of 2 Km long, one directed towards the village Tuzla, of 3 Km long, and the third directed towards the village of Urlichioi of 5 Km length (Fig. 1). The marine origin of the lake is proven, among other things, by the existence of shells of marine life, which today no longer live in the lake due to the concentration of its waters, but which continue to live in the Black Sea, such as *Mutilus edulis* [4]. The lake is 1.5 m below the level of the Black Sea, has a variable depth from 0.5 m to 5 m, reaching in some places 9-10 m. It is supplied with rainwater by the rivers Techirghiol, Mazurat, Carlichioi and Celmalar and springs from Sarmatian limestones, sources not precisely identified. The lake water has a high mineralization, having a salinity of over 90 g /L.

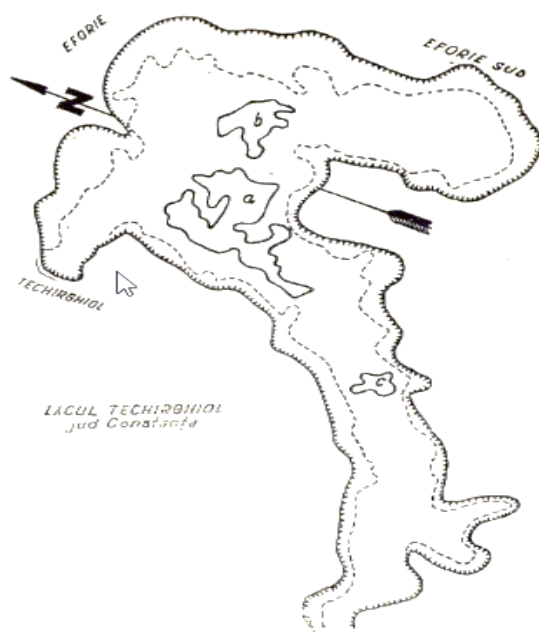


Figure 1. Techirghiol Lake map

The fauna consists of several species of arthropods, worms and protozoa, the flora through several species of algae, and towards the bottom sulfurous bacteria predominate. Lake Techirghiol is a very important avifauna area, declared a Ramsar site in 2006 (with an area of 1462 ha). Among the globally threatened bird species are the red-necked goose (*Branta ruficollis*) and the white-headed duck (*Oxyura leucocephala*).

The invertebrate fauna of Lake Techirghiol is dominated by the crustacean *Artemia salina*, 10-12 mm, red, (Fig.2) which together with the alga *Cladophora cristalina*

provides the raw material for the production of sapropelic mud (Fig. 3). The corpses of *Artemia salina*, through bacterial decomposition, together with the alga *Cladophora cristalina*, forms the sapropelic mud [5]. *Artemia salina* (L.) is a primitive aquatic arthropod (salt lake) in the family *Artemiidae* about 100 million years old. It was discovered by Linnaeus (1758) who named it *Cáncer salinus*, and 61 years later, Leach (1819) renamed it *Artemia salina* (Asem et al., 2010). *Artemia salina* lives only in lakes and ponds with high salinity, which varies between 60 - 300 ppt. [1].

After identifying phytoplankton species and determining their abundance, the following types can be considered to play an important role in the productivity of these lakes with peloidogenic potential:- Filamentous algae: *Cladophora crystallina*, *Enteromorpha clathrata*, *Spirogyra tenuissima*, *Ulotrix zonata*, *Rhizoclonium hieroglyphicum*. These species contribute in significant quantities to the organic material of Techirghiol lakes [5].

Characterization of Sapropelic Muds of Estuaries and Coastal Lakes

The mud from Lake Techirghiol is black as oil, shiny and has a characteristic odor. Sapropelic muds are represented by black deposits rich in colloidal iron hydrosulfide, have a plastic and greasy appearance, are found on the bottom of salt waters originating from the action of microorganisms on the flora and fauna of the aquatic basin which is associated with mineral or inorganic substances.

Table 1. The main quality indicators of sapropelic mud

Type of quality indicators	Description
1 Macroscopic properties	Colour and physical consistency; The texture of the pellets relative to the dispersion state of their solid phase, The size and proportion of the particles entering their composition, Must contain a small percentage of particles with dimensions greater than 0.25 mm, estimated as the degree of dirt in the mud.
2 The humidity of peloids	It is dependent on the chemical composition and their physico-chemical properties, primarily colloidal.
3 Degree of hydration of heterogeneous peloid sediment	The humidity in the global composition: -little hydrated peloids <37% -hydrated peloids 37 - 40% -highly hydrated peloids 40 - 70%
4 The peloidogenetic stage of evolution	Corresponding therapeutic peloid, the degree of decomposition of organic substances, depending on the quantitative ratio between the main classes of organic substances (carbohydrates, humic substances, protein substances, organic carbon / organic nitrogen) and the level of biological oxygen consumption.

5	Overall organic matter content relative to dry matter	Differentiates mineral sludges from organic sludges as their percentage is below or above the 10% limit. The quantitative differences between the main groups of organic substances have their mark on the quality of the therapeutic sludge.
6	Mineralization and ionic composition of the soaking solution of peloids	As factors of interaction with the human body in the skin: poorly mineralized, below 15g / L mineralized, 15-35 g /L strongly mineralized, 35-150 g /L saturated in salts, over 150 g / L
7	Hydrogen sulphide and sulphide content	In particular iron sulphide, as follows: non-sulphurous peloids, below 0.02% FeS weakly sulfurous peloids, 0.02 - 0.15% FeS sulfurous peloids, over 0.15% FeS
8	The pH of the peloids	is an indicator with a wide range of values: acids (pH below 5), weakly acidic (pH between 5 and 7), weakly alkaline (pH between 7 and 8 and alkaline, with pH above 8.

It possesses physical properties that make it extremely useful in various treatments. The sedimented mud on the bottom of the lake has an uneven distribution, being grouped in three islands of different sizes.

These islands have a stratified sludge, namely: a black therapeutic sludge, which is above a brown sludge. The brown sludge is in turn stored over a layer of gray marl. The brown mud appeared as the first deposit when the water of the lake began to separate from the water of the Black Sea, when as a result of the concentration of the waters, the fauna and flora perished massively. Shells of *Mitilus edulis* appear in this layer of mud, which confirms the marine origin of the lake. (3). In Table 1 was presented the main quality indicators of sapropelic mud[6]. The macroscopic properties are very important [7]. The humidity and the degree of hydration of peloids are dependent on the chemical composition. The peloidogenetic stage of evolution give information on the degree of decomposition of organic substances, depending on the quantitative ratio between the main classes of organic substances [7].

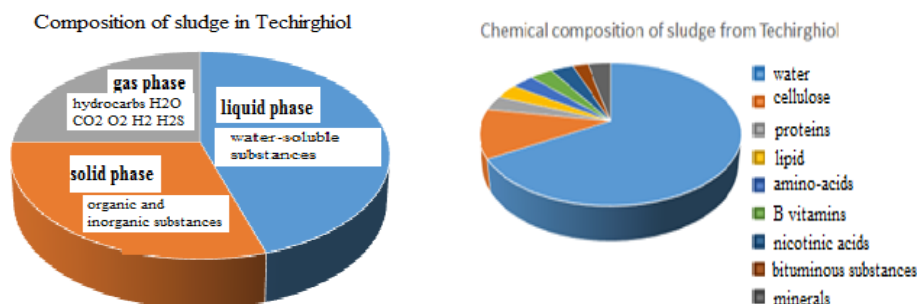
The physical properties

The physical properties of sludge are plasticity, water capacity (hydroxypexia), specific gravity, their ability to retain heat (thermopexy) and granulation are of particular importance in establishing therapeutic indications and in their use in various forms [7, 8].

The ionic balance of a sludge is also reflected on its pH. In general, the sludge is alkaline pH = 9-10. The therapeutic effect of the sludge is given by the combination of its physical and chemical properties.

Chemical Composition

From a physico-chemical point of view, sludge is a heterogeneous physico-chemical system consisting of a liquid phase containing water and water-soluble mineral salts, a solid phase containing mineral and organic substances and a gaseous phase containing hydrogen sulphide, carbide dioxide, hydrocarbons, etc. (see Figure 2.a) In Figure 2.b was presented the main compounds of Techirghiol sludge.



The phases of a heterogeneous sludge main compounds of sludge
Figure 2. Chemical composition of sludge in Techirghiol

Table 2. The classes of the main compounds of Techirghiol sludge

metals	nonmetals	salts
Fe	bromine	bromides
Na	chlorine	clorides
Ca	phosphorus	phosphates
Mg	silicon	silicates
k	Carbon	carbonates
selen	sulfur	sulphates
-	-	sulphides
Fe	bromine	bromides

The classes of main inorganic compounds of Techirghiol sludge was presented in Table 2. The amount of mineral substances of sapropelic sludge is 20-40%.

The organic substance appears almost entirely in colloidal form, being represented by several important groups such as: carbohydrates (cellulose), lignin (hemicellulose), humic components (humic acids and humites), bituminous components (waxes, resins), lipid components and proteins and their degradation products (amino acids). Among the chemical components of the sludge, a special therapeutic importance is given to humic substances, bituminous substances, colloidal iron hydrosulfides, calcium carbonate and zeolites [4]. Humic substances, whose intimate structure has not yet been exactly specified, but whose properties, such as high degree of swelling, enzymatic braking action, ion exchange property, are

known and represent an important physicochemical factor of sludge [4]. Zeolites have the same active participation in ion exchange (ad- and absorption). Calcium carbonate is a good skin emollient. The bituminous fraction is of interest due to the so-called estrogen-active substances it contains, highlighted by biological tests.

Biological Factors of Mud

The enzymatic activity in sludge is mainly of microbial origin, being derived from intracellular, cell-associated or free enzymes [1, 4].

Enzymes are vital activators in the body's processes, but also in sludge and play an important role in maintaining the health of the soil and its environment. These enzymes may include amylase, aryl sulfate, b-glucosidase, cellulase, chitinase, dehydrogenase, phosphatase, protease, and urease [4].

The appearance of estrogen in the aquatic environment attracts increased attention because of their strong disruptive endocrine potential. Estrogen hormones are structurally non-steroidal molecules based on the phenanthrene ring. They are produced from cholesterol primarily in the ovaries in response to signals from the brain or other organs and, albeit in smaller amounts, in the testicles of men (18). Estrogens found naturally in all classes of vertebrates are 17 β -estradiol (β -E2), 17 α -estradiol (α -E2), estrone (E1), and estriol (E3) [1]. Chemicals known to have the potential to bind and to activate estrogen receptors are natural compounds such as phytoestrogens, mycoestrogens and synthetic estrogen analogs, such as the potent pharmaceutical 17 α -ethynylestradiol (the active ingredient in contraceptives) [5].

A unique balance of chemical, physical and biological components (including microbial activities, especially enzymatic), contributes to maintaining the health of the sludge. The assessment of the health of the sludge therefore requires indicators of all these components. Healthy sludge is essential for the integrity of terrestrial ecosystems to remain intact or to recover from disturbances such as drought, climate change, pest infestation, pollution, and human exploitation [4, 7,8].

Therapeutic Methods of Treatment

Balneology and medical recovery complete the allopathic therapeutic arsenal with a wide range of natural healing factors. Therapeutic methods specific to this medical field, applied in isolation or complementary to drug treatment are indicated in a wide range of diseases, in certain stages of the disease, having a prophylactic, curative or recovery role, as addressed to the body at a certain functional stage. of the disease, during the period of convalescence or chronicity. In Table 3 we present different methods of applying peloid therapy.

The effectiveness of the spa cure depends to a large extent on establishing the optimal moment of its application, on the most appropriate choice of the resort according to the clinical profile of the individual. For this reason, the initial clinical evaluation and the recommendation of the family doctor or specialist are decisive [5].

In modern pathology, chronic diseases dominate, which are grafted on some functional disorders of the whole organism and which decrease its resistance capacity. In the modern orientation of therapeutics, in parallel with the specific treatment of various diseases, it is necessary to act consistently, adaptation and normalization of its functions, deranged during the pathological process [7,8].

The application of therapeutic methods given by the use of sludge have a significant prophylactic character, especially for the comfort and toning of the organism, to avoid the chronicity of diseases, the avoidance of recurrences and the complications that may occur in their evolution. In Table 4 we presented the main indications for peloidotherapy [8,10].

Table 3. Different methods of applying peloid therapy

Type of procedure	Methods of applying peloid therapy
The mud anointing	it is the oldest method; involves the application of cold mud on the skin in a thin layer, on limited areas or the whole body, after pre-heating in the sun (10-15 minutes). The patient is then exposed to the sun, in an upright position, until the mud dries (30-60 minutes), followed by a 10-15 bath in lake or sea water, accompanied by joint mobilizations in all planes and a short shower. with cold water, and finally bed rest for at least an hour.
Mud wraps	consist of applying mud in a layer of 1-2 cm heated to 38-46°C on a limited region or on the entire surface of the body, for 20-40 minutes.
Poultices	are mud applications on limited regions of the body.
Mud baths	in bathtubs with heated ghjol water in which 10-12 kg of sludge are added, progressively increasing its concentration up to 10-25%. The mixture can be heated to 44°C. In patients with cardiovascular disease the temperature should not exceed 37 °C, and for those with inflammatory rheumatic diseases <36°C. The duration of the bath is 20-40 minutes. The bath must be followed by a shower at 37-38 °C and a rest of at least one hour. A cure consists of 12-15 sessions, one session per day or every two days.
Gynecological applications	in the form of vaginal tampons with mud at 39-40°C for 2 hours or vaginal irrigation with mud dissolved in ghjol water, heated to 37°C.
Mud massage	involves applying mud to the skin, followed by medical massage techniques.

Table 4. Indications for Peloid therapy

System	Diseases
The locomotor system	inflammatory rheumatism -degenerative rheumatism with different locations: spine (spondylosis, simple discopathies, chronic lumbago, etc.), peripheral (coxarthrosis, gonarthrosis, etc.) - abarctic rheumatism - post-traumatic sequelae

Nervous system	- CNS and peripheral damage
Derm	- Psoriasis - chronic eczema - chronic urticaria
Genital system	- chronic inflammatory -secondary sterility
Respiratory system	- ENT sphere - post-TB sequelae
Endocrine system	- hypothyroidism - obesity - rickets or weakness in children - pituitary dwarfism

The main indications for peloidotherapy are rheumatic diseases, degenerative diseases such as spondylosis, osteoarthritis of the hands and feet, or inflammatory diseases such as ankylosing spondylitis. Among the diseases of the musculoskeletal system indicated for sludge therapy are other conditions such as chronic lumbago by lumbar discopathy, sequelae after disc herniation operated as well as various forms of abarticular rheumatism, tendonitis, fibrosis [11].

An important place in mud therapy is also occupied by diseases of the musculoskeletal system due to trauma, various post-traumatic sequelae, as well as neurological causes, especially neurological disorders of the peripheral nerves [10-12].

Chronic uterine-anxial gynecological diseases and infertility also occupy an important place in mud therapy, as well as a number of endocrine diseases such as hypothyroidism, hypoparathyroidism or pituitary and dermatological dwarfism such as psoriasis, eczema and chronic urticaria, etc. [12].

Contraindications

Mud therapy is contraindicated if the patient suffers from asthma, diabetes, ulcer, any form of cancer or hepatitis, if you have kidney or cardiovascular disease. Special contraindications refer to valve sequelae after acute rheumatoid arthritis, febrile forms or those with systemic manifestations or evolutionary potential marked by rheumatoid arthritis and also to febrile, disabling forms with marked kyphosis and advanced respiratory failure, forms with systemic lesions overweight ankylosing spondylitis (1).

Conclusion

Therapeutic efficiency of sludge used from the spa, Techirghiol highlighted the main conditions for which the sludge treatment is suitable, parameters that must be used for the therapeutic efficacy and the modalities of application of the sludge therapy (peloidotherapy). Among the factors used in the balneotherapy of inflammatory rheumatic diseases, the therapeutic sludge is very important. The treatment applied can have a prophylactic, curative or recovery character, depending on the variety of cases of the disease to which it is addressed.

The treatment for prophylactic purposes will be addressed to patients who have persistent but unsystematized painful musculoskeletal syndromes.

Therapeutic treatment can be applied to patients with rheumatoid arthritis in the early stages, with inflammatory phenomena present, spondylitis, psoriatic arthropathy and arthritis secondary to gonococcal or genital infections.

The recovery treatment is addressed to patients with rheumatoid arthritis in stages II or III biologically stabilized, but with functional deficits, forms of rheumatoid arthritis who have undergone orthopedic-surgical interventions or with respiratory dysfunction.

The objectives of the cure are to reduce the pain, to fight the muscular atrophies, to increase the joint mobility, to increase the body's defence capacity, to rebalance the neuro-vegetative field.

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Double Product as a Predictor of Coronary Artery Disease in Males with Normal Blood Pressure

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Abstract

Aim: This study investigates whether in males with normal blood pressure that underwent exercise stress test Double Product (DB) or Double Product Ratios to workload (DPR) are self-sufficient in predicting the presence of coronary artery disease (CAD). **Method:** 78 male patients with normal blood pressure went through bicycle exercise stress test (EST) and within four weeks they underwent coronary angiography. 34 of them resulted with normal coronary arteries and 44 of them were diagnosed with one or multiple vessel CAD. Pressure rate double product was calculated in rest, in the first stage of the exercise test, in the peak of exercise, and also in the second, fourth and sixth minutes of recovery of the stress test. Also, the ratios of pressure rate double product with the workload, which reflects the relative growth of double product to the workload, were calculated. The results were compared between the two groups, the one with normal coronary arteries, and those with abnormal coronary angiography. **Results:** DP in rest and in the first stage of the exercise are not significantly different for normotensive males with or without CAD, while the peak DB value of the exercise, as well as the second and sixth minutes of the recovery are significantly lower for the group of patients with CAD. The starting peak workloads were significantly lower in the patients' group with CAD ($p=0.0002$ and $p<0.0001$). On the other hand, the double product to workload ratio at the first stage was significantly lower in males with normal blood pressure and CAD. Significant lower DPR are detected also in the fourth and sixth minutes of recovery. **Conclusion:** The values of DP in the peak exercise and at the second and sixth minutes of the recovery phase are significantly lower in normotensive males with abnormal coronary angiography compared to those with normal coronary arteries, and these findings can be used to detect the presence of CAD despite the ECG changes and they are not affected by the baseline characteristics of the

patients. The ratios between DP and workload at the first stage, and in the fourth and sixth minutes of recovery are significantly lower in normotensive male patients with coronary artery disease compared to those without CAD and can be independent predictive parameters for the disease.

Keywords: double product, double product ratios to workload, coronary artery disease, exercise stress test, normal blood pressure, male patients

Introduction

Pressure Rate Product (PRP), also known as the double product (DB), is used in exercise physiology to measure the stress put on the cardiac muscle based on the number of times the heart needs to beat per minute and the arterial blood pressure that pumps against. It is a good indicator of the energy consumption of the myocardial muscle.

$DP = SBP \times HR$

The most important three determining factors of myocardial oxygen uptake are tension within the myocardium, its contractility, and heart rate. While exercising the values of the above three factors increase, the blood flow changes to balance oxygen supply with the increased demand. Double product closely reflects the directly measured myocardial oxygen uptake and coronary blood flow over a range of exercise intensity.

Standard values of DP vary from 6000 at rest (HR, 50b/min; SBP, 120 mmHg) to 40000 during very intense exercise (HR, 200 b/min; SBP, 200 mmHg) (Katch, McArdle, & Katch, 2010).

It is known that high levels of systolic blood pressure to workload rates in males with hypertension reveals the diagnosis of coronary artery disease despite the ECG variations during an exercise stress test, and this is not influenced by other basic characteristics of the patients (Temali & Kamberi, 2020). There are also researchers that have denied the prognostic importance of blood pressure response to exercise due to its rare reproducibility and lack of clinical finding characterizing those who consistently respond in this manner (Sharabi, et al., 2001).

It is also known that exercise heart rate is disproportionally increased with the increase of workload during exercise stress test in males with coronary artery disease (Kamberi, Heba, & Gjoka, 1999).

According to a study an increased systolic SBP and HR are predictors of death and disability in general population, but DB did not add to risk stratification over and beyond SBP and HR (Schutte, et al., 2013).

Systolic (SBP) and diastolic blood pressure (DBP) and mean arterial pressure (MAP) are risk factors for cardiovascular mortality (CVM). (Yazdani, et al., 2020) considered

the DP as a marker of cardiac workload. They have examined the predictive value of DP to coronary angiography. DP proved to be an independent predictor of cardiovascular and all-cause mortality also in multivariate analysis.

However, Liu et al. (2019) found out that DB was significantly associated with all-cause and cardiovascular disease (CVD) mortality and the association between the DP and mortality would be stronger than that between mortality and SBP&HR, amplifying once more the importance of studying DP.

(Berman, Wynne, & Cohn) aimed to determine the value of a multivariate approach for the analysis of the treadmill exercise tolerance test (ETT). Predictive value of a positive ETT was 0.78 using 1.0-1.9 mm ST segment depression criterion. When the 1.0-1.9 mm ST criterion was combined with peak systolic blood pressure-heart rate product (double product) < 23,000, exercise duration less than 6 minutes, and ST depression for greater than 3 minutes into recovery, predictive value improved to 0.89. Predictive value for multivessel disease was also improved using non-ST criteria. Predictive value of a negative ETT for absence of coronary artery disease was 0.60, and was 0.86 if double product was > 30,000.

Rafie, et al. (2008) aimed to assess the prognostic power of double product (DP) parameters in patients referred for standard exercise testing. In this study population, DP reserve had greater prognostic power than metabolic equivalents, maximal HR or systolic blood pressure, or HR recovery.

Villella et al., (Am Heart J., 1999) researched the prognostic significance of DP to maximal symptom-limited exercise stress testing after myocardial infarction treated with thrombolytic agents. They showed that DP is a predictive index to assess prognosis in survivors of acute myocardial infarction treated with thrombolytic agents able to perform an exercise test after acute myocardial infarction, but its usefulness appears to be limited, considering that these patients were at low risk.

A study (Moradi & Fariba, 2017) compared the DP index before and after cardiac rehabilitation in patients undergoing coronary artery bypass grafting (CABG). The results of this study showed that the mean of the DP index, which is a quantitative criterion for the assessment of cardiac function, significantly increased after 12 rehabilitation sessions in patients who underwent CABG.

According to our view not only the peak blood pressure and peak heart rate determine the response of blood pressure and heart rate during recovery, but it is the workload that provokes the increase of heart rate and blood pressure during exercise, and thus during the recovery. Based on this, not only DB should be observed during exercise, but also the rate between DB and workload, known as DB index. Thus, in this study we investigated the relative response of pressure rate double product and its ratios to workload during exercise and recovery.

Methods

78 normotensive males aged 34-64 years old were involved in this study. All of them had gone through the progressive exercise stress test (EST) stage by stage with the goal of maximal physical effort according to the protocol of A. Kamberi (Kamberi A., 1984). EST was performed with an ergonomic bicycle. All the patients underwent coronary angiography within four weeks. The patients were grouped according to the result of the EST and coronary angiography. Four of the patients were excluded from the study because of one of the four basic information.

Electrocardiogram (ECG) is registered at rest in sitting position, in the third minute of every stage of the exercise, and also in the second, fourth and sixth minutes of recovery. Blood pressure is measured in rest in laying position, sitting in the bicycle, and in the last 20 seconds of every exercise stage and in the second, fourth and sixth minutes of recovery.

The definition of hypertension is considered present when SBP is greater or equal to 140 mmHg, or when diastolic blood pressure is found equal to or greater than 90 mmHg (ESC Journal, 2019)

Pressure rate double product is calculated $DP = \text{Heart Rate (HR)} \times \text{SBP} / 100$.

To show the relative increase during exercise and the relative decrease of pressure rate double product in the recovery, rates of DP are calculated as $rDP = DP / \text{Workload (W)}$ respectively in rest, first stage, exercise peak, second, fourth, and six minutes of recovery.

The first stage DPR (DPRf) is calculated as the rate of the double product of the third minute of the exercise to the workload at that stage.

The peak DPR (DBRp) is the ratio of the peak DP to the peak workload.

The second, fourth and sixth DBR (DBR2, DBR4 and DBR6) are the ratios of DP to the peak workload.

The EST is considered as positive when during the exercise or the recovery it is found specific abnormal ECG.

As specific abnormal ECG is considered the presence of horizontal or down-sloping depression of ST segment equal or greater than 1 mm, 80 milliseconds away from the joint point S-ST, or when there is the elevation of ST-segment 1 mm or more starting from the J-point, or there is slow up-sloping depression of ST-segment. Also, the stress test is considered positive when there is angina provoked from exercise, in the absence of ECG changes.

The stress test is considered negative when it is achieved 85% or more of the target heart rate with no specific changes in EG or typical angina. In the absence of achievement of 85% of target heart rate, and of typical angina pectoris, the stress test is considered as non-conclusive.

All of the patients with normal blood pressure and EST are divided into two groups according to the coronary angiography result. Group I, 34 individuals with normal tension and normal coronary angiography, and Group II, 44 patients, with normal tension and abnormal coronary angiography. Each of them is analyzed according to the coronary angiography (Normal – Abnormal), and according to the EST.

Statistical Analysis

All the variables are compared between two groups with *t* test. The analysis of continuous variables is done with ANOVA for all groups and with Scheffe procedure with statistical level of significance of 5%. To determine the impact that other independent factors have to various values of DBR, stepwise regression method is used.

Results

Basic characteristics of normotensive males with normal or abnormal coronary angiography like age, weight, height, body mass index (BMI), ejection fraction, time of exercise, DP at rest and at the initial stage of the EST, the workload at the first stage and at the peak of the exercise, as well as the DP in the sixth minute after recovery, did not show statistical difference in both groups.

Meanwhile, the DP at the peak of exercise and in the second and sixth minute after recovery, in addition to the ratios of initial workload and peak workload to BMI were statistically higher in normotensive males with normal coronary arteries, respectively 298 versus 228 ($p=0.001$) for the peak, 163 versus 133 ($p=0.0003$) for the second minute of recovery, and 120 versus 108 ($p=0.0390$) for the sixth minute of recovery (Table 1).

Starting workload, peak workload and the percentage target heart rate achieved were significantly higher in normotensive males with normal coronary arteries as compared to normotensive males with coronary arteriopathy.

Table 1: Characteristic of normotensive males with normal and abnormal coronary artery disease

Characteristics	Normal coronary Angiography Mean (SD)	P-Value	Abnormal coronary Angiography. Mean (SD)
Age, years	44 (9.8)	0.0004	53 (9.7)
Weight, kg	75 (13)	0.4600	73.3 (8.4)
Height, m	1.70 (0.47)	0.6000	1.70 (0.5)
Body mass index	25.9 (4.03)	0.3200	25.2(2.5)
Ejection fraction, %	0.69 (0.09)	0.0600	0.64 (0.13)
DP at rest, mm Hg	91.8 (13.9)	0.4736	89.3 (16.6)
DP at the end of 1 st exercise stage, mm Hg	143.6 (23.6)	0.3660	138 (29.5)
Peak DP, mm Hg	298 (60.2)	<0.0001	228.4 (63.3)

DP at recovery 2 nd minute	162.5 (38.8)	0.0003	132.6 (29.3)
DP at recovery 4 th minute	132.1 (29.6)	0.2310	117.8 (23.9)
DP at recovery 6 th minute	119.9 (26.5)	0.0391	107.7 (23.4)
Starting work load, watt	39.4(10.1)	0.0002	31.4 (8.2)
Peak work load, watt	144.0 (38.2)	<0.0001	108.3 (35.7)
Exercise Duration, min	10.7 (3.0)	0.0490	9.2 (3.7)
Percentage target heart rate achieved	86.2 (11.2)	<0.0001	70.3 (11.4)

Table 2: Double Product Rates to workload in normotensive males with normal and abnormal coronary artery disease

Double Product Rates to workload	Normal coronary angiography	P-Value	Abnormal coronary angiography
	Mean (SD)		Mean (SD)
First stage DPR	3.921(1.288)	0.0247	4.655(1.484)
Peak DPR	2.137(0.457)	0.3478	2.278(0.708)
2 nd recovery minute DPR	1.175(0.324)	0.0673	1.378(0.552)
4 th recovery minute DPR	0.954(0.265)	0.0074	1.224(0.500)
6 th recovery minute DPR	0.876(0.247)	0.0221	1.113(0.523)

Table 3: Mean Differences and Confidence Interval of Double Product Rates to workload in normotensive males with normal and abnormal coronary artery disease

TAN	Mean Diff	Confidence interval	
		95% lower	95% upper
First stage DPR	-0.734	-1.371	0.096
Peak DPR	-0.142	-0.440	0.157
2 nd recovery minute DPR	-0.134	-0.265	-0.002
4 th recovery minute DPR	-0.270	-0.468	-0.075
6 th recovery minute DPR	-0.236	-0.438	-0.035

Regarding the rates of DB to the workload the first stage, the fourth and sixth minutes of recovery are statistically significant in normotensive males with coronary artery disease compared to normotensive males with normal coronary arteries (

Table 2).

So, the mean difference of the first stage of DPR is -0.734, confidence interval (CI) 95% from -1.371 till 0.096 ($p=0.0247$). In the fourth recovery minute the mean difference is -0.270, whereas the CI 95% ranges from -0.468 to -0.075 ($p=0.0074$), and in the sixth recovery minute the mean difference is -0.236, whereas the CI 95% ranges from -0.438 to -0.035 ($p=0.0221$) according to the analysis shown in

Table 2 and Table 3.

Stepwise regression analysis pointed out the determinant factors of every DPR specifically. It is very important to underline that BMI, weight, height, initial systolic blood pressure (SBPi), and diastolic blood pressure (DBPi) do not have any influence. On the other hand, the peak workload (Wp), the peak SBP (SBPp), the peak heart rate (HRp) are the most common independent determiners in various phases of the exercise stress test, regarding the double product rate. The respective results are displayed in Table 4.

Table 4: Mean Differences and Confidence Interval of Double Product Rates to workload in normotensive males with normal and abnormal coronary artery disease

SBP / Woarkload Rates Stages	Normal coronary angiography Coefficient (MSE)*	Adjusted R ²	Abnormal coronary angiography Coefficient (MSE)*	Adjusted R ²
First stage DPR				
Intercept	-0.369(0.500)	0.980	-0.512(0.721)	0.902
HRi (b/min)	0.039(0.003)		0.045(0.005)	
SBPi (mmHg)	0.028(0.002)		0.005(0.004)	
Wi (Watt)	-0.092(0.004)		-0.129(0.009)	
Peak DPR				
Intercept	1.078(0.320)	0.973	0.209(0.296)	0.897
DBPp (mmHg)	-0.012(0.004)			
HRp (b/min)	0.011(0.001)		0.021(0.003)	
SBPp (mmHg)	0.011(0.001)		0.010(0.001)	
Wp (Watt)	-0.013(0.0005)		-0.022(0.001)	
2 nd recovery minute DPR				
Intercept	1.446(0.655)	0.814	1.310(0.361)	0.682
DBPp (mmHg)	-0.017(0.008)			
HRp (b/min)	0.005(0.001)		0.014(0.004)	
SBPp (mmHg)	0.008(0.001)			
Wp (Watt)	-0.008(0.001)		-0.017(0.002)	
4 th recovery minute DPR				

Intercept	1.111(0.502)	0.839	0.611(0.404)	0.740
Age (years)	0.006(0.002)			
DBPp (mmHg)	-0.013(0.006)			
HRp (b/min)	0.005(0.001)		0.019(0.003)	
HRi (b/min)			0.011(0.005)	
SBPp (mmHg)	0.004(0.001)			
Wp (Watt)	-0.007(0.001)		-0.014(0.002)	
6 th recovery minute DPR				
Intercept	0.478(0.210)	0.741	0.449(0.499)	0.675
Age (years)	0.006(0.002)			
HRp (b/min)	0.006(0.001)		0.009(0.004)	
HRi (b/min)			0.013(0.006)	
Wp (Watt)	-0.006(0.001)		-0.014(0.002)	

Discussion

In normal people double (DP) product is increased with the increase of the workload, but this is only partially true in the presence of cardiovascular diseases. There are limited studies studying the DP during the exercise stress test.

Based on the fact that heart rate and blood pressure responses to exercise are triggered by the workload, we think that also that their decrease during recovery is directly connected to the workload and not to the peak heart rate or blood pressure levels. The same logic can be applied to DB, which is mathematically derived by the above measures. So we assume that if the variation of the DP is provoked by the workload during exercise and the recovery, these can be better represented by the rates of the DB with the workload.

In males with normal blood pressure, DP in rest does not show important changes even in the presence of coronary artery disease, however, their peak workload was significantly lower. It can be deduced that in normotensive males the workload is not the only factor that triggers the increase of DP. An important role is also played by the presence of coronary artery disease. The same is true also for the DB at the end of the first stage of exercise in this group of patients with or without coronary artery diseases.

On the other hand, the DP at the peak of the exercise is significantly lower in males with normal blood pressure and the presence of coronary disease. The same can be stated also for DP in the second, fourth, and sixth minutes of recovery.

Diversely from DP at the first stage of the exercise, the rate of DB to workload in the same stage of exercise is significantly higher in males with normal blood pressure and coronary artery disease. This shows that coronary artery disease is accompanied by an important decrease in the relative efficiency of the heart in the first stage of the exercise or in the submaximal effort.

Although the peak DP is clearly lower in males with normal blood pressure and CAD, the rate of DP to workload in the peak of exercise (DPRp) tends to be higher in this group of patients, although not statistically significant compared to those with normal coronary arteries. These findings can suggest that the relative efficiency of the heart in the peak of exercise in patients with CAD improves similarly to people with normal coronary arteries, but in a significantly lower level of exercise capacity.

Opposed to the fact that DP in the fourth minute of recovery is significantly lower in normotensive males with CAD, the DPR in this phase of recovery is significantly higher in this group of patients. This shows that the debt of myocardial oxygen is higher in patients with CAD and requires a longer time to balance its need. On the other hand, there might be other factors that mask the real decrease of the peak relative efficiency of the heart in these patients.

The above deductions are also supported by the results of DPR in the sixth recovery minute and are a further proof of the above correlations.

It also important to remember that in normotensive males with or without coronary disease the rates of DP to workload is not influenced by basic characteristics such as BMI, weight, height, and initial SBP and DBP.

Conclusion:

The values of DP in the peak exercise and during all the recovery phase are significantly lower in normotensive males with abnormal coronary angiography compared to those with normal coronary arteries and these findings can be used to detect the presence of coronary artery disease despite the ECG changes and they are not affected by the baseline characteristics of the patients.

The ratios between DP to the workload at the first stage, and at the end of the fourth and sixth minutes of recovery is significantly lower in normotensive male patients with coronary artery disease compared to those without CAD and can be independent predictive parameters for the disease.

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Improving *Cinnamomum Burmannii* Blume Value Chains for Farmer Livelihood in Kerinci, Indonesia

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Abstract

Cinnamon is the most common baking spice in the world. It comes from a small evergreen tree that's part of the *Lauraceae* family. Genus *Cinnamomum* regroups some species whose stem bark is harvested, conditioned and traded as cinnamon in the international market. Over the centuries, the species have been domesticated so that now at least six different ones are grown in Southeast Asia. One of the species is *burmannii*, also known as Koerintji Cinnamon, which generates income for numerous smallholder farmers in Kerinci district, Jambi, Indonesia. Koerintji cinnamon is known for its unparalleled quality that comes with its sharp and sweet flavour, with a slightly bitter edge. However, international market requirements for product certification and quality standards make it difficult for a farmer to comply. Our research will address issues related to (improvement of) productivity, sustainability and value chains faced by cinnamon producers in Kerinci, to strengthen their product's value chains. Smallholder farmers are very vulnerable to a well-functioning market, and thus empowering the value chains of agricultural products will increase farmers resilience to have access to the market. The research will analyse the development of agricultural value chains, certification & standards on trade mechanism to help farmers earn a better income and prospects.

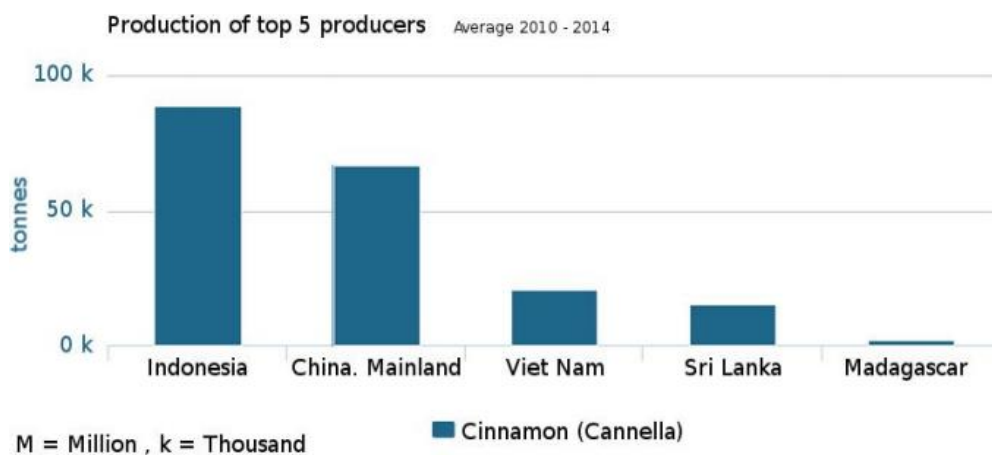
Keywords: *Cinnamomum Burmannii* Blume, Value Chains, Farmer, Livelihood, Kerinci, Indonesia

Introduction

Indonesia contributes to spices which can be found in millions household worldwide. Various of spices which are produced and later on exported from Indonesia are cloves, nutmeg, pepper, ginger, turmeric, cinnamon and others. Spices are mainly applied as food additives at industrial level and commonly used for their taste and flavour (Mandal, DebMandal, Saha, & Pal, 2011). Brown (2003) noted that the 15th century marked the blossoming of the international spice trade in Indonesia, at that time known as Nusantara, with the increasing demands of Maluku spices from its two biggest markets, namely China and Europe. At the beginning of 17th century, Dutch East India Company (VOC) began to establish its influence in Indonesia, by building trading offices, warehouses and forts in Batavia with the goal to monopolised spice commodity trade. Cinnamon was one the spices that were traded by the VOC and gained substantial profit.

FAO (United Nations Food and Agriculture Organization) reports that 46.7% of world cinnamon production comes from Indonesia with production in 2014 reaching 93 thousand tons which are used for flavouring additive in a variety of cuisines, sweet and savoury dishes (FAO, 2014). The demand of spice market in the international market is growing in line with population growth and spice demand in the global market continues to increase, including Cinnamon which is popular as Koerintji Cinnamon / Cassia / Cassia Vera and Indonesian Cinnamon. Cinnamon is obtained from the trees belonging to genus *Cinnamomum* (Chen, 2014). Cinnamon is an essential age-old spice and aromatic crop having wide applications in flavouring, perfumery and medicine.

Figure 1: Global production of cinnamon, 2010-2014



Source: FAOSTAT, 2014

Genus *Cinnamomum* (*Lauraceae*) regroups some species whose stem barks are harvested, sundried and traded as cinnamon categorised spice commodity in the

international market. The best bark comes from the trunk; the bigger the trunk, the thicker and valuable the bark. Cinnamon is considered as a high-value commodity because every part of the tree has market potentials, i.e., stem, leaves, root, and twigs used for pharmaceutical and perfume industry (Jayasekar, 2009). Suyanto et al. (2007) noted that the cinnamon species that were growing in Kerinci were native to Kerinci and traditionally harvested from the forest along the Bukit Barisan mountain range. Cinnamon is now the dominant crop in Kerinci, and the majority of farmers cultivating this spice are smallholders. Cinnamon wood used by local villagers as building materials and furniture. Over the centuries, human use for food (Jayasekar, 2009). There are numerous uses of cinnamon in the traditional kitchen, and it can also be used in incense, perfumes and pharmaceuticals (Bhagya, Raveendra, & Lalithya, 2015). Over the centuries, the species have been domesticated so that now at least six different ones are grown in South East Asia (Barceloux, 2008). About 250 species of cinnamon have identified, four of which are used to obtain the spice cinnamon. Cinnamon is divided into four different type of cinnamon, such as; Ceylon cinnamon (*Cinnamomum zeylanicum* Blume), native from Sri Lanka; Cassia cinnamon or Chinese cinnamon (*Cinnamomum aromaticum* Nees) from China; Indonesian cassia (*Cinnamomum burmannii* (Nees & T. Nees) Blume) from Indonesian islands of Sumatra and Java and Vietnamese cinnamon (*Cinnamomum loureiroi* Ness) from Vietnam (Rismunandar, 1995).

Cinnamomum burmannii Blume is a native plant from Indonesia and also known for its commercial name as Koerintji Cinnamon that generates income to small growers in Kerinci district located in Jambi, the island of Sumatera, Indonesia. The tree grows in West Sumatra in the region known as Kerinci; it is a regency of Jambi province (hence the name Koerintji) near the city of Padang. According FAO, between 2000 and 2014, Indonesia is the largest producer of cinnamon (83,176.79 tons), followed by China (53,176.79 tons), Sri Lanka (13,938.21 tons), Vietnam (13,894.43 tons) and Madagascar (1797.36 tons). The latest cinnamon price in September 2017 for cinnamon powder is Rp.60.000-65.000 / KG, while for cinnamon stick size of 8-10 cm is Rp.40.000-45.000 / kg (Jambi Province Plantation Office, 2017).

The research problem are, more specific that adding value to the value chain process which to improve the farmer's livelihood and environmental practices. This research aimed to identify the constraints of the value chain and sustainable livelihood improvement for cinnamon farmers in Kerinci. These systems are often applauded for their biodiversity conservation value while improving farmers' livelihoods by increasing overall productivity, profitability and sustainability (Atangana et al., 2014 in Jezeer & Verweij, 2015).

Method

To understand of value chain improvement, the researcher conducted various analysis including field research to small growers and buyers.

II.1 Study Area and Ethnographic Background

Kerinci district is the primary location for ground research because the region is the centre of cinnamon production in Indonesia (Wangsa & Nuryati, 2007). Covering an area of 3,808.50km² (BPS Kerinci, 2016), Kerinci is the smallest district of Jambi Province. It is located almost 400km from Jambi City, the capital of the province, and is accessible by land and air transportation which can be seen in Picture 1 bellow.



Picture 1. Map of Kerinci Regency, Jambi Province

Source: Google map

The research was conducted in Talang Kemuning village of *Bukit Kerman* district, Kerinci regency of Jambi province in Indonesia from January and October 2017 (2 months). North of the village is the *Lolo Kecil*, the south by *Bintang Marak* village, the east side by *Lempur* village and on the west of the village is on the border with *Tanjung Sham* village. The distance from Talang Kemuning to Sungai Penuh District capital 39 km and Jambi Province capital 380 km.

II.3 Research Object

Talang Kemuning covered an area of 1,600 ha, with a hilly and mountainous area. The village had a tropical climate during whole year with an average temperature of 22 degree Celsius. The population of Talang Kemuning village was of 1,200 inhabitants and a total of 520 families. In a total of 90% of the community were subsistence farmers, while 10% worked as civil workers and other types of the sector. In the research conducted in January 2017, was identified that up to 40% of the community had high school education.

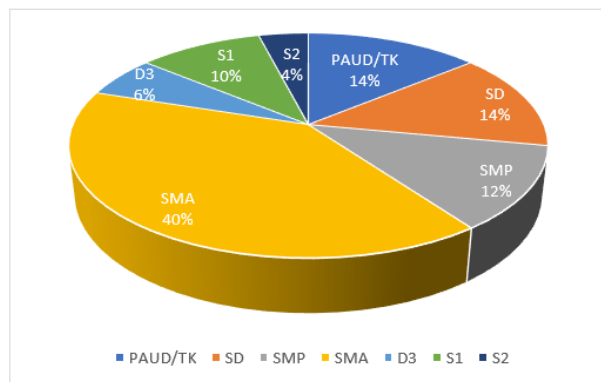


Figure 1. Education Level of Talang Kemuning Community, (Source: Village data 2015)

The object of this research is the traditional farmers (small growers), farmers who are affiliated with farmer association named Kelompok Tani Sakti Alam Kerinci (TAKTIK) and cinnamon collectors “toke” in Talang Kemuning as well as the related buyers in the trading channel of the farmers. The place where the sample was taken had been chosen purposely by choosing the producer and supplier.

II.3 Data Collection Techniques

Data collected included research sites general conditions, social and cultural conditions, Korintje Cinnamon production and processing, and community revenues from Cinnamon. Data collection was conducted through participatory observation using structured questionnaire. In January 2017, there was 40 respondent randomly selected from Talang Kemuning community who is a member of TAKTIK. Further research conducted in October 2017 involving stakeholder which was purposively selected in a total of 20 important respondents who were in the value chain process of the cinnamon sector. Research samples are smallholder farmers who produce and sells cinnamon. Collecting samples and other trading agents involved in the channel and cost of cinnamon trade. This research is to identify the variables that can affect the improvement of farmer's livelihoods with various approaches indicator in the form of increasing the value chain in achieving the welfare of cinnamon farmers. As described earlier, prior to the ground survey, an initial round (January 2007) on this evaluation's impact measures, key informant interviews were conducted in the village concurrent with farmers, middleman (*Toke*), RIKOLTO (Non-Government Organization/NGO), village chiefs, Kerinci & Jambi Province Plantation Office,

and other community leaders to discuss cinnamon business in their villages. Topics included *cinnamomum burmannii* plant, local policy for cinnamon, livelihood and standardization may have become resourceful for research. The findings also collected by using questionnaire design, as they provided a detailed portrait of farmers' socio-economic context. Continuing to explore the gap for the research,

another visit to Talang Kemuning conducted in October 2017, with the goal to have a focus group discussions (FGDs). Actors, which are participating the FGD was selected purposively and was conducted using stakeholder analysis. FGDs were conducted as follows: ten (10) with TAKTIK farmers about value chain process between farmers and input providers and buyers, 5 (five) about farmers' perception of the market access, and 8 (eight) with other stakeholders that are making a derived product of cinnamon bark.

Also, twenty key informant interviews were conducted with community leaders and local NGO. FGD (October 2017) provided information about the linkages between treatment farmers and others in the value chain, including input providers and buyers. Participants were invited purposively from a list of stakeholder provided by RIKOLTO by location. The list included early adopters of TAKTIK, as well as those included in the survey sample frame.

Result

III.1 Koerintji Cinnamon Productivity

Cinnamomum burmannii (Cinnamon) is a plant family *Lauraceae* which are common in tropical and sub-tropical regions. (Rismunandar and Paimin, 2001). *Korintje cinnamon*, or *kayu manis* [Indonesian language], "sweet wood", or *kulit manis*, "sweet bark (skin)", is also known as the botanical term *cinnamomum burmannii*. Cinnamon trees fit in an agroforestry system since it does not need much labour and is therefore suited to be combined with other more labour intensive crops (Michon et al., 1986).

The cinnamon tree has smooth branches and aromatic bark and leaves. The leaves are commonly green, glossy and the fruits are like dark berries. The full description taxonomy of *Cinnamomum burmannii* Nees Ex Blume can be seen in Table 2 below.

Table 2. Taxonomy of *Cinnamomum burmannii* (Nees & Th. Nees) Nees ex Blume

Note: (http://ntbg.org/plants/plant_details, National Plant Database, 2005)

Cinnamomum burmannii (Nees & Th. Nees) Nees Ex Blume	
Kingdom	Plantae - Plants
Subkingdom	Tracheobionta - Vascular plants
Super division	Spermatophyta - Seed plants
Division	Magnoliophyta - Flowering plants
Class	Magnoliopsida - Dicotyledons
Subclass	Magnoliidae
Order	Laurales
Family	Lauraceae - Laurel family
Genus	Cinnamomum Schaeffer - Cinnamon
Species	Cinnamomum burmannii (Nees & Th. Nees) Nees ex Blume
Synonyms	<i>Laurus burmannii</i> Nees (Wagner et al. 1999), <i>Cinnamomum</i>

	<i>pedunculatum</i> Nees (Bailey and Bailey 1976).
Nomenclature	The genus name, <i>Cinnamomum</i> , is derived from the Greek word for cinnamon, <i>kinnamomon</i> (Wagner et al. 1999).
Common names : Korintje Cinnamon, Padang Cassia, or Indonesian cinnamon	

The characteristic of Koerintji cinnamon is illustrated in the table as followed.

Table 2. Characteristic of Koerintji cinnamon (Ravindran, 2004)

Species	<i>Cinnamomum burmannii</i> (Nees & Th. Nees) Nees ex Blume
Taste	Strong and peppery taste
Colour	Reddish-brown to dark brown
Bark	The surface is rough, consist of thin or thick scraped single and double quills
Grows in	West Sumatera, North Sumatera, Bengkulu, West Java, Central Java, East Java and Maluku

Taxonomically, Koerintji cinnamon species are different from the species that are native to Sri Lanka (*Cinnamomum zeylanicum*), commonly known as Ceylon cinnamon or true cinnamon (Babu & Ravindran, 2003). From this point forward, unless otherwise stated, any mention of 'cinnamon' would specifically refer to the species *Cinnamomum burmannii*.

Cinnamon plantation in Kerinci region is recognized as the centre of production of quality, high essential-oil crops for cinnamon bark and the skin of the bark is grey with a distinctive aroma and sweet taste (Paimin, 2001), see on Picture 2 & 3. On the research January 2017, it was identified and measured that the cinnamon tree which grows in the tropical evergreen forest can grow up to 10-15 m in its natural condition. At the harvesting process, other commodities can also be obtained from a cinnamon tree, i.e., stem, leaves, root, and twigs, because these parts also contain beneficial constituents (Kaul et al., 2003). Cinnamon is considered as a high-value plant because every part of the plant, besides functioning as a spice, can also be used for pharmaceutical and perfume (Jayasekar, 2009). The leaves of the tree have a dark green and reddish color with the ovate-oblong in shape and 7-18 cm long. Kerinci cinnamon plants have young red leaves and are cultivated in the highlands of Kerinci district. The flowers are small yellowish-white coloured, arranged in panicles, with a distinct colour. The fruit is purple, 1 cm long berry containing a single seed.



Picture 2. 25 years old (production of powder) & Picture 3. 5-10 years old tree

Note: Photos from Cinnamon Plantation, Kerinci, 2017

In 2015 RIKOLTO's' research paper stated that following climatic factors have great effect on the cinnamon tree to grow well in Kerinci which is explained below;

Rainfall: the tree requires an equal amount of rain throughout the year with an amount of about 2,000 - 2,500 mm / year. Too much rain will affect the low yield of the bark.

Temperature: the tree can grow well at an average temperature of 25 degrees Celsius and by the weather situation in Kerinci.

Humidity: the tree grows well in the humidity situation 70 - 90%. Higher the moisture condition it has a better growth condition for the tree.

Sunlight: affects the process of plant photosynthesis where it takes about 40-70% of sunlight

Soil condition: suitable soil type for cinnamon growth is that soil contains humus, crumbs, sandy and lactose. However, it can also grow on soil types of andosols, red, yellow podzolic and Mediterranean. Acidity (pH) of ground suitable for cinnamon is pH 5.0 - 6.5.

Cinnamon trees fit in an agroforestry system since it does not need much labour and is therefore suited to be combined with other more labour intensive crops (Michon et al., 1986).



The process starts with seeding at the nursery, farm preparation, planting and maintenance. During this maintenance phase is when farmers usually do intercrop, up until the cinnamon plants are around four or five years of age. Pruning of cinnamon trees is usually done when a tree is around seven to ten years old. This is done to give space for the plants to grow more optimally. During this maintenance phase, farmers also use pesticides (insecticides, herbicides, and fungicides) to control pests that might disrupt the growth of the plants. Although the cultivation method is similar to Ceylon cinnamon, Koerintji cinnamon is harvested and processed differently. Harvesting conditions and methods of production often determine the quality of cinnamon (Risnunar, Paimin, F.B, 2001). As a perennial crop, there are usually two harvesting methods. The first one is done just before the trees reach ten years of age. The first method is called *santangan* in local terms, which is done by peeling the bark of the tree. When the young red leaves are present, such as seen in Picture 4 bellow, or the plants are flowering; low peeling can be done by extracting the bark of around 2-3 cm wide. However, during this time, farmers rarely harvest their cinnamon as the bark is rather difficult to peel. High peeling is done when the plants are not in the flowering period. Since it would be easier to peel the bark at this time, farmers extract a wider area of around 7-8 cm in width and 80-100 cm in length.



Picture 4. Traditional peeling by Talang Kemuning peelers

Source: Author, 2017

The second method of harvesting, called *tebang habis* (clear-cutting) is usually done when the plants are over ten years old, and it involves cutting down the whole tree,

followed by peeling the bark. The bark of a tree that is between 10-15 years old is used to make cinnamon sticks, while the older trees usually produce thicker cinnamon bark of higher quality. This process is then followed by scraping the bark to clean the outer layer of the skin. If the tree is ten years or younger, the bark would be used to make sticks. For this purpose, each bark sheet will be cut to 2.5 cm in width. Meanwhile, if the bark comes from a tree that is over 15 years old, they will be made into quills, so they do not need to be cut into smaller widths. This process is followed by washing and soaking the bark for around 12 hours to remove dirt and scraps from the bark. After that comes the sun-drying process. All bark needs to be dried under direct sunlight; a process that usually takes around 3-4 days. To maintain cleanliness, farmers need to line the ground with tarp sheets so that the bark does not come into direct contact with the ground. During this drying process, the bark curls up into quills and turns reddish brown. Dried cinnamon quills or sticks ideally have a water content of 10-14% (Pannell et al., 1991). The cinnamon is then sorted according to their grades, which depends on some factors, such as type (scraped, un-scraped, quills, sticks, and chips), appearance, and volatile oil. In the case of making cinnamon sticks, the long sticks are cut using an electrical saw according to the required length and then sorted further to prepare for storage and packaging.

Thousands of workers are connected with this industry in Kerinci and interact as a social gathering as implicitly way, see picture 4 for the production of Cinnamon farming in Talang Kemuning.



Picture 7. Production of cinnamon bark

Source: Author, 2017

Upgrading productivity can be in the concept of improving the value chain process, as Giuliani (2003) point out in their seminal paper, 'upgrading within a value chain implies escalating on the value ladder, moving away from activities in which competition is of the 'low road' type, and entry barriers are low. There are four types of upgrading identified by Humphrey and Schmitz (2000) and used by Giuliani (2003), as followed and describe in Picture 4;

Process upgrading, where the transforming production process has been reorganized or improved processing technology introduced, such as cinnamon tea from left-over dried bark.

Product upgrading, where natural products are developed into diverse and more sophisticated product lines, with higher values per unit volume, for example, Cinnamon Powder.

Functional upgrading, which refers to cases where new, superior functions are developed in the value chain.

Internal upgrading, which occurs when new research or technology enables a product to shift from one sector into a different commodity. It is potential for extraction of commercial products from cinnamon leaf seeds, which would allow a shift to high-value pharmaceutical use (instead of being discarded); or production of niche-market pulp-paper from the cinnamon tree trunk.

III.2 Cinnamon World Market and Koerintji Cinnamon Challenges

Indonesia as the world's leading cinnamon producer up to accounting for 43% of the total world's production in 2014. Cinnamon with the international trade code HS 0906 (Harmonized system code for cinnamon-cinnamon tree flower) is largely export from sub-tropical countries, including Indonesia as the largest producer. Indonesia produces over 91,400 tons of cinnamon every year, worth about \$85 million which can be seen in table 3. Almost all cinnamon produced in Indonesia come from because of its plantation area to 40,962 ha or 75% that can produce more than 50,000 tons/year (RIKOLTO, 2016), where the cinnamon tree flourishes.

Table 3. World's Top Cinnamon Producing Countries 2014

Rank	Country	Production (Ton)
1	Indonesia	91,400
2	China	71,146
3	Vietnam	31,674
4	Sri Lanka	16,766

Source: wordatlas.com, John Misachi

Indonesian cinnamon products exported are cinnamon bark, essential oil and cinnamon powder which is used as raw material for industry and raw material (Ragimun, 2012). Arifin (2013) explains that cinnamon is one type of spice that is widely used as an ingredient of flavour and taste in foods and beverages, additives on the manufacture of perfumes and drugs. The cinnamon bark can be used directly in the original or powdered form, or already processed into essential oils and oleoresins (Smith, 1986). Indonesia is still the market leader in Cinnamon business to compare with other producing countries who have similarity product, which can be seen in Figure 2.

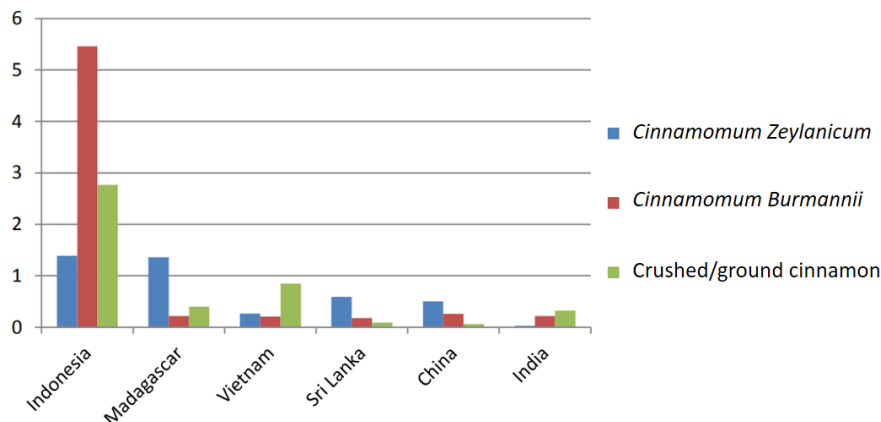


Figure 2. Developing-country suppliers of cinnamon to Europe, by level of processing, 2015, in 1,000 tons*, Source: Eurostat, 2016

Cinnamon product that is exported to European countries are the barks of a cinnamon tree which are sundried and transformed into quills later on categorised into three types of grades depending on the tree ages, which are;

Grade AA/KA: This kind of grade is produced from the bark of cinnamon tree stem that has been through a process so that the bark is dry and the epidermis part is removed. The AA had a light brown colour and harvested after the age of 15-20 years, resulting in outstanding quality. In the market, cinnamon with this grade is sold at the highest price (see picture 3 below).

Grade KB: This grade is almost the same as AA, the difference lies in the epidemic is not removed. The colour is dark brown. This quality can be generated after the tree is over seven years old. This type is usually sold at a lower price than the type AA

Grade KC: This class is called a fraction of cinnamon. This type is generated from KB type cinnamon. In the market, this type is traded at the lowest level compared to the two types mentioned earlier.



Picture 4. Grade AA, Koerintji Cinnamon

Note: The picture above shows a 25 years old bark, with the thickness to 5 cm.

The cinnamon market in the EU continues to provide opportunities for exporters from developing countries, including from Indonesia to conduct business. Imports and prices will continue to increase in the coming years, but the highest demands concurred in 2014 that nearly 18,000 tons are imported to the EU, see Figure 3 (CBI, 2016).

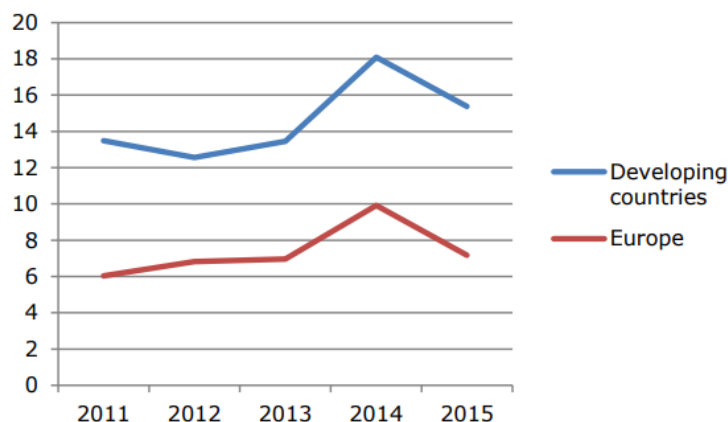


Figure 3: European imports of cinnamon, Ceylon cinnamon and cassia 2011-2015, in 1,000 tons*

Source: Eurostat, 2016

Based on the research and survey conducted in October 2017 in general, there are four supply chain channels involved in the cinnamon products, which are the farmers

as producers, small collectors, large collectors and exporters. Each has their different roles and functions in value chain from farmers to exporter, that

1. Farmers

The trade management functions of fewer farmers are only exchange. The farmer's exchange function is the sales function. Farmers do not perform purchasing functions because farmers act as producers. As a producer, farmers sell cinnamon in the form of three systems, namely:

Farmers with produced the bark, which includes all of the plantings, sorting to grade and drying process.

Farmers sell directly on land with a stem selling system. This system has been going down and down, where the small collectors (toke) measure the volume of cinnamon per stem then multiplied by the number of sweet skins for one piece. In some cases, farmers do not harvest because toke will do the process of harvesting and transportation.

Farmers perform trade management functions. First, the exchange function is the farmer performs the sales function. Second is the physical function where farmers are carried out in the form of transportation and storage. Farmers transport their produce to large collectors. The third is the function of farmers as sorting, that is the separation of products that are not by the quality standards set by collecting traders.

The majority of farmers (about 80%) in Talang Kemuning do not conduct nursery management and cultivate cinnamon as fulltime activity. Most of these growers are part-timers, engaged in other occupations as the main livelihood. They hire personnel to manage their plantations including peelers and transporters. Since their part-time engagement, these holders lack the proper knowledge and strong commitment to control their production.

2. Small collectors

They are often called toke (local language) or known as a middleman. The functions performed are for physical exchange. First, the exchange function performed by local traders in the form of buying and selling. Local traders purchase products to farmers. The second function is the physical retailer made in the form of loading and unloading and transportation. Also, small collectors also perform grading, sorting and storage functions. Toke often have a monopoly on information regarding cinnamon market conditions, including stock availability and price, giving them significant control over the farm gate price (Jaya, et al., 2009). Since toke typically has access to significant financial resources, they can buy cinnamon from some farmers at a low cost, especially when the farmers are in dire need of money. Burgers (2004) noted that the profit margin of the toke in the Kerinci cinnamon value chains is significantly more significant than that of any other actor (over 60%).

3. Large Collectors

Large collectors or *saudagar* (local language) or trader, is an individual or enterprise that buys cinnamon products from *toke*. They usually operate at the district level and collect their supply from the *toke* in various villages within the district. Although not very common, there have been cases where *saudagar* buy cinnamon directly from farmers. They have a significant enough initial capital to buy in advance in large volumes. Based on the information given by farmers in October 2017 that large collectors also purchase land from farmers sold below the market average, so they have enough cinnamon plantation in Kerinci.

4. Exporter

Distinguished exporters from local exporters and exporters outside the region to abroad. These exporters have direct access to the end buyers where the highest price of cinnamon is earned them. Exporters also diversify or further product development, packaging and laboratory tests to check the quality of cinnamon.

The cinnamon industry is not profitable for the farmers in Kerinci due to its oligopsony market. Kerinci cinnamon farmers are growing by thousands of people reaching 12,243 households in 2013, while local collectors are only a few. The collector is also acting as a trader, which also consists of small collectors and large collectors and exporter. This condition causes the farmers do not have bargaining position so that farmers are often harmed. This can be attributed to the income between farmers, and the collectors are very unequal, i.e. farmers earn a maximum of Rp. 40,000 / kg (2,5 Euro/ KG) while wholesalers or exporters can earn up to Rp. 160,000 / kg (10 Euro/kg) after going through the manufacturing and packaging process which can be seen in Table 4 as followed.

Table 4. Income comparison in cinnamon business

Farmer Income (after 9 years)							
Income from Cinnamon (9 years)		Rp. 484,000,000,-					
Total Cost Production (9 years)		Rp. 194,580,000,-					
Profit		Rp. 289,420,000,-					

€ 1 = Rp 15,675

Subject	Large (Ha)	Population (stem)	Vol/Stem (KG)	Sell Price (Rp)	Income (Rp)			(-) Operational Cost
					9 year	1 year	1 month	
Grower	1	4,400	1	40,000	289,420,000	32,157,000	2,680,000 (~ 180 €/m)	
Wholesale Trader	1	4,400	1	160,000	1,936,000,000	215,100,000	17,923,000	

Raw Material : bark
Processed : powder

Source: Develop by research in January 2017

Particularly in agroforestry industry based value chains, value addition has become an essential need for enhancing or develop competitiveness and sustainability. The reason for needing such a change in a value chain is, according to Andreas Stamm et al. (2003), "the demand in large markets is becoming more diverse and consumption patterns increasingly globalised.

One of the reasons for the low prices in cinnamon is the long trading channel between intermediates, as spices produced by smallholders at local, national and international levels (Wangsa, 2007). Due to these long value chains, the profits of smallholders are small compared with the middleman.

III.3 Cinnamon and Livelihood Impact

Kerinci regency extends across several sub-districts Batang Merangin, Gunung Raya, Bukit Kerman, Danau Kerinci, Keliling Danau, Sitinjau Laut, Air Hangat, Depati Tujuh, Siluak, Siluak Mukai, Gunung Kerinci, Kayu Aro etc. The majority of the people living in these sub-districts including Talang Kemuning depend on Korintje Cinnamon and the other commodities for their livelihood. Forests are portrayed as central to the poverty alleviation efforts of millions of rural smallholders across the developing world (Sunderlin et al., 2005). A cinnamon tree that grows in the forest can also contribute to livelihoods have been investigated in some manners, for example, according to three different functions: safety nets, support of current consumption, and a pathway out of poverty (Vedeld et al., 2007). Cinnamon provides a significant role in the local economy for the farmer living Kerinci region. It is one of the essential factors that may contribute to the economy of the district of Kerinci (Askar Jaya, 2009).

However, cinnamon farmers depend entirely on post-harvest time which they have to wait years for production and typically cultivate the bark to support their livelihood. Since 2007, the Kerinci district faced a high open unemployment rate of over 15,000 people, caused by the decrease in employment in the agricultural sector (Moravia, Barus, & Pribadi, 2009). One of the factors is related to the plantation ownership by in Kerinci, which identified on the research on January 2017. Jambi province plantation office stated that in the year of 2015, there is 40,962 ha used for cinnamon plantation. Amount of production of Koerintji cinnamon can reach to 53,623 ton which conducted in a total of 12,843 growers, see table below for description for commodities which are most planted in Kerinci regency. The plantations are spread throughout Kerinci that covers an area of 40,962 ha size are inherent since generations. Dimensions and locations of the plantations can be seen in following table(s) 4 and 5.

Table 4. Land area of cinnamon plantations in Jambi Province

Note: Department of agriculture and plantation, Jambi, 2015

No	Location	Land Area (ha)
1	Bungo	233
2	Kerinci	40,962
3	Merangin	5,017
4	Sarolangun	633
5	Sungai Penuh	347

The cinnamon plantations in Kerinci are spread in several locations, but the most significant farmer plantation is in Gunung Raya with a total area of 11,224 Ha². The spread of cinnamon plantations can be seen in table 1.4 below.

Table 5. Locations of cinnamon plantations in Kerinci regency

Note: Department of agriculture and plantation, Kerinci, 2015

No	Location	Planted Area	Yearly Production (Tons)	Number of Farmers
1	Gunung Raya	11,224	14,357	2,216
2	Batang Merangin	10,735	27,275	2,415
3	Danau Korintje	1,195	764	327
4	Keliling Danau	4,623	3,209	327
5	Sitinjau Laut	72	26	156
6	Air Hangat	1,365	75	1,044
7	Air Hangat Timur	1,034	646	737
8	Gunung Korintje	2,801	1,741	1,624
9	Kulit Aro	3,847	2,981	1,128
10	Depati VII	300	23	265
11	Siulak	1,405	617	983
12	Gunung Tujuh	2,361	1,248	1,021
Total		40,962	52,980	12,243

The table above calculated that cinnamon farmers in Kerinci have less than 3 ha cinnamon plantation per household and produce an average of 2,234 KG/year of cinnamon bark. According to the research conducted in January 2017, was identified that farmers mostly rent the land from other parties yearly. Plantation size can have an impact on the number of crops that are harvested. One tree trunk can produce at least 20 KG cinnamon (Wangsa & Nuryati, 2007). Based on the interviews conducted in October 2017 that 46% of 50 respondents are renting land for plantation which can be seen in Table 5. Soentoro (1981) stated that the land in Indonesia is important as a set for rural communities because it can deliver a natural resource that can be

managed into a source of income. The larger land ownership. The greater possibility of the household to obtain a higher profit for the farmers.

Table 5. Number and Percentage of household by land ownership in Talang Kemuning

	Land Ownership	Household	
		Number	(%)
1	Small (0.5 - 1 ha)	15	30
2	Medium (>1 - 2 ha)	8	16
3	Large (> 2.0 - 3.0)	4	8
4	Others: Rent	23	46

To support their daily income, the farmers conduct intercropping like oranges, avocado, cocoa and other sort fruits and vegetable are easy to be sold in the market. As a traditional farmer, any attempt to enrich nor improve their livelihoods requires an integrated value-chain approach. The United Nations stated that sustainable livelihoods could serve as an integrating factor that allows policies to address 'development, sustainable resource management, and poverty eradication simultaneously' (Krantz, 2001). Farmers in Talang Kemuning started to conduct intercropping to support their livelihood, which can be seen in Picture 6.



Picture 6. Intercropping cocoa tree in Kerinci

Source: author, January 2017

Farmers in Talang Kemuning choose to gain more of their livelihood from agriculture through processes of intercropping to have other income generating earning activities. Another research founding is that the farmers are changing from cinnamon towards coffee. In general, horticulture commodities are than cinnamon; it can also be harvested faster. Some farmers have already switched to grow coffee and cocoa instead. At this moment, coffee and cocoa is a cherished crop to take in the place of cinnamon.

III.4 Upgrading standards and Profitability Impact

Branding the Korintje cinnamon product by putting trademarks of traceability and certification can have an important role in the future of Indonesia spices export

markets. Putting labels, trademarks and food safety certifications can impact on a result that consumers are willing to pay more for the product that is certified and meet the standards regulations which categorized as a premium product and second, access to a wider share of the market due to consumer awareness that product is good quality (Jaffee, 2007). Consumers in Europe are increasingly interested in consuming a product which has 'clean & green' labels because related to health and security of the product that will be consumed. When the products have claimed for its sustainability and traceability campaign, it is crucial to ensure that those claims can be traced (traceability). It requires a system of traceability through a chain of operations to implement for Korintje Cinnamon product. But, if the cinnamon farmers in Kerinci can achieve the demanding quality standards, surely can benefit a farmer in the future. The farmer should, therefore, choose and decide whether or not a particular set of standards is a good for their cinnamon for their livelihoods improvement.

Standard and certification have a vital role to access EU spice market. Therefore, it is wise to have certified labels and comply with the sustainability standards which is essential for the EU consumers. The new environmental regulation and health standards had brought decreasing demand of Koerintji Cinnamon product in the last few years. Small growers have difficulties to comply with the requirement because of their traditional farming methods, including the scalp of the skin, see picture 7.



Picture 7. Traditional scalping of the bark

Source: October 2017

Importance comply with the standard is related to the European legal requirements for food safety (traceability, hygiene and control) in the form of certification. At first, it is required to implement food safety management before entering the EU market, such example BRC, IFS, FSSC22000 and SQF. Social justice, environmental protection also became an important issue for the EU consumers, and that is why FAIR TRADE labelling has a high impact on the end-consumers. The EU regulations also require labelling on the packaging of the product so will provide information for the

consumer, such as with the following information according to CBI Product Factsheet, Cinnamon in Europe (2015):

- the name of the product;
- manufacturer details;
- batch number;
- date of manufacture;
- a grade of the product;
- harvest date
- any information that can be used to trace the product back to its origin.

CBI product factsheet (2015) release a report on cinnamon in Europe. In the report, stated that cinnamon exporters should comply with rules and regulation of EU. The rules are food safety and traceability, corporate social responsibility, sustainable product certification and supplier assessment. The European Standard Association (ESA) in 2015 launched the Quality Minima Document on European legal requirements for unprocessed cinnamon which excluded crushed/ground cinnamon and cinnamon treated for microbial reduction as well as additional buyer requirements (CBI, 2015).

Cinnamon production in Kerinci still lacking from its supporting functions in the value chain stream process. Among others, the lack of knowledge to create derivative products, inadequate access to modern farming equipment and market access, and the information prevent local farmers to benefit from their livelihood. Local cinnamon growers are disorganised and cannot actively interact with capital and negotiate with market actors. Based on the survey in October 2017, that the majority of farmers in Talang Kemuning have minimum have a minimum understanding about legal requirements from the EU such as necessary food safety management, in the example of drying the bark on the street, see Picture 3 below.



Picture 3. Unclean drying process

Note: Photos from farmer house, Kerinci, 2017

It is vital for cinnamon farmers in Kerinci to enhance their compliance capacities of the cinnamon farmers (growers and processors) through certification according to international standards, like the EU standard. Inability to meet the necessary buyer product specifications and hygienic food standards (SPS) will be a bottleneck in the future. ATN as their main commodity buyer had launched in January 2018 a standard specification that must be fulfilled by the Talang Kemung cinnamon farmers, see Picture 9 below.



PT. ALAM SARI INTERBUANA
We Deliver Indonesian Spices and Food Commodities

Product Data sheet
Date: 08-01-2018
Owner: Quality Coordinator

C-0906.11.00
Page: 1 of 2

Cassia VAA sticks

PRODUCT IDENTIFICATION & GENERAL INFORMATION	
Product code	0906.11.01
Product description	Cassia is the dried bark of various laurel trees in the cinnamomun family.
Process description	Cinnamon tree shoots are stripped of bark. The bark is sundried, collected and selected. The product is subsequently cracked, cleaned, sieved, hand-picked and packed after metal detection.
Origin	Indonesia
Composition	Cassia
Legal demands	Products have to comply with all legislation. Most important elements are: - General Food Law (EC) no. 178/2002. - Food Hygiene Law, Regulation (EC) no. 852/2004. - Regulation (EC) no.1881/2006 setting maximum levels of certain contaminants in foodstuffs. - Regulation (EC) no. 396/2005 on maximum residue levels of pesticides in products of plant and animal origin. - Regulation (EC) no. 1829/2003 on genetically modified food en feed - Regulation (EC) no. 834/2007 on organic production.
Labelling	Obligatory label information according to Regulation 2000/13/EG. GMO labelling according to Regulation (EC) no. 1830/2003.

Picture 9. VAA Cassia sticks criteria 2018, Source: PT. Alam Sari Interbuana, 2018

At last, the use of an international standard of ISO 6538:1997 (*cinnamomum burmannii*) and ISO 22000 (Food Safety) for cinnamon can bring advantages and support the cinnamon farmers to enhance their production compliance capacities to meet the conformity requirements of European markets. Building farmers capacity to deliver food hygiene and safety skills development will strengthen their role along the cinnamon value chain. Value chain approach has advantages to address constraints and challenges to improve sustainable practices in farming. In a way to promote inclusive economic growth with the understanding of the environment which can leverage some points along the chain towards small producers, traders or processors. Using value chain as approach and method to see the leverage point for livelihood improvement can start from upstream or downstream process. Upstream actors are the producers, traders or processors who are closely linked to the origin of the product. Downstream value chain actors are the larger traders and processor who has

access to the end market. The approach of identifying and addressing specific can emphasise the interventions method along the chain and benefits for pro-poor growth.

III.5 Geographical Indication & Marketing Potentials

Cinnamon farmer association Kerinci received Geographical Indicators (GI) certification in 2015 from Indonesian Ministry of Law and Human Rights, which should benefit and creates jobs in the cinnamon business. The Directorate General conducted a field assessment in Kerinci on 16 February 2016, and following this, the application was announced through a Gazette

Numbered: 03/IG/II/A/2016. It was made public for three months between 25 February 2016 and 25 May 2016. The application was approved on 26 May 2016 (No. ID G 000000043), making Kerinci cinnamon the 43rd product protected by GI in Indonesia. The certificate was officially handed to the Regent of Kerinci by the Indonesian Vice President in Jakarta, 18 July 2016 with the policy Nomor.525/486/Dishutbun/2015. The Indonesian GI name is 'Kayumanis Koerintji' or Koerintji Cinnamon. Through this certification, it can enhance product development rather than just selling raw material (bark of cinnamon). Cinnamon products that have market potentials according to the RIKOLTO are as followed; (i). Dried Cinnamon bark with grade quality KM, KF, KS and KA. (ii). Cinnamon sticks grade VAA, VA and cutting, (iii). Cinnamon powder. The cinnamon products that which are certified with GI label are organic according to International Organic Certification (EU, USDA and JAS) with the condition not contaminated with nonorganic materials. TAKTIK members in a total of 261 members from 500 have received this GI certification since 2015. As in many developing countries, GIs appeared as an efficient way to promote agricultural products in a context of globalisation and to reduce the risk of the misappropriation of names (Anders & Caswell, 2009; Bramley & Bie'nabe, 2012; Vittori, 2010). Koerintji cinnamon GI certification can provide a value for its qualities and reputation. Moreover, the GI can enable a marketing and promotional value in the global market. Another potential function of GIs is product differentiation. In a globalised context, GIs can be an effective role as "decommodified", by changing the status of an agricultural product from "commodity" to "origin product" (Galtier, Belletti, & Marescotti, 2013), which can, in turn, increase the selling price and market share. Jambi province plantation office expects that the GI registration will strengthen the bargaining position and add value to Koerintji cinnamon in international markets, resulting in increased recognition for the quality and unique nature of Kerinci cinnamon. GI can minimize environmental impacts, increase product quality and access to the wider market. It is also anticipated that this GI would play a role in maintaining the body of local wisdom in Kerinci regarding the management of natural resources, thus playing a role in conservation efforts in the region.

However, the situation appears on the October 2017 visit, that product certification can benefit a farmer if a minimum number of farmers adopt this origin-labelled certification with the support and active coordination among actors in the value chain.

IV. Discussion

IV.1 Improving the value chain approach in Cinnamon

Improving the cinnamon value chain in Kerinci is hypostatically possible. According to Garret (1997), agroforestry can enhance the sustainability of farming systems, diverse farmers' incomes, provide new products and create a new landscape. To meet Garret's concept, it needs to be enhanced using the suitable value chain approach, because it is an integral part of tree domestication and agroforestry programs (Leakey, 1998). A value chain describes a full range of individuals and activities starting from production to consumption (Kaplinsky, 2002).

For cinnamon, one reason for the low prices is due to long supply chain process which includes many intermediates (middleman), as different intermediates trade spices produced by smallholders at local, national and international levels (Boomsma and Mangnus, 2011). Due to these long value chains, the profits of farmers are constrained by weak market linkages between smallholders and exporters since the middlemen also try to make a profit, mostly at the expense of the farmers' benefit. Only in the local part of the value chain already are several intermediaries active, mainly because farmers are dependent on them for transport for example. Farmers who do not receive a fair price will remain dependent on these middlemen, ending with an increasing amount of farmers changing to cash crops.

Constraints in post-harvest cinnamon process arise because of regulations, standards, laws and also informal rules & norms that are not supporting the value chains improvement can be seen in table 7.

Categories	Constraints	Opportunities [January & October 2017]
Product and Market	• Not rewarded fair price • Farmer are price-takers • No access to market (local and international)	• Access to information for price • Access to wholesalers and end-market • Shorten the channel of distribution
Technology & Production	• No ownership of land • No investment in transportation and accommodative infrastructure • Traditional technology	Support by Local and State government for productivity improvement : farming technology, investment schemes, training etc
Human Resources	• Traditional harvesting and farming method • No regeneration of growers • Dependable only on Cinnamon	• Train farmers on improving capacities for farming and business • Organize community farmers to share experience • Need establish farmer forum
Finance & access to capital	• No support from investment bodies • No support from local and state government • Difficult to access to loans	• Establish cooperative • Partnership with local trade union and community banks
Environmental Issues	• Clear cutting • Product hygiene • No environmental certification	Training and facilitating by partners to conduct GAP

Jambi provincial government should issue a policy stating that cinnamon should not be sold as raw materials (bark) but it should be processed through the cinnamon grinding mill to improve its value so that it can be sold both in local and international markets. Jambi provincial government can set and enforce rules to initiate and finance a grinding machine that can make cinnamon powder, essential oils, and oleoresin that has a higher sale value in the market. Another constraint is related to the direct supply chain. Because of the absence of harbour facility in Jambi, the product should be delivered to another city takes another process of trading. The last constraint in the off-farm issues deals with the international standards for agriculture practices that are difficult for small growers to comply. All of those issues eventually ended up in small growers as price takers on the basic gate-price of the cinnamon market.

Even though the income earned from cinnamon plays a vital role for farmers in Talang Kemuning, but the primary concern of cinnamon farmers deals with the extended period of harvest time. One cinnamon tree produces about 20 kg of bark with the range of age up to 20 years for production with a variant of quality and price. Cinnamon tree is cultivated three times for its bark. The first harvest occurred when the tree reaches the age of 6 years, and the second crop is at ten years and the last harvest time is at 15 years old. During that harvest time, the farmers are looking for other solutions to generate income, such as intercropping and planting another product that is more productive. Therefore, it is essential to find a solution for the farmers to produce derivative products and create a product diversification that can give added value and improve the value chains for higher income. According to Humphrey and Schmitz (2001), there are four types of upgrading:

Process improvement, where the transforming production process will reorganise or improve processing technology;

Product development, where natural products will develop into diverse and more sophisticated product lines, with higher values per unit volume;

Functional improvement, which refers to cases where new and superior functions will draw up in the value chains;

Inter-sectoral upgrading, which occurs when new research or technology enables a product to shift from one sector to a different "new area."

The involvement of other parties to improve the value chains for greater farmer income is also important in the outcome, such as described below:

Business, producer associations, universities, NGO's and local government through policy support;

Establishment of research and development (R&D) capabilities of national or regional universities, or R&D facilities of large firms with whom partnerships will form;

Strategic use of labelling, branding, trademarks, and certification.

Majority of small growers in developing countries, including those who are in Koerintji area, are facing series of constraints that often limit their ability to participate competitively in a value chain improvement model including supporting functions. The following are the model of four major constraints that limit the competitiveness of small and medium-sized manufacturers and their entry into value chains (Lie H *et al.*, 2012):

- Access to end-market
- Access to skills & capacity improvement
- Collaboration and cooperative building
- Access to finance & incentives

First, access to the end-market is relevant to improve value chains for smallholders. In the context of this model, it refers specifically to the presence of value chain connections between small growers and buyers and how they can be established. It is also crucial for the consumer to be informed about the origin of the products using traceability tools and sustainable measurements. In this case, neither the small-grower organic or chemical pesticide can reduce the climate change impacts. Second, while smallholders work at the farm from their childhood, specific training is often required to improve the productivity and product quality. Such training can include the introduction of new technologies and plant varieties, not only explaining how to comply with food safety and other certification requirements but also how the value chains works [8]. Nevertheless, there are also new agricultural practice adaptations including new cutting that impact on biodiversity loss and land-slide. Third, building coordination and collaboration at two coordination levels that can trigger R&D and infrastructure improvement by any condition. Finally, the last part is access to finance that can support product diversification and technology investment including more environmentally friendly agricultural machinery.

In both value chains, farmer households try to include into the value chain. The insertion of smallholders in national, regional and global agriculture value chains has essential consequences to reduce poverty in rural areas of developing nations due to their potential to increase incomes and create employment and therefore adds to the sustainability of their livelihoods (Gereffi and Fernandez-Stark, 2016). The majority of farmers in developing countries face a series of constraints that often limit their capacity to participate competitively in these chains, and there has been considerable concern that these producers are being excluded from substantial growth opportunities. Fernandez-Stark *et al.* (2012) show a model of four significant constraints were identified that limit the competitiveness of small- and medium-sized producers and their entry into value chains. (1) Access to market; (2) access to training; (3) collaboration and cooperative building; and (4) access to finance. Access to market is relevant to inclusion in value chains for smallholders. In the context of this model, which refers specifically to the presence of value chain linkages between producers and buyers and how they can be established. Second, while smallholders

work at the farm from their childhood, specific training is often required to improve productivity and product quality. Such training can include introducing new technologies and plant varieties, how to comply with food safety and other certification requirements, but also how the value chain works (Fernandez-Stark et al., 2012). Third, building coordination and collaboration building occur at two levels. First, horizontal coordination amongst producers facilitates the formation of producer groups or associations, to reach economies of scale to be able to compete in the marketplace, but also to provide opportunities to add value to their product, such as upgrading. Second, vertical coordination and collaboration involve interactions with other actors of the chain to establish linkages, find synergies and share information to improve the performance of the chain as a whole. Chain stakeholders include all the actors that play a role in the development of the industry. Finally, entry into the value chain requires certain investments to cover infrastructure, equipment and obtaining certifications. Small producers, however, often face liquidity and credit constraints and have no access to formal finance channels, both of which limit their potential to make the required investments (Fernandez-Stark et al., 2012).



Figure 10. Model for smallholder inclusion in agro-food chains (Fernandez-Stark et al., 2016)

In a way to enhance cinnamon value chains for greater farmer income, can be done on several models such as educating farmers about the sustainable practices for the environment, helping them to access local and international markets, supporting their productivity improvement, promoting good agricultural practices, providing organic fertiliser, and so forth. However, it also necessary for the farmers to increase their knowledge about the regulation standard so they can access EU market.

Another way to maximising the use of the Koerintje Cinnamon GI will have a significant role in the future of Indonesia's spices export markets. Putting on labels, marks and food safety certifications can influence the customers to pay more for the product that is certified and meet the standard regulations and categorised as a premium product. Consumers in Europe are increasingly interested in consuming a product that has a 'clean & green' label because they are aware of the health and security of the product that will be consumed. When the products have claimed for its sustainability and traceability campaign, it is crucial to ensure that those claims can be traced. It requires a system of traceability to be implemented in Koerintji Cinnamon products. However, if the cinnamon farmers in Kerinci can achieve the demanding quality standards, they surely can get more benefit and gain brighter prospects.

IV.2 Farmers inclusion in the value chain

In a method to enhance farmers capacity, can be done by conducting capacity building and social capital to become instituting farmers who can lead to strengthening their business capacity to meet the premium conformity of EU market. Here below are the constraints related farmers value chain improvement based on the research in October 2017.

Farmers are solely dependent on income from cinnamons and have limited access to financial resources.

Farmers have no access to direct market and depend on *Toke* daily as their direct buyer.

Farmers use traditional farming equipment and have lest interest in product development and innovation

Conclusion

Research in October 2017 found from empirical evidence from the analysis that the value chain in Talang Kemuning, Kerinci is a buyer-driven chain where the buyer "toke" (trader and exporter) have a significant role and power in the cinnamon business. It results in smallholder farmer involving into value-added activities because of the like the concept "business as usual". Cinnamon market channel in Talang Kemuning is a single channel which focuses on the international export market. Intermediaries had a significant role in the value chain process. Trader in Talang Kemuning, play a role in setting the farm-gate price, while cooperative with the support of local NGO made various attempts to improve the value channel of the farmer in the whole value chain. Upgrading the cinnamon value chain is one of the means for smallholder farmer to regain their role in the value chain. With the concept of upgrading, smallholder farmer can improve their competitiveness in the global market which can improve their livelihood. One of the missing actor in the whole cinnamon value chain is the local and central government.

Involvement of Indonesian government as the main stakeholder in the cinnamon value chain is important because it can bring value to national income (FAO, 2014). Indonesian ministries such as the ministry of agriculture, the ministry of environment and forestry can support the development and coordination of cinnamon value chain in the way of a system of law in a fair price, access to broader market and Investments. Government involvement can lead to greater productivity, and the ability to capture a higher value include methods of cultivating, drying, packaging, research development, education and training in product marketing in the future.

The Indonesian government should also guide smallholder farmer related to international market demands for product certification, and quality standards make it difficult for small growers to meet the request. The international consumer protection agency demands safe products, free from chemical elements harmful to human health, causing exporters to be careful in providing quality commodities, as well as requiring that farmers conduct cultivation according to operational standards.

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