

A PubMed evaluation of the *Rhodiola rosea* adaptogen

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Abstract

Introduction. *Rhodiola rosea* (RR) has been used as an adaptogen to increase an organism's resistance to stress.

Objectives. The objective was to highlight the interest in RR as an adaptogen, from the perspective of the age of participants, in a PubMed evaluation.

Methods. Keywords were selected: “*Rhodiola rosea* adaptogen” (RRAD); “*Rhodiola rosea* and stress” (RRS); “*Rhodiola rosea* and cortisol” (RRC); “*Rhodiola rosea* and anxiety” (RRA). The PubMed filter chosen was gender (Sex), with sub-filters: human male (HM), human female (HF) and human male and female (HM+HF). Chosen time periods: 1963-1969, 1970-1979, 1980-1989, 1990-1999, 2000-2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018. Analysis criteria: total number of publications (N); average number of publications per year (N/Y).

Results. a) RRAD: differences were significant between: N-HM ($p=0.00002$); N-HF ($p<0.00001$) and N-HM+HF ($p=0.00004$). b) RRS. Differences were significant between: N-HM ($p=0.0004$); N-HF ($p=0.0002$) and N-HM+HF ($p=0.0007$). c) RRC. Differences were significant between: N-HM ($p=0.0406$) and N-HF ($p=0.0191$). d) RRA. Differences were significant between: N-HM ($p=0.0012$); N-HF ($p=0.0007$) and N-HM+HF ($p=0.0012$).

Conclusions. 1) The studies regarding *Rhodiola rosea* as an adaptogen were analyzed from the first publications posted by PubMed, regarding RRAD, RRS, RRC and RRA, until the end of 2018, for a total period of 32 years. 2) The studies regarding RRAD, RRS, RRC and RRA, although reduced numerically (154), show an increase in time, the highest interest being in RRS, and the lowest one, in RRC. 3) Most studies on RRAD, RRS, RRC and RRA were performed on human subjects, of both genders. 4) This study shows that, although there is still modest interest in publications on RR as an adaptogen, it is still increasing.

Keywords: *Rhodiola rosea*, adaptogen, stress, cortisol, anxiety, PubMed filters, PubMed sub-filters.

Introduction

A. Adaptogens

Adaptogens are extracts or compounds from natural plants (Kaur et al., 2017) that increase adaptability and survival, in stressed organisms (Panossian et al., 2018). For adaptogenic plants, the criteria include a high level of safety, no adverse effects on normal physiological functions, and normalization of body functions, regardless of the nature of the stressors (Panossian et al., 2012; Xia et al., 2016; Panossian, 2017).

Adaptogens are stress response modifiers that increase non-specific stress resistance of an organism by augmenting its ability to adapt and survive (Kaur et al., 2017; Panossian, 2017). In a context of fatigue and stress,

their stimulatory effect is more pronounced (Panossian & Wikman, 2010).

The main adaptogens, the most studied and effective ones, are represented by: *Rhodiola rosea*, *Schisandra chinensis* and *Eleutherococcus senticosus* (Panossian et al., 2012; Panossian, 2017; Bleakney, 2008; Panossian & Wikman, 2008; Panossian, 2013).

B. *Rhodiola rosea*

For a long time in traditional medical systems in Asia and Europe, the root of *Rhodiola rosea* (RR) has been used as an adaptogen to increase an organism's resistance to physical stress (Schriner et al., 2009).

Rhodiola rosea L., belonging to the Crassulaceae family, is a type of herbaceous perennial (Panossian et al., 2010; Nabavi et al., 2016). Nearly 200 species are included

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in the genus *Rhodiola*, but *R. rosea* is the most studied and known species (Kosakowska et al., 2018). For centuries, RR has belonged to traditional medicine in parts of Russia, Asia and Europe (Ishaque et al., 2012).

C. Rhodiola rosea adaptogen

Many in vitro and in vivo as well as pharmacological studies have been carried out, and traditional medicinal RR uses have been established: for fatigue, stress, age-related conditions, cognitive decline, depression, and behavioral disorders (Ishaque et al., 2012; Hung et al., 2011; Booker et al., 2016; Chiang et al., 2015). RR also inhibits painful behavior, mechanical hyperalgesia and thermal pain (Doncheva et al., 2013), has antioxidant capacity (Shen et al., 2013), and significantly improves long-term memory (Petkov et al., 1986) and mental performance (Timpmann et al., 2018).

Thus, RR attenuates responses to stress (Timpmann et al., 2018) and can also play an important role in the modulation of anxiety (Jurcău et al., 2012), physical stress (Jurcău et al., 2012), fatigue (Jurcău et al., 2019; Jurcău & Jurcău, 2018; Panossian et al., 2010), cognition and mood (Panossian et al., 2010).

RR decreases cortisol (Zhang et al., 2009; Panossian et al., 2010), by interacting with the HPA system (Panossian et al., 2010). For example, repeated administration of RR increases the ability to concentrate and decreases the cortisol response in patients with fatigue syndrome (Olsson et al., 2009).

RR is effective in mild to moderate depression and generalized anxiety (Panossian et al., 2010), extenuating anxiety (Ma et al., 2018). For example, administration of RR in subjects with moderate anxiety resulted in a significant reduction of stress, anxiety, anger, confusion and depression, and a significant improvement in mood (Croy et al., 2015). The anxiolytic effects of RR can be mediated through pathways other than GABAA (Cayer et al., 2013).

Objectives

The objective was to highlight the interest in RR as an adaptogen, from the perspective of the age of participants, in a PubMed evaluation.

Hypothesis

So far, studies have shown interest in RR in general. On the other hand, RR as an adaptogen remains relatively little analyzed, given the number of publications found on the PubMed site.

Material and methods

The information was obtained from the database of the PubMed site.

Keywords

To highlight the importance of RR as an adaptogen, we selected for the analysis a few keywords related to the uses of RR and the stress domain: cortisol, one of the most important stress markers; and anxiety, one of the most important reactions to stress. Therefore, the keywords chosen were:

- “*Rhodiola rosea* adaptogen” (RRAD)
- “*Rhodiola rosea* and stress” (RRS)

- “*Rhodiola rosea* and cortisol” (RRC)
- “*Rhodiola rosea* and anxiety” (RRA)

PubMed filters

The PubMed filter that we chose for the analysis was gender (Sex), with the sub-filters: human male (HM), human female (HF) and human male and female (HM+HF).

Periods of research

We chose the time periods from the year of the first publication posted by the site, until the end of 2018: 1963-1969, 1970-1979, 1980-1989, 1990-1999, 2000-2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018.

Study design

The study was carried out based on the following criteria:

- Analysis of the chosen keywords in relation to the total number of publications (N).
- Analysis of the chosen keywords in relation to the sub-filters and the average number of publications per year (N/Y).

Statistical evaluation

- The results obtained were analyzed using SPSS 19.0. statistical package.
- For continuous data examination, Student’s t test was used.
- The differences were considered significant at a p< 0.05.

Results

The data were collected in January 2019. For all groups, data distribution was normal, according to the Kolmogorov-Smirnov test (1). The analysis was made for the chosen time periods.

A. Analysis of the total number (N) of publications (Table I).

Of the chosen keyword combinations, those with the longest period for which PubMed presented publications were RRS (32 years), and those with the shortest period for which PubMed presented publications were RRA (18 years). Most publications were for RRS (194), and the fewest were for RRC (11). For all the word combinations chosen, the most numerous publications were for HM+HF.

Table I

Total number (N) of publications for the chosen keywords

Key-words	Time period for which PubMed presented studies	N	Sex Filter		
			HM	HF	HM+HF
RRAD	1991-2018	54	7	3	8
RRS	1986-2018	194	21	16	26
RRC	1987-2018	11	3	2	4
RRA	2000-2018	18	3	2	3

B. Analysis of keyword combinations

a. Analysis of the keyword “Rhodiola rosea adaptogen”

It was found that (Fig. 1): N/Y for HM was higher than for HF, for all periods; HM and HF had the same N/Y between 2000-2009 (=0.1), 2010 (=1), 2013 (=1) and 2014 (=1); N/Y for HM+HF was higher than for HM and HF and was the highest in 2010 and 2018 (each=2); the site published no studies for: HF in 2012, 2016 and 2017; HM, HF and HM+HF between 1991-1999, in 2011 and 2015.

The differences were significant (in *italics*) between (Table II): N-HM ($p=0.00002$); N-HF ($p<0.00001$) and N-HM+HF ($p=0.00004$). The differences were not significant between: HM+HF-HM ($p=0.382$) and HM+HF-HF ($p=0.0582$).

Table II

The mean, standard deviation and p-value for the keyword “Rhodiola rosea adaptogen”

Period 1991-2018	N	HM	HF	HM+HF
Mean	3.6909	0.7364	0.3727	0.8273
Standard Deviation	1.8218	0.6064	0.475	0.7059
p for comparison with N	-	0.00002	< 0.00001	0.00004
p for comparison with HM+HF	-	0.382	0.0582	-

b. Analysis of the keyword “Rhodiola rosea and stress”

It was found that (Fig. 2): N/Y for HM was higher than for HF for all periods, excepting the years where N/Y was equal, 2010 (each=1), 2014 (each=2), 2015 (each=4) and 2016 (each=2); N/Y for HM+HF was the highest in 2015 (=4); the site published no studies for: HM in 2010; HM, HF and HM+HF between 1986-1999, in 2011.

Table III

The mean, standard deviation and p-value for the keywords “Rhodiola rosea and stress”

Period 1991-2018	N	HM	HF	HM+HF
Mean	13.175	1.1583	1.125	1.7417
Standard Deviation	8.2185	1.0688	1.0825	1.3041
p for comparison with N	-	0.0004	0.0002	0.0007
p for comparison with HM+HF	-	0.2909	0.1522	-

The differences were significant between (Table III): N-HM ($p=0.0004$); N-HF ($p=0.0002$) and N-HM+HF ($p=0.0007$). There were no significant differences between: HM+HF-HM ($p=0.2909$) and HM+HF-HF ($p=0.1522$).

c. Analysis of the keywords “Rhodiola rosea and cortisol”

It was found that (Fig. 3): N/Y for HM was higher than for HF between 2000-2009; HM and HF had the same number of studies in 2013 (=1); N/Y for HM+HF was the highest in 2013 (=2); the site published no studies for: HM, HF and HM+HF between 1987-1999, between 2010-2012 and 2014-2018.

The differences were significant between (Table IV): N-HM ($p=0.0406$) and N-HF ($p=0.0191$). The differences were not significant between: N-HM+HF ($p=0.0725$); HM+HF-HM ($p=0.3876$) and HM+HF-HF ($p=0.2576$).

Table IV

The mean, standard deviation and p-value for the keywords “Rhodiola rosea and cortisol”

Period 1991-2018	N	HM	HF	HM+HF
Mean	0.625	0.1	0.0917	0.1833
Standard Deviation	0.6112	0.2769	0.2752	0.5505
p for comparison with N	-	0.0406	0.0191	0.0725
p for comparison with HM+HF	-	0.3876	0.2576	-

d. Analysis of the keyword “Rhodiola rosea and anxiety”

It was found that (Fig. 4): N/Y for HM was higher than for HF in 2013; HM and HF had the same number of studies between 2000-2009 and in 2015 (=1); N/Y for HM+HF was the highest in 2013 and 2015 (each=1); the

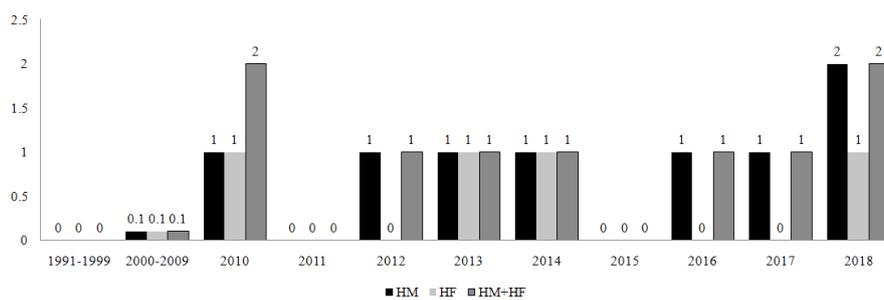


Figure 1 - N/Y for the keyword “Rhodiola rosea adaptogen”.

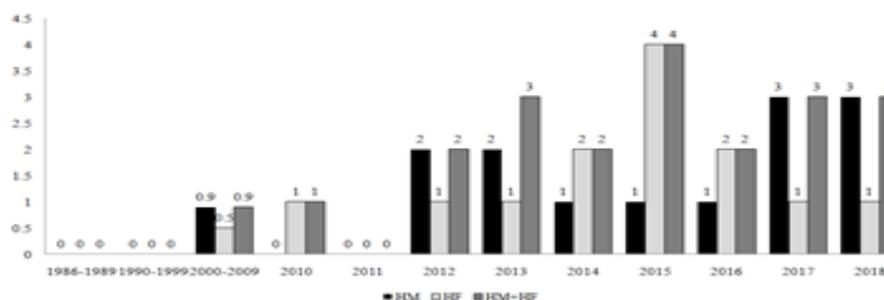


Figure 2 - N/Y for the keywords “Rhodiola rosea and stress”.

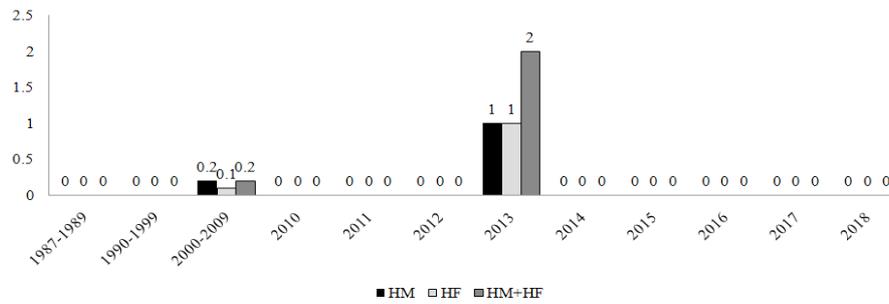


Figure 3 - N/Y for the keywords “Rhodiola rosea and cortisol”.

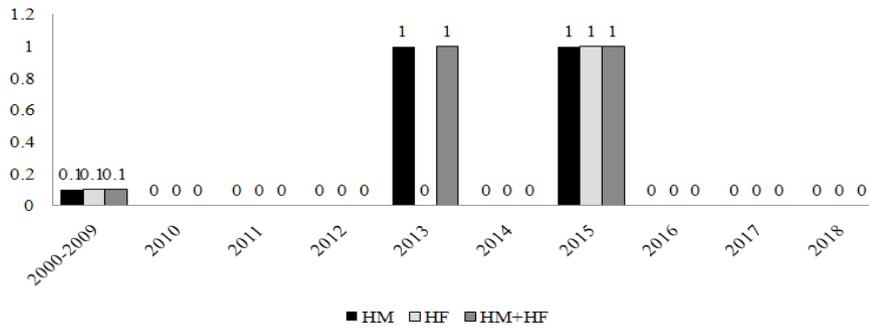


Figure 4 - N/Y for the keywords “Rhodiola rosea and anxiety”.

site published no studies for: HF in 2013; HM, HF and HM + HF between 2010-2012, 2014 and 2016-2018.

The differences were significant between (Table V): N-HM ($p=0.0012$); N-HF ($p=0.0007$) and N-HM+HF ($p=0.0012$). There were no significant differences between: HM+HF-HM ($p=0.5$) and HM+HF-HF ($p=0.3154$).

Table V
The mean, standard deviation and p-value for the keywords “Rhodiola rosea and anxiety”

Period 1991-2018	NM	HM	HF	HM+HF
Mean	1.64	0.21	0.11	0.21
Standard Deviation	1.151	0.3961	0.2982	0.3961
p for comparison with N	-	0.0012	0.0007	0.0012
p for comparison with HM+HF	-	0.5	0.3154	-

Discussions

A. Analysis of the total number (N) of publications

The main interest of studies regarding the selected keyword combinations was in RRS, followed numerically by RRAD. It can be observed that although RR is an adaptogen, the studies in which the word adaptogen was found were much fewer compared to those referring to RR and stress, even though the quality of adaptogen refers to stress. The increased interest in the relationship between RR and stress is also evidenced by the much longer time period during which the studies were conducted, compared to the periods for RRAD, RRC and RRA.

B. Analysis of keywords

“*Rhodiola rosea* adaptogen”. The number of studies on HM was consistently higher than that of studies on HF,

showing that interest in male subjects was higher.

“*Rhodiola rosea* and stress”. There was interest in both HM and HF studies, which were more numerous in 2014, 2015, 2016.

“*Rhodiola rosea* and cortisol”. Gender references were completely absent, except for the period 2000-2009 and the year 2013, when there was similar interest in studies with subjects of both genders.

“*Rhodiola rosea* and anxiety”. Gender mentions were very few, only in the period 2000-2009 and over the years 2013 and 2015, when there was similar interest in studies with subjects of both genders.

Regarding the Gender filter, studies for all the chosen keyword combinations were reduced numerically, but there was an almost constant increase in interest starting with 2012. For the entire period of publications, the greatest research interest was in subjects of both genders.

Conclusions

1. The studies regarding *Rhodiola rosea* as an adaptogen were analyzed from the first publications posted by PubMed, regarding RRAD, RRS, RRC and RRA, until the end of 2018, for a total period of 32 years.

2. The studies regarding RRAD, RRS, RRC and RRA, although reduced numerically (154), show an increase in time, the highest interest being in RRS, and the lowest interest, in RRC.

3. Most studies on RRAD, RRS, RRC and RRA were performed in human subjects, of both genders.

4. This study shows that, although there is still modest interest in publications on RR as an adaptogen, it is still increasing.

Conflicts of interest

Nothing to declare.

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