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Co-Grazing Beef Cattle and Goats in Kentucky

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Abstract

A two season grazing study of mixed (goats and beef cattle) species was conducted in 2006 and 2008 at Sebastian Farms in Breathitt County KY. The objective of this study was to determine if the order of mixed species grazing affected beef cattle and goat weight gain and goat exposure to the barber pole worm *(Haemonchus contortus)* in a rotational grazing system. In this study, two co-grazing management strategies were tested. In treatment 1, goats and cattle were rotationally grazed together. In treatment 2, goats rotated through pastures as first grazers followed by cattle. Each co-grazing treatment was assigned a set of four pastures similar in size, terrain and plant species composition. The stocking rate for each treatment was approximately 1.2 acres per animal unit (1 animal unit = 1,000 lbs live weight). Animal performance data was collected every 30 days during the grazing season. In 2007, the study was suspended due to extreme drought conditions. In 2006 and 2008 goat weight gain and FAMACHA scores were not affected by grazing treatment. In 2006, cattle weight gain was slightly higher for cows grazing with goats. In contrast, cows following goats in 2008 had the greatest weight gain. Based on field observations, beef cattle and goats were compatible grazers and no herd health issues were related to mixed species grazing during this study.

Introduction

Many beef cattle producers in Kentucky are investigating the potential benefits of adding goats to their livestock operations for supplemental income and improved weed control in their pastures. Unfortunately, little research has been conducted in Kentucky on the co-grazing of goats and beef cattle. In general, goats and cattle differ in their dietary forage preferences (Table 1). Goats prefer to graze above their shoulders and select browse species growing on steeper terrain. Cattle prefer to graze grasses and legumes growing on more gently rolling landscape positions. For most Kentucky pastures, co-grazing beef cattle and goats would appear to be a beneficial grazing management strategy resulting in increased utilization of all pasture plant species and subsequently improved weed control.

Internal parasites (worms) are a concern in ruminants. A limited number of gastro-intestinal parasites can affect both goats and cattle. *Trichostrongylus axei* parasitizes a wide range of hosts, including cattle, goats and horses. *Trichostrongylus* organisms do not usually cause serious illness in well-nourished, unstressed ruminants. *Strongyloides* can be shared between ruminant species yet rarely causes disease. *Haemonchus* can infect young calves, but cattle become immune to the parasite more readily than goats. Co-grazing provides an opportunity for goats to be exposed to cattle internal parasites (cross infection) and vise-a-versa. The exposure to other ruminant parasites during co-grazing appears to be a minimal risk in healthy livestock.

Table 1. Dietary forage preferences for different livestock species.			
	Type of Diet		
Species	Grasses	Broadleaf Weeds and Legume	Browse[1]
	%		
Cattle	65 –75	20 – 30	5 – 10
Horse	70 – 80	15 – 25	0 – 5
Sheep	45 – 55	30 – 40	10 - 20
Goats	20 – 30	10 – 30	40 – 60

[1] **Shrubs or trees. SOURCE: D. Forbes and G.W. Evers, Texas A&M Univ.; D.I. Bransby, Auburn Univ.; M.A. McCann, Virginia Tech Univ.; and W.R. Getz, Fort Valley State Univ. in Southern Forages 3rd Edit.**

Materials and Methods

A 2-season mixed species grazing study was conducted in 2006 and 2008 at Sebastian Farms in Breathitt County KY. Two co-grazing management strategies were tested. In treatment 1, goats and cattle were rotationally grazed together. In treatment 2, goats rotated thru pastures as first grazers followed by cattle. Approximately 35 acres of pasture were divided into a total of 8 paddocks for this study. Botanical composition of each pasture was determined by using the 100 point transect method. The average composition of each pasture at the beginning of this study consisted of 28.2% tall fescue, 20.1 % orchardgrass, 9.2% bluegrass, 4.4% clover and 38% weeds. Each co-grazing treatment was assigned a set of four pastures similar in size, terrain and plant species composition (Figure 1). Each treatment consisted of 15 cows (plus their spring born calves) and 22 does (plus their spring born kids). The stocking rate for each treatment was approximately 1.2 acres per animal unit (1 animal unit = 1,000 lbs liveweight). Goats selected for the study were primarily Boer and Boer crosses with dairy influences. Cattle used in the study were primarily Angus and Angus crosses. A University of Kentucky recommended cattle mineral supplement was provided to all animals throughout the study. No other supplementation was provided during the 2006 and 2008 grazing seasons. Existing barbed wire and wooden plank perimeter fences were modified using electrified, 12 gauge high tensile wire to contain goats. Interior fences, for dividing pastures into paddocks, consisted of a combination of 4 strands of 12 ga. high tensile electric wire and 2 strands of electrified white poly-tape.

In 2006, grazing treatments began on April 20 and ended on October 3 for a total of 186 grazing days. In 2008, grazing treatments began on May 9 and ended on September 19 for a total of 131 grazing days. Goats and their spring kids from each grazing treatment were weighed, FAMACHA scores recorded and fecal samples collected every 30 days. Cows and their spring calves were weighed every 30 days as well. Fecal egg counts were conducted on samples from goats using a modified McMaster method. Goats were de-wormed based on FAMACHA scores following the recommendations of extension veterinarian, Dr. Patty Scharko.

The FAMACHA system, developed in South Africa by Dr. Fafa Malan (**FA**FA **MA**LAN **CHA**RT), was used to determine the level of anemia resulting from the internal blood–sucking parasite *Haemonchus contortus* (barber pole worm) and the need for de-worming. The FAMACHA system involves the examination of the mucus membranes of the goat's lower eyelid relating the color (shades of red on a scale of 1-5) to the degree of anemia in an animal. A score of 1 is red and not anemic, and a score of 5 is pale and extremely anemic. Other goat health issues, such as foot scald, caseous lymphadenitis, etc. were also monitored and treated during the study.

Two types of de-wormers (anthelmintics) were used during this study: Prohibit® Soluble Drench Powder™ (Levamisole hydrochloride, reconstituted to 44.7 mg/ml of active ingredient) and Cydectin® (moxidectin) Pour On for Cattle™. Both de-wormers were administered orally. A decision regarding whether to administer a de-wormer was based on FAMACHA scores of individual animals. Goats with FAMACHA scores of 1 and 2 received no treatment. Goats with a FAMACHA score of 4 received levamisole and goats with a FAMACHA score of 5 were treated with moxidectin. The dosage rate for levamisole was 3 ml per 25 pounds of body weight

(12 mg/kg) and the dosage rate for moxidectin was 1 ml per 25 pounds of body weight (0.4 mg/kg). Goats with a FAMACHA score of 3 were evaluated to determine if their body condition score and health was below normal; if inadequate, the goats received levamisole treatment.

De-worming recommendations for this study were developed by Ray M. Kaplan, DVM, PhD and modified by Patty Scharko DVM, MPH. Producers should consult their veterinarian for advice to determine appropriate treatment and dosages for their herd. These drugs are not approved by the FDA for use in goats, and when used in goats are considered extra label use. The FDA regards extra-label use of drugs as an exclusive privilege of the veterinary profession and is only permitted when a bona fide veterinarian-client-patient relationship exists and an appropriate medical diagnosis has been made.

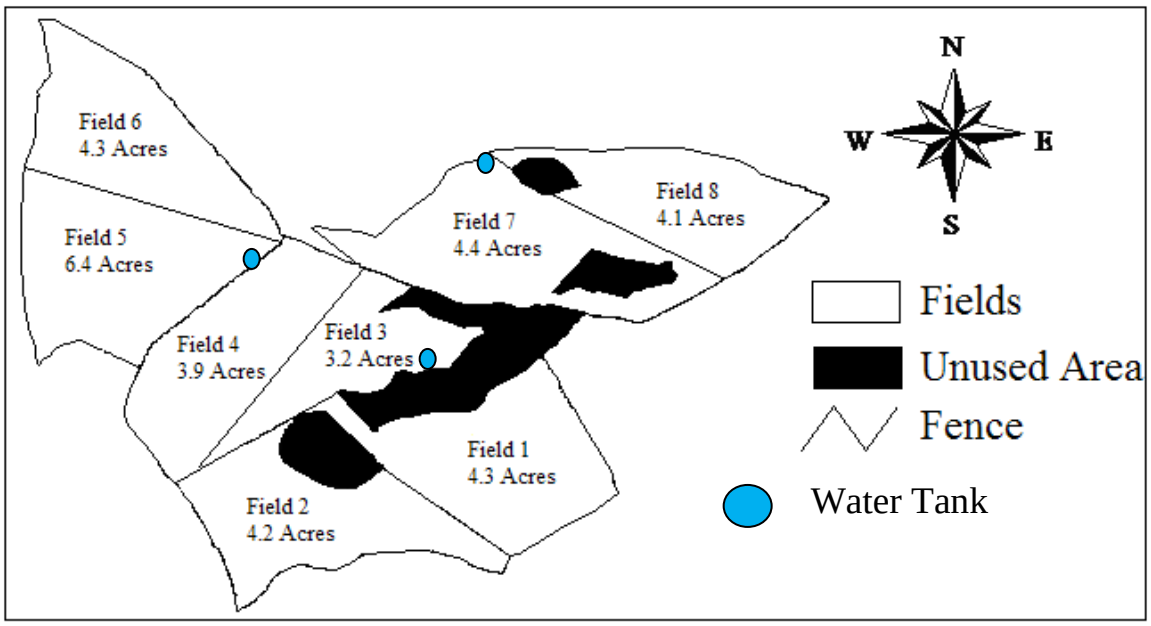

Figure 1. Layout of Rotational Grazing System

Fields 1 and 2: Gently rolling grass/weed pastures
Fields 3 and 4: Gently rolling grass/weed pastures
Fields 5 and 6: Steep terrain grass/weed/browse pastures
Fields 7 and 8: Steep terrain grass/weed pastures

Results

Goat Performance

Animal weights were collected monthly and averaged by grazing treatment and work date. At the end of the 2006 grazing season (186 days), does grazing with the cows gained an average of 12.3 lbs compared to 15.9 lbs for does grazing ahead of the cows (Table 2). At the end of the 2008 grazing season (133 days), does grazing with cows gained an average of 12.3 lbs. compared to 7.3 lbs for does grazing ahead of cows (Table 3). These contrasting results make interpretation of the data difficult and support the need for more research in this area.

Table 2. Average doe weights in 2006 as affected by grazing treatment and work date.

	Work Date						
	April 20	**May 26**	**June 23**	**July 27**	**Aug 28**	**Oct 3**	**Change**
Treatment	……..Weight (lbs)……..						
Goats + Cows	65.9	69.9	74.8	78.6	83.3	78.2	+12.3

Goats First	65.9	74.2	81.0	82.2	84.2	81.8	+15.9

Table 3. Average doe weights in 2008 as affected by grazing treatment and work date.							
	Work Date						
	April 28	**May 28**	**June 27**	**July 28**	**Aug 27**	**Sept 19**	**Change**
Treatment	.....Weight (lbs)……..						
Goats + Cows	79.5	79.5	82.2	86.6	89.9	91.8	+12.3
Goats First	82.6	87.5	86.3	88.1	86.6	89.9	+7.3

Goat FAMACHA Scores

In 2006 and 2008, the average FAMACHA scores for goats in both grazing treatments were similar and little change was measured at the end of each grazing season (Table 4 and 5). These data suggest that the order in which goats graze with cattle has little or no impact on internal parasite exposure. In general, FAMACHA scores were slightly higher in 2008 compared to 2006. This is probably due to the summer drought conditions during most of the 2008 grazing season. Limited rainfall and high temperatures resulted in slower plant re-growth. Subsequently, goats were rotated between paddocks more frequently and forced to graze closer to the ground increasing their exposure to parasitic larva. Despite extremely dry summer conditions in 2008, heavy morning dews were common in this area and provided a suitable environment for fecal eggs to hatch and larva to be ingested.

Table 4. Average doe FAMACHA scores in 2006 as affected by grazing treatment and work date.							
	Work Date						
	April 20	**May 26**	**June 23**	**July 27**	**Aug 28**	**Oct 3**	**Change**
Treatment	.....FAMACHA Score (1-5).....						
Goats + Cows		2.9	2.9	2.9	3.3	2.9	0.0
Goats First		2.8	2.8	3.0	3.2	2.8	0.0

Table 5. Average doe FAMACHA scores in 2008 as affected by grazing treatment and work date.							
	Work Date						
	April 28	**May 28**	**June 27**	**July 28**	**Aug 27**	**Sept 19**	**Change**
Treatment	……..FAMACHA Score (1-5)……..						
Goats + Cows	3.1	3.0	4.0	3.5	3.3	3.5	+0.4
Goats First	3.0	3.4	3.5	3.6	3.4	3.5	+0.5

Goat Fecal Egg Counts

Fecal egg count is a quantitative method to determine the presence of gastro-intestinal worms (including the barber pole worm) and the production of eggs. Unfortunately, interpretation of fecal egg count data is often difficult due to the high level of parasitism variability that occurs in livestock. In 2006, fecal egg counts for does grazing with cows increased by an average of 274% compared to a 206% increase from April 20 to October 3 in does grazing ahead of cattle (Table 6). In 2008, fecal egg counts for does grazing with cattle increased by an average of 198% compared to a 2% decrease from May 28 to August 27 in does grazing ahead of cattle (Table 7). These data would suggest that exposure to barber pole worm larva and other internal parasites is less in a grazing system where goats graze ahead of cattle compared to goats grazing with cattle. Animals with

FAMACHA scores of 1 or 2 usually have low FEC, which was confirmed by this data.

Relationship between FAMACHA Scores and Fecal Egg Counts

Regression analysis was used to determine the relationship between fecal egg counts (FEC) per gram of feces and FAMACHA scores measured during this study. Dr. Ray Kaplan has reported that there is a strong correlation between FAMACHA and FEC. The data set for this analysis included 227 matched fecal egg counts and FAMACHA scores. The resulting correlation coefficient (R^2) was calculated to be 0.4685, which indicates a weak statistical relationship between FEC and FAMACHA scores (Figure 2). Each goat may respond differently to barber pole worm exposure with FEC and FAMACHA scores due to animal age, health, nutrition, genetics and environmental conditions (*H. contortus* may become inhibited during drought periods and not mature into adult until better conditions develop).

Table 6. 2006 Average doe fecal egg counts as affected by grazing treatment and work date.

	Work Date						
	April 20	**May 26**	**June 23**	**July 27**	**Aug 28**	**Oct 3**	**Change**
Treatment	.....eggs/gram feces……..						
Goats + Cows	818	639	1778	1876	772	2247	+1429
Goats First	787	770	1217	1452	939	1621	+834

Table 7. 2008 Average doe fecal egg counts as affected by grazing treatment and work date.

	Work Date				
	May 28	**June 27**	**July 28**	**Aug 27**	**Change**
Treatment	.....eggs/gram feces……..				
Goats + Cows	1937	3568	2556	3845	+1908
Goats First	2800	1692	2263	2768	-32

De-worming Frequency and Effectiveness

Whole herd de-worming is a common practice among goat producers in Kentucky. In theory, this practice saves time and reduces the risk of internal parasites reaching a fatal level in the herd. However, frequent and unnecessary de-worming is costly, and more importantly, may lead to early parasite resistance to the de-wormers being used. In this study, goats were gathered (worked) five times each season to determine if de-worming was needed.

As a result of using the FAMACHA system to determine the need for de-worming, 9 out of 25 does (36.0%) grazing with cows never received de-worming treatment in 2006 (Table 8). Similarly, 10 out of 24 does (41.7%) grazing ahead of cows never received de-worming treatment. Only one doe in each grazing treatment required de-worming all of the 5 work dates. In 2008, 22.7% of the does grazing with cows and 27.3% of the does grazing ahead of cows never received de-worming treatment (Table 9).

Table 8. De-worming Frequency of Goats in 2006			
Grazing Treatment	**Number of Does**	**Number of De-worming Treatments**	**Percentage of Does**
Goats + Cows	1	5	4.0
	1	4	4.0
	1	3	4.0
	2	2	8.0
	11	1	44.0
	9	0	36.0
Goats First	1	5	4.1
	2	4	8.3
	1	3	4.2
	4	2	16.7
	6	1	25.0
	10	0	41.7
Overall	2	5	4.1
	3	4	6.1
	2	3	4.1
	6	2	12.2
	17	1	34.7
	19	0	38.8

Table 9. De-worming Frequency of Goats in 2008			
Grazing Treatment	**Number of Does**	**Number of De-worming Treatments**	**Percentage of Does**
Goats + Cows	3	5	13.6
	3	4	13.6
	5	3	22.7
	4	2	18.2
	2	1	9.1
	5	0	22.7
Goats First	3	5	13.6
	5	4	22.7
	2	3	9.1
	4	2	18.2
	2	1	9.1
	6	0	27.3
Overall	6	5	13.6
	8	4	18.2
	7	3	15.9
	8	2	18.2
	4	1	9.1
	11	0	25.0

De-worming resistance was determined with the DrenchRite Test at University of Georgia on September 5, 2006. The results included that Haemonchus was 50% and Trichostrongylus was 40% of the worm species present in the fecal eggs. The worms were highly resistant to benzimidazoles and levamisole, and resistant to ivermectin and moxidectin. Predicted drug efficacy for levamisole was 52% for Haemonchus. In 2006, a total of 34 doses of levamisole were administered from May until August. Of these, fifteen doses were given to goats grazing with cows and nineteen doses were given to goats grazing ahead of cows. Sixty six percent of the goats with cows treated with levamisole improved their FAMACHA scores at the next work date. Similarly, 68% of the does treated with levamisole that were grazing ahead of cows improved their FAMACHA scores (Table 10).

Table 10. Levamisole De-worming Effectiveness by FAMACHA Score in 2006			
Treatment	**Number of Doses of Levamisole Administered**	**Number of Improved FAMACHA Scores**	**Percent of Improved FAMACHA Scores**
Goats + Cows	15	10	66.7
Goats First	19	13	68.4
Total	34	23	67.7

In 2008, a total of 77 doses of levamisole were administered between April and August to goat with FAMACHA scores of 4. Of these, 40 doses were given to goats grazing with cows and 37 doses were given to goats grazing ahead of cows. Twenty percent of the treated goats grazing with cows improved their FAMACHA scores at the next work date. Sixteen percent of the doses administered to the goats grazing ahead of cows improved their FAMACHA scores. (Table 11.)

Table 11. Levamisole De-worming Effectiveness by FAMACHA Score in 2008			
Treatment	**Number of Doses of Levamisole Administered**	**Number of Improved FAMACHA Scores**	**Percent of Improved FAMACHA Scores**
Goats + Cows	40	8	20.0
Goats First	37	6	16.2
Total	77	14	18.2

In 2006, a total of 15 doses of moxidectin were administered between April and August to severely anemic goats with FAMACHA scores of 5. Six of these doses were given to goats grazing with cattle and 9 were given to goats grazing ahead of cattle. Goats grazing with cattle improved their FAMACHA scores by 83% while goats grazed ahead of cattle showed an improvement of 78% (Table 12).

Table 12. Moxidectin De-worming Effectiveness by FAMACHA Score in 2006			
Treatment	**Number of Doses of Moxidectin Administered**	**Number of Improved FAMACHA Scores**	**Percent of Improved FAMACHA Scores**
Goats + Cows	6	5	83.3
Goats First	9	7	77.8
Total	15	12	80.0

In 2008, a total of 23 doses of moxidectin were administered between April and August. Twelve of these were given to goats grazing with cattle and 11 were given to goats grazing ahead of cattle. Eighty three percent of the treated goats grazing with cattle improved FAMACHA scores by the next work day. Similarly, 82% of the treated goats grazing ahead of cattle had improved FAMACHA scores (Table 13).

Table 13. Moxidectin De-worming Effectiveness by FAMACHA Score in 2008			
Treatment	**Number of Doses of Moxidectin Administered**	**Number of Improved FAMACHA Scores**	**Percent of Improved FAMACHA Scores**
Goats + Cows	12	10	83.3
Goats First	11	9	81.8
Total	23	19	82.6

De-worming Costs

In comparison with other costs associated with meat goat production, de-worming is relatively inexpensive. This is likely the reason many goat producers de-worm their entire herds every time they are worked. It has been noted that whole herd de-worming can contribute to parasite resistance to de-wormers[i,ii]. In this study, the combined cost for de-

worming with levamisole and moxidectin, based on FAMACHA scores was $18.91 each grazing season. If all goats (44 total) in the study had been de-wormed at every work date with levamisole or moxidectin, the total cost of de-worming with levamisole would have been $85.72 and with moxidectin $183.90 each grazing season. It is also important to note that no death loss due to internal parasites was observed during this study.

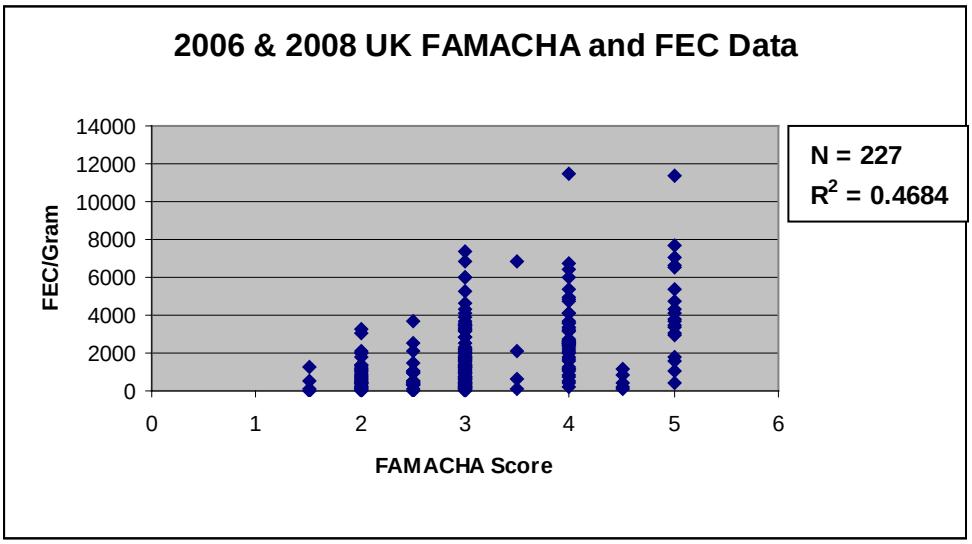

Figure 2. Relationship between FAMACHA scores and fecal egg count in 2006 & 2008 UK Co-Grazing Study.

Table 14. 2006 Average cattle weights as affected by grazing treatment and work date*.							
	Work Date						
	April 20	May 26	June 23	July 27	Aug 28	Oct 3	Change
Treatment	……..Weight (lbs)……..						
Goats + Cows	1028	1122	1104	1121	1099	1088	+60
Goats First	1008	1065	1077	1033	1058	1045	+37
• Rainfall for this grazing period = 21.7 inches							

Table 15. 2008 Average cattle weights as affected by grazing treatment and work date*.						
	Work Date					
	May 9	June 10	July 21	Aug 25	Sept 19	Change
Treatment	……Weight (lbs)……					
Goats + Cows	1117	1103	1150	1188	1182	+65
Goats First	951	976	1010	1069	1070	+119
• Rainfall for this grazing period = 14.5 inches						

Cattle Performance

In general, beef cattle in both grazing treatments gained weight during the 2006 and 2008 grazing seasons. In 2006, cows (with spring calves) grazing with goats gained an average of 60 lbs compared to an average gain of 37 lbs for cows following goats during the 186 grazing day period (Table 14). In contrast, cows (with spring calves) following goats in 2008, gained an average of 119 lbs compared to an average gain of 65 lbs for cows grazing with goats

during a 133 day grazing period (Table 15). An explanation for the differences in cattle weight gain by treatment each year is difficult as treatments were not replicated and factors such as cattle age and genetics were not controlled variables in this study. However, these data strongly support the need for more co-grazing research to better determine the affect on beef cattle performance. No cow herd health issues during this 2-year study were related to co-grazing beef cattle and goats.

Summary

Based on measurements recorded and observations made during this 2-yr demonstration, beef cattle and goats appeared to be compatible grazers when managed as a grazing unit and easily rotated from paddock to paddock during the grazing season. In general, goat performance (average weight gain and FAMACHA score) did not appear to be affected by the order in which goats graze with beef cattle. Unfortunately, contrasting beef cattle performance data for 2006 and 2008 made interpretation of results difficult and further supports the need for more mixed grazing research to determine the affect of mixed grazing on beef cattle performance.

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[i] Georgis' Parasitology for Veterinarians (9th Edition), Dwight D. Bowman, 2009, p. 169.
[ii] Goat Medicine (2nd Edition), Mary C. Smith and David M. Sherman, 2009, p.455-460.